

Middlesex County Retirement System

Actuarial Valuation and Review as of
January 1, 2016

A large, stylized blue arrow pointing to the right, with the Segal Consulting logo and name inside it.

✦ Segal Consulting



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December 14, 2016

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

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2016. It summarizes the actuarial data used in the valuation, establishes the funding requirements for fiscal 2017 and later years and analyzes the preceding two years' experience.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist in administering the Retirement System. The census information and financial information on which our calculations were based was prepared by the staff of the Middlesex County Retirement System. That assistance is gratefully acknowledged.

The measurements shown in this actuarial valuation may not be applicable for other purposes. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period); 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.

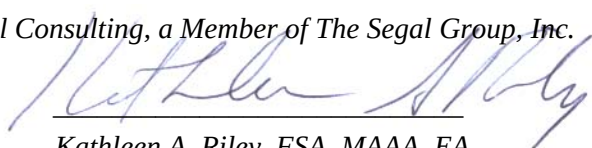
The actuarial calculations were directed under my supervision. I am a member of the American Academy of Actuaries and I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of my knowledge, the information supplied in the actuarial 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 at your next meeting 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

Purpose

This report has been prepared by Segal Consulting to present a valuation of the Middlesex County Retirement System as of January 1, 2016. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits. The contribution requirements presented in this report are based on:

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

Certain disclosure information required by Governmental Accounting Standards Board Statements (GASB) Numbers 67 and 68 as of December 31, 2015 for the Middlesex County Retirement System, a cost-sharing multiple-employer defined benefit pension plan, is provided in a separate report.

Significant Issues in Valuation Year

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

1. The actuarial valuation report as of January 1, 2016 is based on financial information as of that date. Changes in the value of assets subsequent to that date are not reflected.
2. During the plan years ended December 31, 2014 and December 31, 2015, the market value rates of return were 7.38% and 0.71%, respectively. Because the actuarial value of assets gradually recognizes market value fluctuations, the actuarial rates of return for the plan years ended December 31, 2014 and December 31, 2015 were 9.36% and 7.10%, respectively. The actuarial value of assets as of December 31, 2015 was \$1.14 billion, or 103.3% of the market value of assets of \$1.10 billion (as reported in the Annual Statement). As of December 31, 2013, the actuarial value of assets was 95.4% of market value.

SECTION 1: Valuation Summary for the Middlesex County Retirement System

3. The total unrecognized investment loss as of December 31, 2015 was \$36.6 million. This investment loss will be recognized in the determination of the actuarial value of assets for funding purposes in the next few years, to the extent it is not offset by recognition of investment gains derived from future experience. This implies that earning the assumed rate of investment return (net of expenses) on a **market value** basis will result in investment losses on the actuarial value of assets in the next few years. The unrecognized investment losses are not reflected in the funding schedule shown in Section 2, Chart 16.
4. This valuation reflects the following changes in actuarial assumptions and methods:
 - 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 the RP-2000 Healthy Annuitant 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.

The changes in assumptions and methods increased the unfunded liability by \$88.8 million and increased the normal cost by \$3.5 million.
5. The following plan change is included in this 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.
6. The unfunded liability was expected to increase from \$1,228.6 million as of January 1, 2014 to \$1,262.1 million as of January 1, 2016. The actual unfunded liability as of January 1, 2016 of \$1,351.0 million is \$88.9 million greater than expected due to the changes in assumptions noted above and the experience loss detailed in Section 2 of this report.

SECTION 1: Valuation Summary for the Middlesex County Retirement System

7. The recommended contribution for fiscal 2017 was set to the previously budgeted amount of \$107,210,668. In fiscal 2018 through fiscal 2024, the recommended contribution will be the prior year's budgeted amount increased 6.5%. Thereafter, the amortization payment on the unfunded liability will increase 4% per year. This will result in a total fiscal 2018 appropriation of \$114,179,361 and a total fiscal 2019 appropriation of \$121,601,019. These amounts reflect payment of the appropriation in two equal amounts on July 1 and December 31. If the appropriation is made in one payment on July 1, the amount will be lower. Under this funding schedule, the System will be fully funded by fiscal 2035, the same as the prior funding schedule. Chart 16 in Section 2 shows the detail of the funding schedule.
8. On a market value basis, the funded ratio has decreased from 46.18% as of January 1, 2014 to 44.32% as of January 1, 2016. On an actuarial basis, the funded ratio has increased from 44.05% as of January 1, 2014 to 45.79% as of January 1, 2016.

SECTION 1: Valuation Summary for the Middlesex County Retirement System

Summary of Key Valuation Results

	2016	2014
Contributions for fiscal year beginning July 1:		
Recommended for fiscal 2017 and 2015	\$107,210,668	\$94,523,281
Recommended for fiscal 2018 and 2016	114,179,361	100,667,294
Recommended for fiscal 2019 and 2017	121,601,019	107,210,668
Funding elements for plan year beginning January 1:		
Normal cost, including administrative expenses	\$61,949,136	\$55,532,389
Market value of assets (MVA)	1,104,482,897	1,014,013,415
Actuarial value of assets (AVA)	1,141,122,663	967,146,018
Actuarial accrued liability	2,492,161,766	2,195,732,452
Unfunded actuarial accrued liability	1,351,039,103	1,228,586,434
Funded ratio based on MVA	44.32%	46.18%
Funded ratio based on AVA	45.79%	44.05%
Demographic data for plan year beginning January 1:		
Number of retired participants and beneficiaries	5,327	5,072
Number of inactive participants entitled to a return of their employee contributions	2,640	2,632
Number of inactive participants with a vested right to a deferred or immediate benefit	321	384
Number of active participants	9,072	9,082
Total payroll*	\$421,085,856	\$398,185,255
Average payroll*	46,416	43,843

* Payroll figures are for the prior calendar year and reflect annualized salaries for participants hired during the year.

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 Plan, it is not a fiduciary in its capacity as actuaries and consultants with respect to the Plan.

SECTION 2: Valuation Results for the Middlesex County Retirement System

A. PARTICIPANT DATA

The Actuarial Valuation and Review considers the number and demographic characteristics of covered participants, including active participants, inactive participants, retired participants and beneficiaries.

This section presents a summary of significant statistical data on these participant groups.

More detailed information for this valuation year and the preceding valuation can be found in Section 4, Exhibits A and B.

A historical perspective of how the participant population has changed over the past nine valuations can be seen in this chart.

CHART 1

Participant Population: 1999 – 2015

Year Ended December 31	Active Participants	Inactive Participants	Retired Participants and Beneficiaries	Ratio of Non-Actives to Actives
1999	8,437	1,887	4,383	0.74
2001	9,246	2,331	4,481	0.74
2003	9,043	2,913	4,780	0.85
2005	9,106	3,158	4,763	0.87
2007	9,285	3,267	4,764	0.86
2009	9,093	3,430	4,833	0.91
2011	8,979	3,102	4,886	0.89
2013	9,082	3,016	5,077	0.89
2015	9,072	2,961	5,327	0.91

SECTION 2: Valuation Results for the Middlesex County Retirement System

Active Participants

Plan costs are affected by the age, years of service and payroll of active participants. In this year's valuation, there were 9,072 active participants with an average age of 48.2, average years of service of 11.6 years and average payroll of \$46,416. The 9,082 active participants in the prior valuation had an average age of 48.3, average service of 11.7 years and average payroll of \$43,843.

Among the active participants, there were 17 participants with unknown age. The actuarial calculations were adjusted for the missing information by assuming that it was the same as information provided for other active participants with similar known characteristics.

Inactive Participants

In this year's valuation, there were 321 participants with a vested right to a deferred or immediate vested benefit and 2,640 participants entitled to a return of their employee contributions.

These graphs show a distribution of active participants by age and by years of service.

CHART 2

Distribution of Active Participants by Age as of December 31, 2015

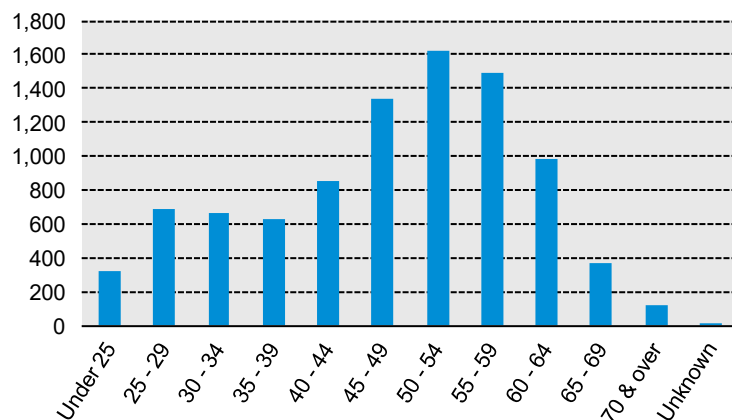
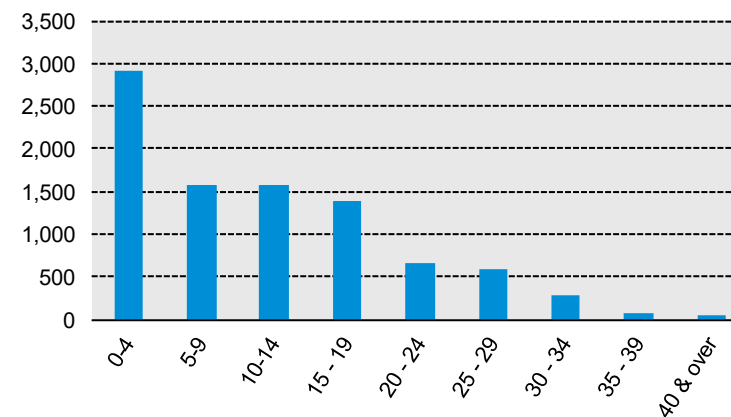


CHART 3

Distribution of Active Participants by Years of Service as of December 31, 2015



SECTION 2: Valuation Results for the Middlesex County Retirement System

Retired Participants and Beneficiaries

As of December 31, 2015, 4,725 retired participants and 602 beneficiaries were receiving total monthly benefits of \$10,832,618, excluding COLAs reimbursed by the Commonwealth. For comparison, in the previous valuation, there were 4,459 retired participants and 613 beneficiaries receiving monthly benefits of \$9,567,934, excluding COLAs reimbursed by the Commonwealth. There were no retired participants or beneficiaries in suspended status this year and three retired participants and two beneficiaries in suspended status in the prior valuation.

These graphs show a distribution of the current retired participants and beneficiaries based on their monthly amount and age, by type of pension.

CHART 4

Distribution of Retired Participants and Beneficiaries by Type and by Monthly Amount as of December 31, 2015

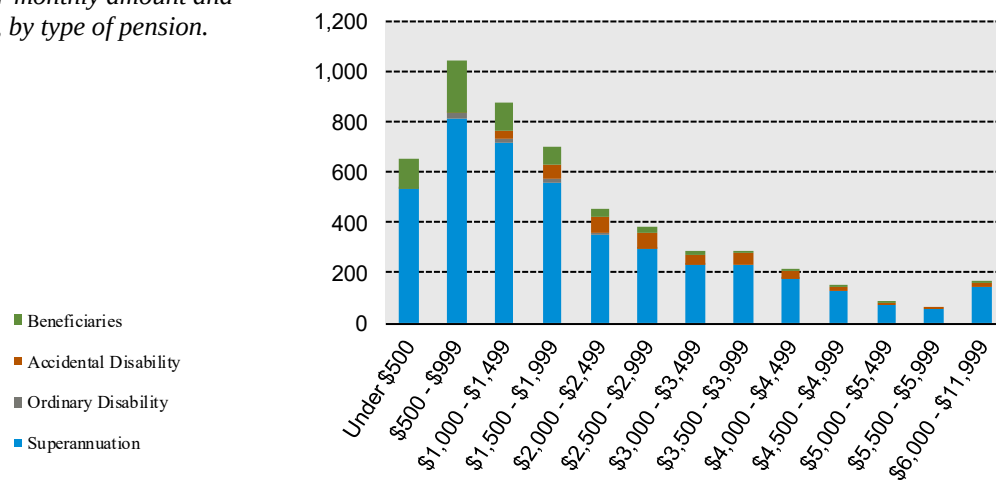
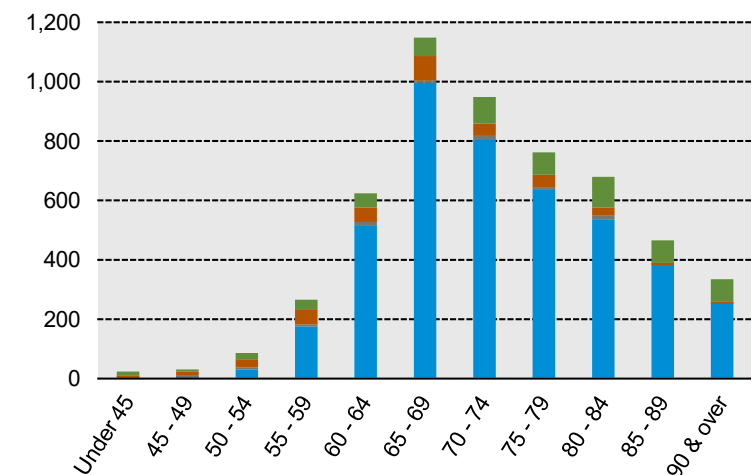


CHART 5

Distribution of Retired Participants and Beneficiaries by Type and by Age as of December 31, 2015



SECTION 2: Valuation Results for the Middlesex County Retirement System

B. FINANCIAL INFORMATION

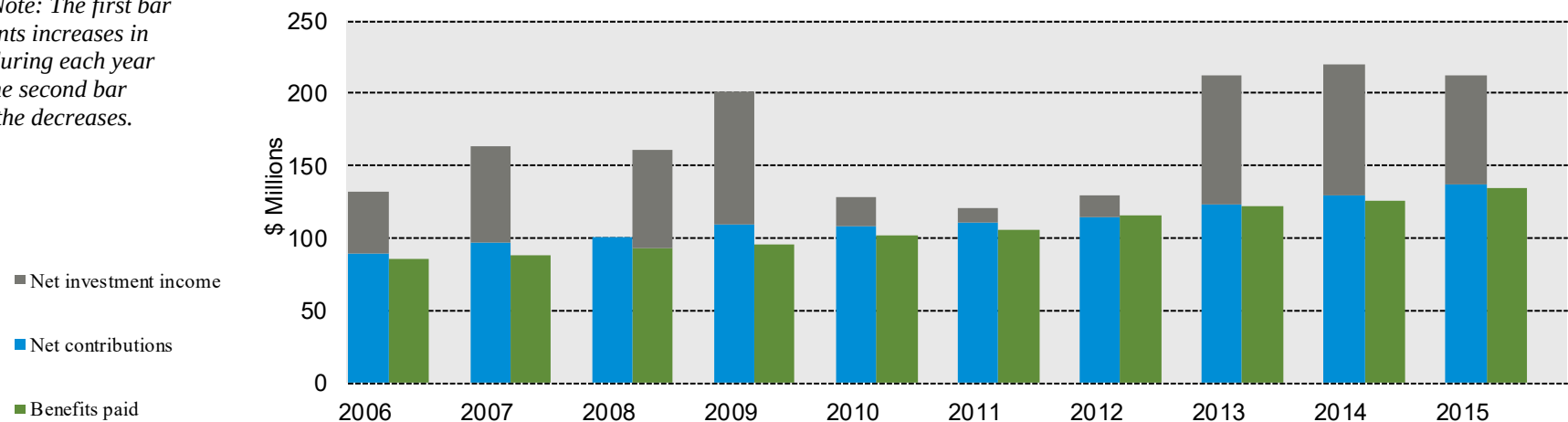
Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and net investment earnings (less investment fees) will be needed to cover benefit payments.

Retirement plan assets change as a result of the net impact of these income and expense components. Additional financial information, including a summary of these transactions for the valuation year, is presented in Section 4, Exhibits C and D.

The chart depicts the components of changes in the actuarial value of assets over the last ten years. Note: The first bar represents increases in assets during each year while the second bar details the decreases.

CHART 6

Comparison of Increases and Decreases in the Actuarial Value of Assets for Years Ended December 31, 2006 – 2015



SECTION 2: Valuation Results for the Middlesex County Retirement System

It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable.

The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

The chart shows the determination of the actuarial value of assets as of the valuation date.

CHART 7

Determination of Actuarial Value of Assets

	Year Ended	
	December 31, 2015	December 31, 2014
1. Market value of assets	\$1,104,482,897	\$1,093,560,674
2. Calculation of unrecognized return*	Original <u>Amount</u>	Unrecognized <u>Return</u>
(a) Year ended December 31, 2015	-\$78,422,911	N/A
(b) Year ended December 31, 2014	-5,071,171	-\$4,056,937
(c) Year ended December 31, 2013	53,733,022	32,239,813
(d) Year ended December 31, 2012	38,240,281	15,296,112
(e) Year ended December 31, 2011	-62,178,701	<u>-12,435,740</u>
(f) Total unrecognized return	-36,639,766	31,043,248
3. Preliminary actuarial value: (1) - (2f)	1,141,122,663	1,062,517,426
4. Adjustment to be within 20% corridor	0	0
5. Final actuarial value of assets as of December 31, 2015: (3) + (4)	<u>\$1,141,122,633</u>	<u>\$1,062,517,426</u>
6. Actuarial value as a percentage of market value: (5) ÷ (1)	103.3%	97.2%

* Unrecognized return is the difference between the total return and the expected return on a market value basis and is recognized over a five-year period.

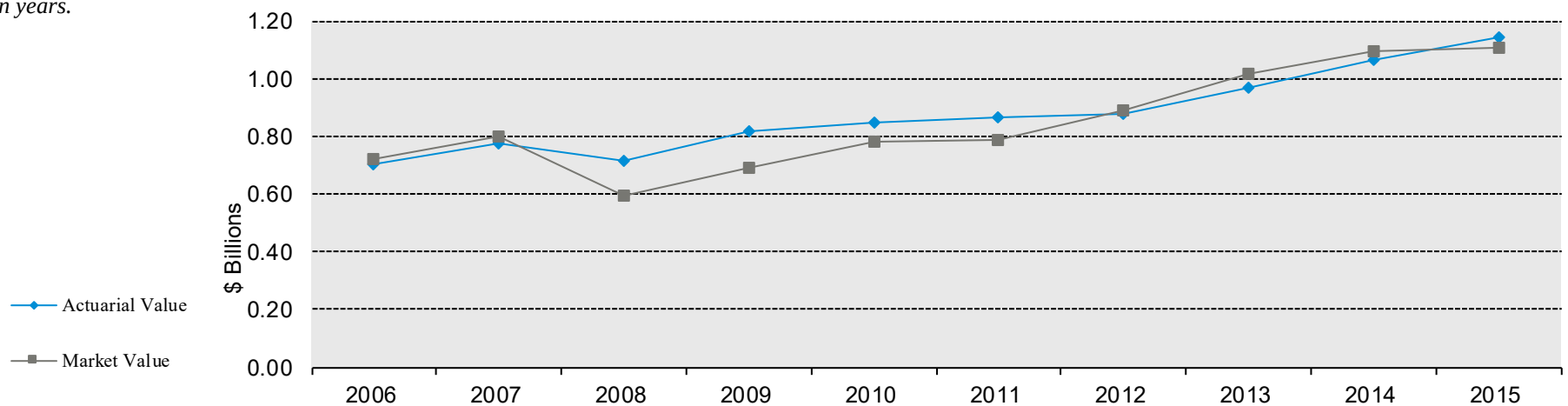
SECTION 2: Valuation Results for the Middlesex County Retirement System

Both the actuarial value and market value of assets are representations of the Middlesex County Retirement System's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the Middlesex County Retirement System's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

This chart shows the change in the actuarial value of assets versus the market value over the past ten years.

CHART 8

Actuarial Value of Assets vs. Market Value of Assets as of December 31, 2006 – 2015



SECTION 2: Valuation Results for the Middlesex County Retirement System

C. ACTUARIAL EXPERIENCE

To calculate the required contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), the contribution requirement will decrease from the previous year. On the other hand, the contribution requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single year's experience was a short-term

development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

The total experience loss for the two-year period ended December 31, 2015 is \$136,245. A discussion of the major components of the actuarial experience is on the following pages.

This chart provides a summary of the actuarial experience over the past two years.

CHART 9

Actuarial Experience for Two-Year Period Ended December 31, 2015

1. Net gain from investments*	\$7,285,993
2. Net gain from administrative expenses	251,544
3. Net loss from other experience**	<u>-7,673,782</u>
4. Net experience loss: (1) + (2) + (3)	-\$136,245

* Details in Chart 10

** Details in Chart 13

SECTION 2: Valuation Results for the Middlesex County Retirement System

Investment Rate of Return

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Middlesex County Retirement System's investment policy. For valuation purposes, the assumed rate of return on the actuarial value of assets was 7.875% for 2015 and 2014. The actual rate of return on an actuarial basis for the 2015 and 2014 plan years was 7.10% and 9.36%, respectively.

Since the actual return for the two-year period was greater than the assumed return, the Middlesex County Retirement System experienced an actuarial gain of \$7,285,993 (including an adjustment for interest) during the two-year period ending December 31, 2015 with regard to its investments.

This chart shows the gain/(loss) due to investment experience.

CHART 10 Actuarial Value Investment Experience

	Year Ended	
	December 31, 2015	December 31, 2014
1. Actual return	\$75,500,265	\$90,787,044
2. Average value of assets	1,064,069,912	969,438,200
3. Actual rate of return: (1) ÷ (2)	7.10%	9.36%
4. Assumed rate of return	7.875%	7.875%
5. Expected return: (2) x (4)	\$83,795,506	\$76,343,259
6. Actuarial gain/(loss): (1) – (5)	<u>-\$8,295,241</u>	<u>\$14,443,785</u>

SECTION 2: Valuation Results for the Middlesex County Retirement System

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the market value investment return for the last ten years, including five-year and ten-year averages.

Based upon this experience and future expectations, we have lowered the assumed rate of return from 7.875% to 7.75%.

CHART 11

Investment Return – Actuarial Value vs. Market Value: 2006 - 2015

Year Ended December 31	Actuarial Value Investment Return		Market Value Investment Return	
	Amount	Percent	Amount	Percent
2006	\$42,522,819	6.49%	\$78,230,492	12.26%
2007	67,081,999	9.53	69,754,061	9.66
2008	-68,010,444	-8.73	-208,326,323	-26.04
2009	92,107,036	12.77	80,318,175	13.34
2010	20,487,695	2.49	85,309,569	12.32
2011	10,333,913	1.22	1,488,563	0.19
2012	15,213,243	1.77	101,170,082	12.86
2013	88,945,014	10.14	124,783,005	14.05
2014	90,787,044	9.36	74,962,895	7.38
2015	<u>75,500,265</u>	7.10	<u>7,817,250</u>	0.71
Total	\$434,968,584		\$415,507,769	
	Five-year average return	6.08%		6.79%
	Ten-year average return	5.24%		5.18%

Note: Investment returns for 2007 and earlier are net of investment and administrative expenses. Returns for 2008 and later are net of investment expenses only.

SECTION 2: Valuation Results for the Middlesex County Retirement System

Subsection B described the actuarial asset valuation method that gradually takes into account fluctuations in the market value rate of return. The effect of this is to stabilize the actuarial rate of return, which contributes to leveling pension plan costs.

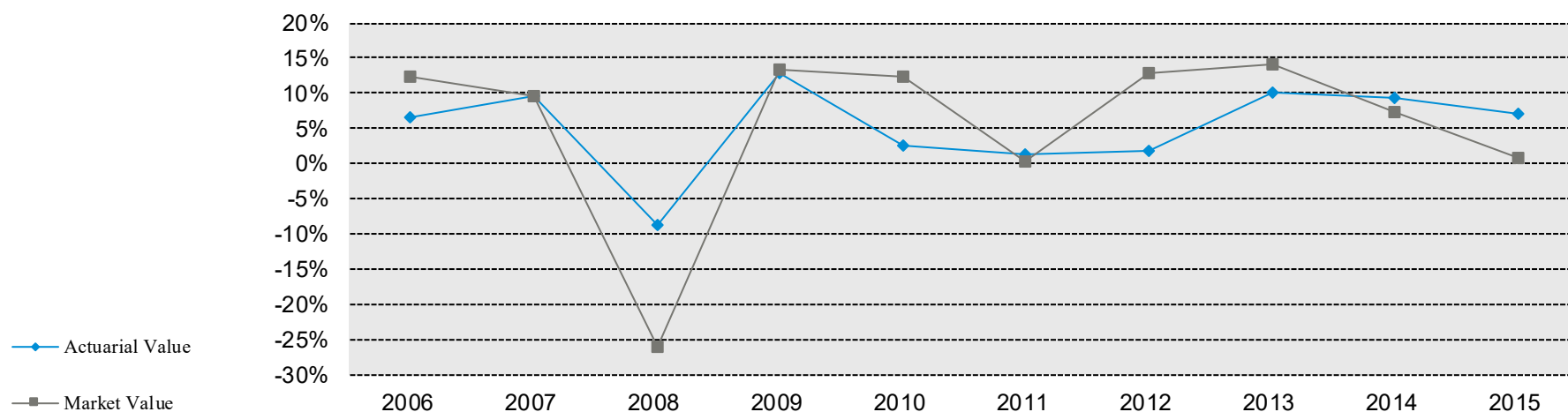
Administrative Expenses

Administrative expenses for the years ended December 31, 2014 and 2015 were \$3,540,884 and \$3,290,167, respectively, compared to the assumption of \$3,400,000 for calendar 2014 and \$3,536,000 for calendar 2015. This resulted in a gain of \$251,544 for the two-year period, including an adjustment for interest. We have reset the administrative expense assumption to \$3,500,000 for calendar year 2016, increasing 3.5% per year, based on information provided by the Retirement System.

This chart illustrates how this leveling effect has actually worked over the years 2006 - 2015.

CHART 12

Market and Actuarial Rates of Return for Years Ended December 31, 2006 - 2015



SECTION 2: Valuation Results for the Middlesex County Retirement System

Other Experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- the extent of turnover among the participants,
- retirement experience (earlier or later than expected),
- mortality (more or fewer deaths than expected),
- the number of disability retirements, and
- salary increases different than assumed.

The net loss from this other experience for the two-year period ending December 31, 2015 amounted to \$7,673,782, which is 0.3% of the actuarial accrued liability.

A brief summary of the demographic gain/(loss) experience of the Middlesex County Retirement System for the two-year period ending December 31, 2015 is shown in the chart below.

This valuation reflects the following changes in actuarial assumptions and methods:

- 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 the RP-2000 Healthy Annuitant 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.

The chart shows elements of the experience gain/(loss) for the most recent years.

CHART 13

Experience Due to Changes in Demographics for Two-Year Period Ended December 31, 2015

1. Salary increases less than expected for continuing actives	\$18,238,796
2. Fewer deaths than expected among retired members and changes in benefit amounts	-1,065,919
3. Net 3(8)(c) reimbursements out of System	-5,972,308
4. Loss due to data changes, other miscellaneous experience and Section 101 increases	<u>-18,874,351</u>
5. Net experience loss	<u>-\$7,673,782</u>

SECTION 2: Valuation Results for the Middlesex County Retirement System

The changes in assumptions and methods increased the unfunded liability by \$88.8 million and increased the normal cost by \$3.5 million.

The following plan change is included in this 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.

The unfunded liability was expected to increase from \$1,228.6 million as of January 1, 2014 to \$1,262.1 million as of January 1, 2016. The actual unfunded liability as of January 1, 2016 of \$1,351.0 million is \$88.9 million higher than expected as detailed in Chart 14 below.

CHART 14

Development of Unfunded Actuarial Accrued Liability and (Gain)/Loss

	Year Ended	
	December 31, 2015	December 31, 2014
1. Unfunded actuarial accrued liability at beginning of year	\$1,247,293,080	\$1,228,586,434
2. Normal cost at beginning of year	57,753,685	55,532,389
3. Total contributions	-140,690,644	-133,207,926
4. Interest		
(a) For whole year on (1) + (2)	\$102,772,433	\$101,124,357
(b) For half year on (3)	<u>-5,008,558</u>	<u>-4,742,174</u>
(c) Total interest	<u>97,763,875</u>	<u>96,382,183</u>
5. Expected unfunded actuarial accrued liability	\$1,262,119,996	\$1,247,293,080
6. Changes due to:		
(a) Net experience loss	\$136,245	--
(b) Assumption changes	<u>88,782,862</u>	--
(c) Total changes	<u>88,919,107</u>	--
7. Unfunded actuarial accrued liability at end of year: (5) + (6c)	<u>\$1,351,039,103</u>	--

SECTION 2: Valuation Results for the Middlesex County Retirement System

D. RECOMMENDED CONTRIBUTION

The amount of annual contribution required to fund the Plan is comprised of an employer normal cost payment and a payment on the unfunded actuarial accrued liability.

The recommended contribution for fiscal 2017 was set to the previously budgeted amount of \$107,210,668. In fiscal 2018 through fiscal 2024, the recommended contribution will be the prior year's budgeted amount increased 6.5%. Thereafter, the amortization payment on the unfunded liability will increase 4% per year. This will result in a total fiscal 2018 appropriation of \$114,179,361 and a total fiscal

2019 appropriation of \$121,601,019. These amounts reflect payment of the appropriation in two equal amounts on July 1 and December 31. If the appropriation is made in one payment on July 1, the amount will be lower. Under this funding schedule, the System will be fully funded by fiscal 2035, the same as the prior funding schedule. Chart 16 on the following page shows the detail of the funding schedule.

The chart compares this valuation's recommended contribution with the prior valuation.

CHART 15
Recommended Contribution

	Year Beginning January 1			
	2016		2014	
	Amount	% of Payroll	Amount	% of Payroll
1. Total normal cost	\$58,449,136	13.29%	\$52,132,389	12.54%
2. Administrative expenses	3,500,000	0.80%	3,400,000	0.82%
3. Expected employee contributions	<u>-42,068,898</u>	<u>-9.57%</u>	<u>-39,232,068</u>	<u>-9.44%</u>
4. Employer normal cost: (1) + (2) + (3)	\$19,880,238	4.52%	\$16,300,321	3.92%
5. Actuarial accrued liability	2,492,161,766		2,195,732,452	
6. Actuarial value of assets	<u>1,141,122,663</u>		<u>967,146,018</u>	
7. Unfunded actuarial accrued liability: (5) - (6)	\$1,351,039,103		\$1,228,586,434	
8. Employer normal cost projected to July 1, 2016 and 2014, adjusted for timing*	20,606,111	4.61%	16,941,148	4.00%
9. Projected unfunded actuarial accrued liability	1,402,415,032		1,276,045,381	
10. Payment on projected unfunded actuarial accrued liability, adjusted for timing*	86,604,557	19.36%	77,582,133	18.29%
11. Total recommended contribution: (8) + (10)	<u>\$107,210,668</u>	<u>23.97%</u>	<u>\$94,523,281</u>	<u>22.29%</u>
12. Projected payroll	\$447,271,930		\$423,986,338	

* Recommended contributions are assumed to be paid on July 1 and December 31.

SECTION 2: Valuation Results for the Middlesex County Retirement System

CHART 16

Fully funded by 2035 with appropriations that increase 6.5% per year from fiscal 2018 through fiscal 2024 and lower increases thereafter

(1) Fiscal Year Ended June 30	(2) Employer Normal Cost	(3) Amortization of 2002 ERI Liability	(4) Amortization of 2003 ERI Liability	(5) Amortization of 2010 ERI Liability	(6) Amortization of Remaining Unfunded Liability	(7) Total Plan Cost: (2) + (3) + (4) + (5) + (6)	(8) Total Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(9) Percent Increase in Total Cost
2017	\$20,606,111	\$1,672,875	\$731,903	\$60,733	\$84,139,046	\$107,210,668	\$1,402,415,032	- -
2018	21,421,380	1,672,875	731,903	60,733	90,292,470	114,179,361	1,419,511,007	6.50%
2019	22,268,622	1,672,875	731,903	60,733	96,866,886	121,601,019	1,431,424,186	6.50%
2020	23,149,081	0	731,903	60,733	105,563,368	129,505,085	1,437,307,669	6.50%
2021	24,064,050	0	0	60,733	113,798,133	137,922,916	1,436,219,101	6.50%
2022	25,014,872	0	0	60,733	121,812,301	146,887,906	1,427,111,297	6.50%
2023	26,002,941	0	0	0	130,432,679	156,435,620	1,408,822,019	6.50%
2024	27,029,706	0	0	0	139,574,229	166,603,935	1,380,062,819	6.50%
2025	28,096,673	0	0	0	147,171,124	175,267,797	1,339,406,866	5.20%
2026	29,205,404	0	0	0	153,057,969	182,263,373	1,287,565,758	3.99%
2027	30,357,522	0	0	0	159,180,288	189,537,810	1,225,481,158	3.99%
2028	31,554,713	0	0	0	165,547,500	197,102,213	1,152,110,163	3.99%
2029	32,798,729	0	0	0	172,169,400	204,968,129	1,066,319,084	3.99%
2030	34,091,389	0	0	0	179,056,176	213,147,565	966,876,012	3.99%
2031	35,434,580	0	0	0	186,218,423	221,653,003	852,442,790	3.99%
2032	36,830,266	0	0	0	193,667,160	230,497,426	721,566,349	3.99%
2033	38,280,484	0	0	0	201,413,846	239,694,330	572,669,353	3.99%
2034	39,787,351	0	0	0	209,470,400	249,257,751	404,040,105	3.99%
2035	41,353,063	0	0	0	217,849,215	259,202,278	213,821,645	3.99%
2036	42,979,905	0	0	0	0	42,979,905	0	-83.42%
2037	44,670,247	0	0	0	0	44,670,247	0	3.93%
2038	46,426,552	0	0	0	0	46,426,552	0	3.93%
2039	48,251,376	0	0	0	0	48,251,376	0	3.93%
2040	50,147,376	0	0	0	0	50,147,376	0	3.93%

Notes: Recommended contributions are assumed to be paid on July 1 and December 31.

Fiscal 2017 appropriation is budgeted amount determined with prior valuation.

Item (2) reflects 3.5% growth in payroll as well as a 0.15% adjustment to total normal cost to reflect the effects of mortality improvement due to generational mortality assumption.

Projected normal cost does not reflect the future impact of pension reform for new hires.

Items (3), (4) and (5) reflect level dollar amortization.

Item (6) increases 4% per year beginning in fiscal 2026.

Projected unfunded actuarial accrued liability does not reflect deferred investment gains.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results

Summary of Actuarial Valuation Results for Total

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 602 beneficiaries in pay status)	5,327
2. Participants active during the year ended December 31, 2015	9,072
3. Inactive participants entitled to a return of their employee contributions	2,640
4. Inactive participants with a vested right to a deferred or immediate benefit	321

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$58,449,136
2. Administrative expenses		3,500,000
3. Expected employee contributions		<u>-42,068,898</u>
4. Employer normal cost: (1) + (2) + (3)		\$19,880,238
5. Actuarial accrued liability		2,492,161,766
Retired participants and beneficiaries	\$1,254,052,923	
Active participants	1,193,429,619	
Inactive participants	44,679,224	
6. Actuarial value of assets		1,141,122,663
7. Unfunded actuarial accrued liability: (5) – (6)		1,351,039,103
8. Reallocated unfunded actuarial accrued liability		<u>0</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,351,039,103

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$20,606,111	4.61%
2. Projected unfunded actuarial accrued liability	1,402,415,032	
3. Payment on projected unfunded actuarial accrued liability	84,139,046	
4. Payment on 2002 ERI	1,672,875	
5. Payment on 2003 ERI	731,903	
6. Payment on 2010 ERI	<u>60,733</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$107,210,668	23.97%
8. Total FY17 Appropriation, payable on July 1	105,198,076	23.52%
9. Projected payroll	447,271,930	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$21,421,380	\$22,268,622
2. Payment on projected unfunded actuarial accrued liability	90,292,470	96,866,886
3. Payment on 2002 ERI	1,672,875	1,672,875
4. Payment on 2003 ERI	731,903	731,903
5. Payment on 2010 ERI	<u>60,733</u>	<u>60,733</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$114,179,361	\$121,601,019
7. Total Appropriation, payable on July 1	112,068,427	119,352,874

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Middlesex County Retirement Board

1

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	11
2. Participants active during the year ended December 31, 2015	19
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$137,256
2. Administrative expenses		8,219
3. Expected employee contributions		<u>-129,582</u>
4. Employer normal cost: (1) + (2) + (3)		\$15,893
5. Actuarial accrued liability		8,524,508
Retired participants and beneficiaries	\$3,705,552	
Active participants	4,597,178	
Inactive participants	221,778	
6. Actuarial value of assets		3,962,888
7. Unfunded actuarial accrued liability: (5) – (6)		4,561,620
8. Reallocated unfunded actuarial accrued liability		<u>96,898</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$4,658,518

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$16,473	1.23%
2. Projected unfunded actuarial accrued liability	4,835,667	
3. Payment on projected unfunded actuarial accrued liability	293,035	
4. Payment on 2002 ERI	8,383	
5. Payment on 2003 ERI	20,314	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$338,205	25.18%
8. Total FY17 Appropriation, payable on July 1	331,856	24.71%
9. Projected payroll	1,343,217	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$17,271	\$18,104
2. Payment on projected unfunded actuarial accrued liability	306,408	328,718
3. Payment on 2002 ERI	8,383	8,383
4. Payment on 2003 ERI	20,314	20,314
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$352,376	\$375,519
7. Total Appropriation, payable on July 1	345,861	368,576

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Middlesex County

100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 56 beneficiaries in pay status)	146
2. Participants active during the year ended December 31, 2015	0
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost	\$0
2. Administrative expenses	0
3. Expected employee contributions	-0
4. Employer normal cost: (1) + (2) + (3)	\$0
5. Actuarial accrued liability	18,094,527
Retired participants and beneficiaries	\$18,094,527
Active participants	0
Inactive participants	0
6. Actuarial value of assets	0
7. Unfunded actuarial accrued liability: (5) – (6)	18,094,527
8. Reallocated unfunded actuarial accrued liability	-18,094,527
9. Total unfunded actuarial accrued liability: (7) + (8)	\$0

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$0	0.00%
2. Projected unfunded actuarial accrued liability	0	
3. Payment on projected unfunded actuarial accrued liability	0	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$0	0.00%
8. Total FY17 Appropriation, payable on July 1	0	0.00%
9. Projected payroll	0	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$0	\$0
2. Payment on projected unfunded actuarial accrued liability	0	0
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$0	\$0
7. Total Appropriation, payable on July 1	0	0

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Middlesex Hospital

200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 5 beneficiaries in pay status)	86
2. Participants active during the year ended December 31, 2015	0
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$0
2. Administrative expenses		0
3. Expected employee contributions		<u>-0</u>
4. Employer normal cost: (1) + (2) + (3)		\$0
5. Actuarial accrued liability		9,915,325
Retired participants and beneficiaries	\$9,915,325	
Active participants	0	
Inactive participants	0	
6. Actuarial value of assets		0
7. Unfunded actuarial accrued liability: (5) – (6)		9,915,325
8. Reallocated unfunded actuarial accrued liability		<u>-9,915,325</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$0

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$0	0.00%
2. Projected unfunded actuarial accrued liability	0	
3. Payment on projected unfunded actuarial accrued liability	0	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$0	0.00%
8. Total FY17 Appropriation, payable on July 1	0	0.00%
9. Projected payroll	0	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$0	\$0
2. Payment on projected unfunded actuarial accrued liability	0	0
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$0	\$0
7. Total Appropriation, payable on July 1	0	0

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Acton

300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 18 beneficiaries in pay status)	172
2. Participants active during the year ended December 31, 2015	194
3. Inactive participants entitled to a return of their employee contributions	50
4. Inactive participants with a vested right to a deferred or immediate benefit	12

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,724,767
2. Administrative expenses		103,281
3. Expected employee contributions		<u>-1,250,937</u>
4. Employer normal cost: (1) + (2) + (3)		\$577,111
5. Actuarial accrued liability		84,571,698
Retired participants and beneficiaries	\$43,254,727	
Active participants	39,272,591	
Inactive participants	2,044,380	
6. Actuarial value of assets		42,193,362
7. Unfunded actuarial accrued liability: (5) – (6)		42,378,336
8. Reallocated unfunded actuarial accrued liability		<u>961,321</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$43,339,657

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$598,183	4.52%
2. Projected unfunded actuarial accrued liability	44,987,733	
3. Payment on projected unfunded actuarial accrued liability	2,930,571	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$3,528,754	26.64%
8. Total FY17 Appropriation, payable on July 1	3,462,510	26.14%
9. Projected payroll	13,246,300	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$621,895	\$646,538
2. Payment on projected unfunded actuarial accrued liability	2,897,296	3,108,256
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$3,519,191	\$3,754,794
7. Total Appropriation, payable on July 1	3,454,129	3,685,376

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Ashby

400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	8
2. Participants active during the year ended December 31, 2015	19
3. Inactive participants entitled to a return of their employee contributions	6
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$137,774
2. Administrative expenses		8,250
3. Expected employee contributions		<u>-85,857</u>
4. Employer normal cost: (1) + (2) + (3)		\$60,167
5. Actuarial accrued liability		3,546,501
Retired participants and beneficiaries	\$1,126,638	
Active participants	2,363,129	
Inactive participants	56,734	
6. Actuarial value of assets		2,283,313
7. Unfunded actuarial accrued liability: (5) – (6)		1,263,188
8. Reallocated unfunded actuarial accrued liability		<u>40,313</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,303,501

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$62,364	6.87%
2. Projected unfunded actuarial accrued liability	1,353,069	
3. Payment on projected unfunded actuarial accrued liability	114,314	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$176,678	19.46%
8. Total FY17 Appropriation, payable on July 1	173,361	19.09%
9. Projected payroll	907,918	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$64,768	\$67,265
2. Payment on projected unfunded actuarial accrued liability	85,373	91,589
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$150,141	\$158,854
7. Total Appropriation, payable on July 1	147,365	155,917

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Ashland

500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 14 beneficiaries in pay status)	124
2. Participants active during the year ended December 31, 2015	258
3. Inactive participants entitled to a return of their employee contributions	130
4. Inactive participants with a vested right to a deferred or immediate benefit	10

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,538,008
2. Administrative expenses		92,098
3. Expected employee contributions		<u>-1,083,565</u>
4. Employer normal cost: (1) + (2) + (3)		\$546,541
5. Actuarial accrued liability		61,451,775
Retired participants and beneficiaries	\$31,526,770	
Active participants	28,516,029	
Inactive participants	1,408,976	
6. Actuarial value of assets		32,119,315
7. Unfunded actuarial accrued liability: (5) – (6)		29,332,460
8. Reallocated unfunded actuarial accrued liability		<u>698,518</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$30,030,978

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$566,497	4.91%
2. Projected unfunded actuarial accrued liability	31,172,966	
3. Payment on projected unfunded actuarial accrued liability	1,662,250	
4. Payment on 2002 ERI	180,385	
5. Payment on 2003 ERI	55,053	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$2,464,185	21.34%
8. Total FY17 Appropriation, payable on July 1	2,417,927	20.94%
9. Projected payroll	11,545,501	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$588,799	\$611,972
2. Payment on projected unfunded actuarial accrued liability	1,985,157	2,129,701
3. Payment on 2002 ERI	180,385	180,385
4. Payment on 2003 ERI	55,053	55,053
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,809,394	\$2,977,111
7. Total Appropriation, payable on July 1	2,757,454	2,922,071

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Ayer

600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 15 beneficiaries in pay status)	71
2. Participants active during the year ended December 31, 2015	88
3. Inactive participants entitled to a return of their employee contributions	23
4. Inactive participants with a vested right to a deferred or immediate benefit	9

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$733,313
2. Administrative expenses		43,912
3. Expected employee contributions		<u>-513,270</u>
4. Employer normal cost: (1) + (2) + (3)		\$263,955
5. Actuarial accrued liability		33,270,005
Retired participants and beneficiaries	\$16,254,115	
Active participants	16,263,472	
Inactive participants	752,418	
6. Actuarial value of assets		17,453,573
7. Unfunded actuarial accrued liability: (5) – (6)		15,816,432
8. Reallocated unfunded actuarial accrued liability		<u>378,178</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$16,194,610

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$273,593	5.06%
2. Projected unfunded actuarial accrued liability	16,810,442	
3. Payment on projected unfunded actuarial accrued liability	1,150,300	
4. Payment on 2002 ERI	15,780	
5. Payment on 2003 ERI	17,166	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,456,839	26.93%
8. Total FY17 Appropriation, payable on July 1	1,429,491	26.42%
9. Projected payroll	5,409,850	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$284,348	\$295,524
2. Payment on projected unfunded actuarial accrued liability	1,071,762	1,149,799
3. Payment on 2002 ERI	15,780	15,780
4. Payment on 2003 ERI	17,166	17,166
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$1,389,056	\$1,478,269
7. Total Appropriation, payable on July 1	1,363,375	1,450,939

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Bedford

700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 16 beneficiaries in pay status)	171
2. Participants active during the year ended December 31, 2015	372
3. Inactive participants entitled to a return of their employee contributions	140
4. Inactive participants with a vested right to a deferred or immediate benefit	5

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,347,724
2. Administrative expenses		140,584
3. Expected employee contributions		<u>-1,746,923</u>
4. Employer normal cost: (1) + (2) + (3)		\$741,385
5. Actuarial accrued liability		89,129,829
Retired participants and beneficiaries	\$40,108,147	
Active participants	48,145,632	
Inactive participants	876,050	
6. Actuarial value of assets		42,543,020
7. Unfunded actuarial accrued liability: (5) – (6)		46,586,809
8. Reallocated unfunded actuarial accrued liability		<u>1,013,133</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$47,599,942

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$768,455	4.16%
2. Projected unfunded actuarial accrued liability	49,410,024	
3. Payment on projected unfunded actuarial accrued liability	3,017,829	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$3,786,284	20.50%
8. Total FY17 Appropriation, payable on July 1	3,715,207	20.12%
9. Projected payroll	18,465,838	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$799,129	\$831,014
2. Payment on projected unfunded actuarial accrued liability	3,195,661	3,428,345
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$3,994,790	\$4,259,359
7. Total Appropriation, payable on July 1	3,920,935	4,180,613

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Billerica

800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 61 beneficiaries in pay status)	436
2. Participants active during the year ended December 31, 2015	623
3. Inactive participants entitled to a return of their employee contributions	93
4. Inactive participants with a vested right to a deferred or immediate benefit	7

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$4,579,944
2. Administrative expenses		274,254
3. Expected employee contributions		<u>-3,206,145</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,648,053
5. Actuarial accrued liability		222,278,370
Retired participants and beneficiaries	\$120,381,746	
Active participants	100,231,450	
Inactive participants	1,665,174	
6. Actuarial value of assets		87,984,008
7. Unfunded actuarial accrued liability: (5) – (6)		134,294,362
8. Reallocated unfunded actuarial accrued liability		<u>2,526,624</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$136,820,986

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,708,221	5.03%
2. Projected unfunded actuarial accrued liability	142,023,869	
3. Payment on projected unfunded actuarial accrued liability	8,306,412	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$10,014,633	29.47%
8. Total FY17 Appropriation, payable on July 1	9,826,635	28.92%
9. Projected payroll	33,983,520	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,775,382	\$1,845,163
2. Payment on projected unfunded actuarial accrued liability	9,210,438	9,881,075
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$10,985,820	\$11,726,238
7. Total Appropriation, payable on July 1	10,782,713	11,509,447

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Boxborough

900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 3 beneficiaries in pay status)	33
2. Participants active during the year ended December 31, 2015	46
3. Inactive participants entitled to a return of their employee contributions	21
4. Inactive participants with a vested right to a deferred or immediate benefit	4

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$408,233
2. Administrative expenses		24,445
3. Expected employee contributions		<u>-273,456</u>
4. Employer normal cost: (1) + (2) + (3)		\$159,222
5. Actuarial accrued liability		17,098,330
Retired participants and beneficiaries	\$8,256,850	
Active participants	8,114,119	
Inactive participants	727,361	
6. Actuarial value of assets		7,906,637
7. Unfunded actuarial accrued liability: (5) – (6)		9,191,693
8. Reallocated unfunded actuarial accrued liability		<u>194,356</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$9,386,049

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$165,036	5.78%
2. Projected unfunded actuarial accrued liability	9,742,972	
3. Payment on projected unfunded actuarial accrued liability	518,857	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$683,893	23.97%
8. Total FY17 Appropriation, payable on July 1	671,055	23.52%
9. Projected payroll	2,852,875	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$171,469	\$178,151
2. Payment on projected unfunded actuarial accrued liability	635,287	681,544
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$806,756	\$859,695
7. Total Appropriation, payable on July 1	791,841	843,801

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Burlington

1000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 30 beneficiaries in pay status)	336
2. Participants active during the year ended December 31, 2015	565
3. Inactive participants entitled to a return of their employee contributions	162
4. Inactive participants with a vested right to a deferred or immediate benefit	15

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$4,078,985
2. Administrative expenses		244,254
3. Expected employee contributions		<u>-3,012,527</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,310,712
5. Actuarial accrued liability		190,417,879
Retired participants and beneficiaries	\$93,019,259	
Active participants	95,464,425	
Inactive participants	1,934,195	
6. Actuarial value of assets		82,974,106
7. Unfunded actuarial accrued liability: (5) – (6)		107,443,773
8. Reallocated unfunded actuarial accrued liability		<u>2,164,467</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$109,608,240

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,358,569	4.26%
2. Projected unfunded actuarial accrued liability	113,776,310	
3. Payment on projected unfunded actuarial accrued liability	6,870,892	
4. Payment on 2002 ERI	264,709	
5. Payment on 2003 ERI	70,883	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$8,565,053	26.84%
8. Total FY17 Appropriation, payable on July 1	8,404,267	26.34%
9. Projected payroll	31,905,766	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,412,683	\$1,468,931
2. Payment on projected unfunded actuarial accrued liability	7,296,884	7,828,188
3. Payment on 2002 ERI	264,709	264,709
4. Payment on 2003 ERI	70,883	70,883
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$9,045,159	\$9,632,711
7. Total Appropriation, payable on July 1	8,877,933	9,454,623

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Carlisle

1100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	32
2. Participants active during the year ended December 31, 2015	103
3. Inactive participants entitled to a return of their employee contributions	40
4. Inactive participants with a vested right to a deferred or immediate benefit	4

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$685,592
2. Administrative expenses		41,054
3. Expected employee contributions		<u>-475,919</u>
4. Employer normal cost: (1) + (2) + (3)		\$250,727
5. Actuarial accrued liability		21,740,957
Retired participants and beneficiaries	\$6,209,189	
Active participants	15,123,809	
Inactive participants	407,959	
6. Actuarial value of assets		12,722,285
7. Unfunded actuarial accrued liability: (5) – (6)		9,018,672
8. Reallocated unfunded actuarial accrued liability		<u>247,128</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$9,265,800

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$259,882	5.01%
2. Projected unfunded actuarial accrued liability	9,618,150	
3. Payment on projected unfunded actuarial accrued liability	560,150	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$820,032	15.80%
8. Total FY17 Appropriation, payable on July 1	804,638	15.50%
9. Projected payroll	5,191,643	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$270,081	\$280,677
2. Payment on projected unfunded actuarial accrued liability	623,911	669,339
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$893,992	\$950,016
7. Total Appropriation, payable on July 1	877,464	932,452

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Chelmsford

1200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 48 beneficiaries in pay status)	428
2. Participants active during the year ended December 31, 2015	525
3. Inactive participants entitled to a return of their employee contributions	114
4. Inactive participants with a vested right to a deferred or immediate benefit	22

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$3,210,086
2. Administrative expenses		192,224
3. Expected employee contributions		<u>-2,224,137</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,178,173
5. Actuarial accrued liability		155,324,513
Retired participants and beneficiaries	\$91,163,939	
Active participants	61,511,081	
Inactive participants	2,649,493	
6. Actuarial value of assets		60,804,858
7. Unfunded actuarial accrued liability: (5) – (6)		94,519,655
8. Reallocated unfunded actuarial accrued liability		<u>1,765,563</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$96,285,218

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,221,191	5.14%
2. Projected unfunded actuarial accrued liability	99,946,654	
3. Payment on projected unfunded actuarial accrued liability	6,177,754	
4. Payment on 2002 ERI	297,748	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$7,696,693	32.43%
8. Total FY17 Appropriation, payable on July 1	7,552,208	31.82%
9. Projected payroll	23,735,957	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,269,098	\$1,318,871
2. Payment on projected unfunded actuarial accrued liability	6,403,153	6,869,383
3. Payment on 2002 ERI	297,748	297,748
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$7,969,999	\$8,486,002
7. Total Appropriation, payable on July 1	7,822,651	8,329,114

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Dracut

1300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 18 beneficiaries in pay status)	216
2. Participants active during the year ended December 31, 2015	323
3. Inactive participants entitled to a return of their employee contributions	35
4. Inactive participants with a vested right to a deferred or immediate benefit	11

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,090,837
2. Administrative expenses		125,202
3. Expected employee contributions		<u>-1,372,120</u>
4. Employer normal cost: (1) + (2) + (3)		\$843,919
5. Actuarial accrued liability		98,091,871
Retired participants and beneficiaries	\$56,267,434	
Active participants	40,852,800	
Inactive participants	971,637	
6. Actuarial value of assets		44,388,209
7. Unfunded actuarial accrued liability: (5) – (6)		53,703,662
8. Reallocated unfunded actuarial accrued liability		<u>1,115,004</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$54,818,666

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$874,732	5.94%
2. Projected unfunded actuarial accrued liability	56,903,254	
3. Payment on projected unfunded actuarial accrued liability	3,439,936	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,314,668	29.28%
8. Total FY17 Appropriation, payable on July 1	4,233,672	28.73%
9. Projected payroll	14,735,871	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$908,713	\$944,005
2. Payment on projected unfunded actuarial accrued liability	3,682,698	3,950,844
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$4,591,411	\$4,894,849
7. Total Appropriation, payable on July 1	4,506,526	4,804,354

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Dunstable

1400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	8
2. Participants active during the year ended December 31, 2015	23
3. Inactive participants entitled to a return of their employee contributions	4
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$172,088
2. Administrative expenses		10,305
3. Expected employee contributions		<u>-114,119</u>
4. Employer normal cost: (1) + (2) + (3)		\$68,274
5. Actuarial accrued liability		4,661,377
Retired participants and beneficiaries	\$1,544,102	
Active participants	3,049,675	
Inactive participants	67,600	
6. Actuarial value of assets		2,637,756
7. Unfunded actuarial accrued liability: (5) – (6)		2,023,621
8. Reallocated unfunded actuarial accrued liability		<u>52,986</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$2,076,607

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$70,767	5.85%
2. Projected unfunded actuarial accrued liability	2,155,574	
3. Payment on projected unfunded actuarial accrued liability	162,294	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$233,061	19.26%
8. Total FY17 Appropriation, payable on July 1	228,686	18.90%
9. Projected payroll	1,210,122	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$73,521	\$76,381
2. Payment on projected unfunded actuarial accrued liability	137,346	147,346
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$210,867	\$223,727
7. Total Appropriation, payable on July 1	206,969	219,591

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Groton

1500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 9 beneficiaries in pay status)	69
2. Participants active during the year ended December 31, 2015	109
3. Inactive participants entitled to a return of their employee contributions	22
4. Inactive participants with a vested right to a deferred or immediate benefit	3

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,001,811
2. Administrative expenses		59,990
3. Expected employee contributions		<u>-700,168</u>
4. Employer normal cost: (1) + (2) + (3)		\$361,633
5. Actuarial accrued liability		37,857,639
Retired participants and beneficiaries	\$19,725,274	
Active participants	17,569,396	
Inactive participants	562,969	
6. Actuarial value of assets		16,831,397
7. Unfunded actuarial accrued liability: (5) – (6)		21,026,242
8. Reallocated unfunded actuarial accrued liability		<u>430,325</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$21,456,567

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$374,837	5.23%
2. Projected unfunded actuarial accrued liability	22,272,496	
3. Payment on projected unfunded actuarial accrued liability	1,290,463	
4. Payment on 2002 ERI	189,557	
5. Payment on 2003 ERI	19,367	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,874,224	26.13%
8. Total FY17 Appropriation, payable on July 1	1,839,040	25.64%
9. Projected payroll	7,173,751	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$389,568	\$404,874
2. Payment on projected unfunded actuarial accrued liability	1,404,824	1,507,112
3. Payment on 2002 ERI	189,557	189,557
4. Payment on 2003 ERI	19,367	19,367
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,003,316	\$2,120,910
7. Total Appropriation, payable on July 1	1,966,279	2,081,699

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Holliston

1600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 9 beneficiaries in pay status)	110
2. Participants active during the year ended December 31, 2015	262
3. Inactive participants entitled to a return of their employee contributions	134
4. Inactive participants with a vested right to a deferred or immediate benefit	12

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,359,817
2. Administrative expenses		81,427
3. Expected employee contributions		<u>-970,572</u>
4. Employer normal cost: (1) + (2) + (3)		\$470,672
5. Actuarial accrued liability		50,795,365
Retired participants and beneficiaries	\$21,155,781	
Active participants	28,287,506	
Inactive participants	1,352,078	
6. Actuarial value of assets		28,632,530
7. Unfunded actuarial accrued liability: (5) – (6)		22,162,835
8. Reallocated unfunded actuarial accrued liability		<u>577,388</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$22,740,223

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$487,857	4.66%
2. Projected unfunded actuarial accrued liability	23,604,964	
3. Payment on projected unfunded actuarial accrued liability	1,451,604	
4. Payment on 2002 ERI	56,414	
5. Payment on 2003 ERI	20,905	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$2,016,780	19.26%
8. Total FY17 Appropriation, payable on July 1	1,978,920	18.90%
9. Projected payroll	10,472,968	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$507,121	\$527,138
2. Payment on projected unfunded actuarial accrued liability	1,510,324	1,620,294
3. Payment on 2002 ERI	56,414	56,414
4. Payment on 2003 ERI	20,905	20,905
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,094,764	\$2,224,751
7. Total Appropriation, payable on July 1	2,056,036	2,183,620

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Hopkinton

1700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 8 beneficiaries in pay status)	80
2. Participants active during the year ended December 31, 2015	267
3. Inactive participants entitled to a return of their employee contributions	102
4. Inactive participants with a vested right to a deferred or immediate benefit	16

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,851,648
2. Administrative expenses		110,879
3. Expected employee contributions		<u>-1,298,767</u>
4. Employer normal cost: (1) + (2) + (3)		\$663,760
5. Actuarial accrued liability		54,965,620
Retired participants and beneficiaries	\$18,770,025	
Active participants	33,494,301	
Inactive participants	2,701,294	
6. Actuarial value of assets		36,170,942
7. Unfunded actuarial accrued liability: (5) – (6)		18,794,678
8. Reallocated unfunded actuarial accrued liability		<u>624,791</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$19,419,469

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$687,995	5.03%
2. Projected unfunded actuarial accrued liability	20,157,932	
3. Payment on projected unfunded actuarial accrued liability	1,183,501	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,871,496	13.69%
8. Total FY17 Appropriation, payable on July 1	1,836,364	13.43%
9. Projected payroll	13,668,916	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$715,055	\$743,170
2. Payment on projected unfunded actuarial accrued liability	1,306,963	1,402,126
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,022,018	\$2,145,296
7. Total Appropriation, payable on July 1	1,984,635	2,105,634

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Hudson

1800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 22 beneficiaries in pay status)	193
2. Participants active during the year ended December 31, 2015	462
3. Inactive participants entitled to a return of their employee contributions	143
4. Inactive participants with a vested right to a deferred or immediate benefit	12

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,915,477
2. Administrative expenses		174,582
3. Expected employee contributions		<u>-2,025,033</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,065,026
5. Actuarial accrued liability		109,716,788
Retired participants and beneficiaries	\$51,831,209	
Active participants	56,034,803	
Inactive participants	1,850,776	
6. Actuarial value of assets		51,984,910
7. Unfunded actuarial accrued liability: (5) – (6)		57,731,878
8. Reallocated unfunded actuarial accrued liability		<u>1,247,143</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$58,979,021

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,103,913	5.09%
2. Projected unfunded actuarial accrued liability	61,221,815	
3. Payment on projected unfunded actuarial accrued liability	3,672,120	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,776,033	22.01%
8. Total FY17 Appropriation, payable on July 1	4,686,376	21.59%
9. Projected payroll	21,703,223	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,147,241	\$1,192,258
2. Payment on projected unfunded actuarial accrued liability	3,964,139	4,252,778
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$5,111,380	\$5,445,036
7. Total Appropriation, payable on July 1	5,016,882	5,344,369

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Lincoln

1900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 12 beneficiaries in pay status)	99
2. Participants active during the year ended December 31, 2015	195
3. Inactive participants entitled to a return of their employee contributions	107
4. Inactive participants with a vested right to a deferred or immediate benefit	9

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,238,467
2. Administrative expenses		74,161
3. Expected employee contributions		<u>-912,712</u>
4. Employer normal cost: (1) + (2) + (3)		\$399,916
5. Actuarial accrued liability		47,984,532
Retired participants and beneficiaries	\$23,294,306	
Active participants	23,444,219	
Inactive participants	1,246,007	
6. Actuarial value of assets		24,352,289
7. Unfunded actuarial accrued liability: (5) – (6)		23,632,243
8. Reallocated unfunded actuarial accrued liability		<u>545,437</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$24,177,680

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$414,518	4.30%
2. Projected unfunded actuarial accrued liability	25,097,084	
3. Payment on projected unfunded actuarial accrued liability	1,544,391	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,958,909	20.34%
8. Total FY17 Appropriation, payable on July 1	1,922,136	19.95%
9. Projected payroll	9,632,634	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$431,019	\$448,170
2. Payment on projected unfunded actuarial accrued liability	1,622,410	1,740,541
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,053,429	\$2,188,711
7. Total Appropriation, payable on July 1	2,015,466	2,148,246

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Littleton

2000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 11 beneficiaries in pay status)	94
2. Participants active during the year ended December 31, 2015	240
3. Inactive participants entitled to a return of their employee contributions	72
4. Inactive participants with a vested right to a deferred or immediate benefit	12

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,486,382
2. Administrative expenses		89,006
3. Expected employee contributions		<u>-1,066,531</u>
4. Employer normal cost: (1) + (2) + (3)		\$508,857
5. Actuarial accrued liability		52,263,175
Retired participants and beneficiaries	\$23,060,454	
Active participants	27,535,134	
Inactive participants	1,667,587	
6. Actuarial value of assets		29,919,769
7. Unfunded actuarial accrued liability: (5) – (6)		22,343,406
8. Reallocated unfunded actuarial accrued liability		<u>594,072</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$22,937,478

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$527,437	4.68%
2. Projected unfunded actuarial accrued liability	23,809,721	
3. Payment on projected unfunded actuarial accrued liability	1,383,711	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,911,148	16.95%
8. Total FY17 Appropriation, payable on July 1	1,875,271	16.63%
9. Projected payroll	11,274,194	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$548,289	\$569,958
2. Payment on projected unfunded actuarial accrued liability	1,544,689	1,657,161
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,092,978	\$2,227,119
7. Total Appropriation, payable on July 1	2,054,283	2,185,944

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of North Reading

2100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 23 beneficiaries in pay status)	166
2. Participants active during the year ended December 31, 2015	254
3. Inactive participants entitled to a return of their employee contributions	35
4. Inactive participants with a vested right to a deferred or immediate benefit	4

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,674,957
2. Administrative expenses		100,298
3. Expected employee contributions		<u>-1,222,642</u>
4. Employer normal cost: (1) + (2) + (3)		\$552,613
5. Actuarial accrued liability		79,307,632
Retired participants and beneficiaries	\$39,763,787	
Active participants	39,116,440	
Inactive participants	427,405	
6. Actuarial value of assets		34,953,610
7. Unfunded actuarial accrued liability: (5) – (6)		44,354,022
8. Reallocated unfunded actuarial accrued liability		<u>901,485</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$45,255,507

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$572,790	4.38%
2. Projected unfunded actuarial accrued liability	46,976,437	
3. Payment on projected unfunded actuarial accrued liability	2,914,768	
4. Payment on 2002 ERI	21,598	
5. Payment on 2003 ERI	56,849	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$3,566,005	27.27%
8. Total FY17 Appropriation, payable on July 1	3,499,063	26.76%
9. Projected payroll	13,076,424	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$595,533	\$619,171
2. Payment on projected unfunded actuarial accrued liability	3,017,343	3,237,043
3. Payment on 2002 ERI	21,598	21,598
4. Payment on 2003 ERI	56,849	56,849
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$3,691,323	\$3,934,661
7. Total Appropriation, payable on July 1	3,623,078	3,861,918

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Pepperell

2200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 7 beneficiaries in pay status)	53
2. Participants active during the year ended December 31, 2015	71
3. Inactive participants entitled to a return of their employee contributions	9
4. Inactive participants with a vested right to a deferred or immediate benefit	6

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$604,153
2. Administrative expenses		36,177
3. Expected employee contributions		<u>-429,719</u>
4. Employer normal cost: (1) + (2) + (3)		\$210,611
5. Actuarial accrued liability		29,079,785
Retired participants and beneficiaries	\$13,840,213	
Active participants	14,148,161	
Inactive participants	1,091,411	
6. Actuarial value of assets		13,868,136
7. Unfunded actuarial accrued liability: (5) – (6)		15,211,649
8. Reallocated unfunded actuarial accrued liability		<u>330,548</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$15,542,197

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$218,301	4.87%
2. Projected unfunded actuarial accrued liability	16,133,220	
3. Payment on projected unfunded actuarial accrued liability	877,087	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,095,388	24.44%
8. Total FY17 Appropriation, payable on July 1	1,074,825	23.98%
9. Projected payroll	4,481,279	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$226,914	\$235,863
2. Payment on projected unfunded actuarial accrued liability	1,050,751	1,127,258
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$1,277,665	\$1,363,121
7. Total Appropriation, payable on July 1	1,254,044	1,337,920

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Sherborn

2300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 3 beneficiaries in pay status)	42
2. Participants active during the year ended December 31, 2015	79
3. Inactive participants entitled to a return of their employee contributions	32
4. Inactive participants with a vested right to a deferred or immediate benefit	8

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$585,731
2. Administrative expenses		35,074
3. Expected employee contributions		<u>-382,334</u>
4. Employer normal cost: (1) + (2) + (3)		\$238,471
5. Actuarial accrued liability		19,976,232
Retired participants and beneficiaries	\$9,742,500	
Active participants	9,480,239	
Inactive participants	753,493	
6. Actuarial value of assets		10,107,866
7. Unfunded actuarial accrued liability: (5) – (6)		9,868,366
8. Reallocated unfunded actuarial accrued liability		<u>227,069</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$10,095,435

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$247,178	6.06%
2. Projected unfunded actuarial accrued liability	10,479,333	
3. Payment on projected unfunded actuarial accrued liability	644,203	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$891,381	21.85%
8. Total FY17 Appropriation, payable on July 1	874,648	21.44%
9. Projected payroll	4,079,258	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$256,772	\$266,736
2. Payment on projected unfunded actuarial accrued liability	677,485	726,814
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$934,257	\$993,550
7. Total Appropriation, payable on July 1	916,985	975,181

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Shirley

2400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 5 beneficiaries in pay status)	38
2. Participants active during the year ended December 31, 2015	40
3. Inactive participants entitled to a return of their employee contributions	32
4. Inactive participants with a vested right to a deferred or immediate benefit	4

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$319,684
2. Administrative expenses		19,143
3. Expected employee contributions		<u>-193,444</u>
4. Employer normal cost: (1) + (2) + (3)		\$145,383
5. Actuarial accrued liability		15,498,963
Retired participants and beneficiaries	\$9,242,611	
Active participants	5,368,643	
Inactive participants	887,709	
6. Actuarial value of assets		7,134,073
7. Unfunded actuarial accrued liability: (5) – (6)		8,364,890
8. Reallocated unfunded actuarial accrued liability		<u>176,176</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$8,541,066

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$150,691	7.39%
2. Projected unfunded actuarial accrued liability	8,865,857	
3. Payment on projected unfunded actuarial accrued liability	565,969	
4. Payment on 2002 ERI	32,842	
5. Payment on 2003 ERI	19,683	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$769,185	37.70%
8. Total FY17 Appropriation, payable on July 1	754,746	36.99%
9. Projected payroll	2,040,237	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$156,480	\$162,490
2. Payment on projected unfunded actuarial accrued liability	560,803	601,636
3. Payment on 2002 ERI	32,842	32,842
4. Payment on 2003 ERI	19,683	19,683
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$769,808	\$816,651
7. Total Appropriation, payable on July 1	755,576	801,553

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Stow

2500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 4 beneficiaries in pay status)	36
2. Participants active during the year ended December 31, 2015	58
3. Inactive participants entitled to a return of their employee contributions	5
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$461,092
2. Administrative expenses		27,611
3. Expected employee contributions		<u>-325,131</u>
4. Employer normal cost: (1) + (2) + (3)		\$163,572
5. Actuarial accrued liability		18,750,264
Retired participants and beneficiaries	\$8,079,472	
Active participants	10,444,730	
Inactive participants	226,062	
6. Actuarial value of assets		9,077,348
7. Unfunded actuarial accrued liability: (5) – (6)		9,672,916
8. Reallocated unfunded actuarial accrued liability		<u>213,133</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$9,886,049

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$169,544	4.94%
2. Projected unfunded actuarial accrued liability	10,261,986	
3. Payment on projected unfunded actuarial accrued liability	593,390	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$762,934	22.22%
8. Total FY17 Appropriation, payable on July 1	748,612	21.80%
9. Projected payroll	3,433,902	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$176,220	\$183,157
2. Payment on projected unfunded actuarial accrued liability	665,962	714,453
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$842,182	\$897,610
7. Total Appropriation, payable on July 1	826,612	881,015

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Sudbury

2600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 17 beneficiaries in pay status)	193
2. Participants active during the year ended December 31, 2015	286
3. Inactive participants entitled to a return of their employee contributions	104
4. Inactive participants with a vested right to a deferred or immediate benefit	16

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,928,803
2. Administrative expenses		115,499
3. Expected employee contributions		<u>-1,451,647</u>
4. Employer normal cost: (1) + (2) + (3)		\$592,655
5. Actuarial accrued liability		92,881,448
Retired participants and beneficiaries	\$48,714,819	
Active participants	41,973,128	
Inactive participants	2,193,501	
6. Actuarial value of assets		40,253,261
7. Unfunded actuarial accrued liability: (5) – (6)		52,628,187
8. Reallocated unfunded actuarial accrued liability		<u>1,055,777</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$53,683,964

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$614,294	3.96%
2. Projected unfunded actuarial accrued liability	55,725,403	
3. Payment on projected unfunded actuarial accrued liability	3,396,951	
4. Payment on 2002 ERI	26,234	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,037,479	26.02%
8. Total FY17 Appropriation, payable on July 1	3,961,686	25.53%
9. Projected payroll	15,518,746	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$638,898	\$664,477
2. Payment on projected unfunded actuarial accrued liability	3,599,622	3,861,719
3. Payment on 2002 ERI	26,234	26,234
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$4,264,754	\$4,552,430
7. Total Appropriation, payable on July 1	4,185,908	4,468,265

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Tewksbury

2700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 32 beneficiaries in pay status)	298
2. Participants active during the year ended December 31, 2015	405
3. Inactive participants entitled to a return of their employee contributions	82
4. Inactive participants with a vested right to a deferred or immediate benefit	9

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,878,323
2. Administrative expenses		172,357
3. Expected employee contributions		<u>-1,979,845</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,070,835
5. Actuarial accrued liability		143,526,218
Retired participants and beneficiaries	\$84,607,325	
Active participants	57,685,487	
Inactive participants	1,233,406	
6. Actuarial value of assets		55,402,942
7. Unfunded actuarial accrued liability: (5) – (6)		88,123,276
8. Reallocated unfunded actuarial accrued liability		<u>1,631,453</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$89,754,729

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,109,934	5.30%
2. Projected unfunded actuarial accrued liability	93,167,830	
3. Payment on projected unfunded actuarial accrued liability	5,440,117	
4. Payment on 2002 ERI	228,220	
5. Payment on 2003 ERI	349,369	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$7,127,640	34.06%
8. Total FY17 Appropriation, payable on July 1	6,993,838	33.42%
9. Projected payroll	20,928,337	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,153,413	\$1,198,584
2. Payment on projected unfunded actuarial accrued liability	5,915,005	6,345,691
3. Payment on 2002 ERI	228,220	228,220
4. Payment on 2003 ERI	349,369	349,369
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$7,646,007	\$8,121,864
7. Total Appropriation, payable on July 1	7,504,649	7,971,708

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Townsend

2800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 2 beneficiaries in pay status)	26
2. Participants active during the year ended December 31, 2015	58
3. Inactive participants entitled to a return of their employee contributions	11
4. Inactive participants with a vested right to a deferred or immediate benefit	6

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$416,520
2. Administrative expenses		24,942
3. Expected employee contributions		<u>-272,803</u>
4. Employer normal cost: (1) + (2) + (3)		\$168,659
5. Actuarial accrued liability		17,699,813
Retired participants and beneficiaries	\$8,855,151	
Active participants	8,038,641	
Inactive participants	806,021	
6. Actuarial value of assets		9,286,545
7. Unfunded actuarial accrued liability: (5) – (6)		8,413,268
8. Reallocated unfunded actuarial accrued liability		<u>201,193</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$8,614,461

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$174,817	6.00%
2. Projected unfunded actuarial accrued liability	8,942,042	
3. Payment on projected unfunded actuarial accrued liability	508,272	
4. Payment on 2002 ERI	20,119	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$703,208	24.12%
8. Total FY17 Appropriation, payable on July 1	690,007	23.66%
9. Projected payroll	2,915,789	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$181,606	\$188,657
2. Payment on projected unfunded actuarial accrued liability	577,108	619,128
3. Payment on 2002 ERI	20,119	20,119
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$778,833	\$827,904
7. Total Appropriation, payable on July 1	764,434	812,598

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Tyngsborough

2900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 12 beneficiaries in pay status)	71
2. Participants active during the year ended December 31, 2015	169
3. Inactive participants entitled to a return of their employee contributions	45
4. Inactive participants with a vested right to a deferred or immediate benefit	7

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,030,966
2. Administrative expenses		61,735
3. Expected employee contributions		<u>-700,085</u>
4. Employer normal cost: (1) + (2) + (3)		\$392,616
5. Actuarial accrued liability		40,382,609
Retired participants and beneficiaries	\$18,793,215	
Active participants	21,007,623	
Inactive participants	581,771	
6. Actuarial value of assets		19,532,075
7. Unfunded actuarial accrued liability: (5) – (6)		20,850,534
8. Reallocated unfunded actuarial accrued liability		<u>459,026</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$21,309,560

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$406,951	5.41%
2. Projected unfunded actuarial accrued liability	22,119,899	
3. Payment on projected unfunded actuarial accrued liability	1,152,380	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,559,331	20.72%
8. Total FY17 Appropriation, payable on July 1	1,530,059	20.33%
9. Projected payroll	7,525,062	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$422,854	\$439,373
2. Payment on projected unfunded actuarial accrued liability	1,444,049	1,549,194
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$1,866,903	\$1,988,567
7. Total Appropriation, payable on July 1	1,832,388	1,951,803

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Wayland

3000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 19 beneficiaries in pay status)	231
2. Participants active during the year ended December 31, 2015	392
3. Inactive participants entitled to a return of their employee contributions	135
4. Inactive participants with a vested right to a deferred or immediate benefit	11

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,419,327
2. Administrative expenses		144,872
3. Expected employee contributions		<u>-1,730,101</u>
4. Employer normal cost: (1) + (2) + (3)		\$834,098
5. Actuarial accrued liability		97,457,228
Retired participants and beneficiaries	\$52,084,215	
Active participants	44,043,231	
Inactive participants	1,329,782	
6. Actuarial value of assets		45,914,404
7. Unfunded actuarial accrued liability: (5) – (6)		51,542,824
8. Reallocated unfunded actuarial accrued liability		<u>1,107,790</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$52,650,614

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$864,553	4.71%
2. Projected unfunded actuarial accrued liability	54,652,757	
3. Payment on projected unfunded actuarial accrued liability	3,429,133	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	22,758	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,316,444	23.50%
8. Total FY17 Appropriation, payable on July 1	4,235,414	23.05%
9. Projected payroll	18,371,591	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$898,705	\$934,196
2. Payment on projected unfunded actuarial accrued liability	3,523,076	3,779,599
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	22,758	22,758
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$4,444,539	\$4,736,553
7. Total Appropriation, payable on July 1	4,362,369	4,648,984

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Westford

3100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 15 beneficiaries in pay status)	194
2. Participants active during the year ended December 31, 2015	558
3. Inactive participants entitled to a return of their employee contributions	173
4. Inactive participants with a vested right to a deferred or immediate benefit	11

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$3,262,908
2. Administrative expenses		195,387
3. Expected employee contributions		<u>-2,319,206</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,139,089
5. Actuarial accrued liability		107,177,927
Retired participants and beneficiaries	\$43,011,732	
Active participants	62,724,971	
Inactive participants	1,441,224	
6. Actuarial value of assets		58,864,656
7. Unfunded actuarial accrued liability: (5) – (6)		48,313,271
8. Reallocated unfunded actuarial accrued liability		<u>1,218,284</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$49,531,555

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,180,680	4.82%
2. Projected unfunded actuarial accrued liability	51,415,091	
3. Payment on projected unfunded actuarial accrued liability	2,951,877	
4. Payment on 2002 ERI	101,387	
5. Payment on 2003 ERI	25,298	
6. Payment on 2010 ERI	<u>60,733</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,319,975	17.62%
8. Total FY17 Appropriation, payable on July 1	4,238,879	17.29%
9. Projected payroll	24,518,970	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,227,254	\$1,275,651
2. Payment on projected unfunded actuarial accrued liability	3,292,252	3,531,969
3. Payment on 2002 ERI	101,387	101,387
4. Payment on 2003 ERI	25,298	25,298
5. Payment on 2010 ERI	<u>60,733</u>	<u>60,733</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$4,706,924	\$4,995,038
7. Total Appropriation, payable on July 1	4,619,903	4,902,690

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Weston

3200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 23 beneficiaries in pay status)	229
2. Participants active during the year ended December 31, 2015	372
3. Inactive participants entitled to a return of their employee contributions	176
4. Inactive participants with a vested right to a deferred or immediate benefit	21

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,453,179
2. Administrative expenses		146,899
3. Expected employee contributions		-1,829,664
4. Employer normal cost: (1) + (2) + (3)		\$770,414
5. Actuarial accrued liability		104,275,117
Retired participants and beneficiaries	\$52,193,401	
Active participants	48,980,561	
Inactive participants	3,101,155	
6. Actuarial value of assets		45,081,826
7. Unfunded actuarial accrued liability: (5) – (6)		59,193,291
8. Reallocated unfunded actuarial accrued liability		1,185,288
9. Total unfunded actuarial accrued liability: (7) + (8)		\$60,378,579

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$798,544	4.12%
2. Projected unfunded actuarial accrued liability	62,674,594	
3. Payment on projected unfunded actuarial accrued liability	3,846,541	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$4,645,085	23.99%
8. Total FY17 Appropriation, payable on July 1	4,557,886	23.54%
9. Projected payroll	19,361,847	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$830,440	\$863,598
2. Payment on projected unfunded actuarial accrued liability	4,052,313	4,347,372
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$4,882,753	\$5,210,970
7. Total Appropriation, payable on July 1	4,792,481	5,114,630

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Town of Wilmington

3300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 38 beneficiaries in pay status)	247
2. Participants active during the year ended December 31, 2015	402
3. Inactive participants entitled to a return of their employee contributions	101
4. Inactive participants with a vested right to a deferred or immediate benefit	12

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$2,771,330
2. Administrative expenses		165,950
3. Expected employee contributions		<u>-2,058,083</u>
4. Employer normal cost: (1) + (2) + (3)		\$879,197
5. Actuarial accrued liability		132,528,605
Retired participants and beneficiaries	\$66,893,207	
Active participants	63,856,378	
Inactive participants	1,779,020	
6. Actuarial value of assets		55,360,546
7. Unfunded actuarial accrued liability: (5) – (6)		77,168,059
8. Reallocated unfunded actuarial accrued liability		<u>1,506,444</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$78,674,503

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$911,299	4.18%
2. Projected unfunded actuarial accrued liability	81,666,256	
3. Payment on projected unfunded actuarial accrued liability	4,902,022	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$5,813,321	26.65%
8. Total FY17 Appropriation, payable on July 1	5,704,192	26.15%
9. Projected payroll	21,812,264	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$947,654	\$985,444
2. Payment on projected unfunded actuarial accrued liability	5,287,680	5,672,689
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$6,235,334	\$6,658,133
7. Total Appropriation, payable on July 1	6,120,056	6,535,038

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Acton-Boxborough RSD

3400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 4 beneficiaries in pay status)	109
2. Participants active during the year ended December 31, 2015	339
3. Inactive participants entitled to a return of their employee contributions	40
4. Inactive participants with a vested right to a deferred or immediate benefit	11

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$1,665,052
2. Administrative expenses		99,705
3. Expected employee contributions		<u>-1,193,090</u>
4. Employer normal cost: (1) + (2) + (3)		\$571,667
5. Actuarial accrued liability		47,311,091
Retired participants and beneficiaries	\$19,261,727	
Active participants	26,671,151	
Inactive participants	1,378,213	
6. Actuarial value of assets		21,944,419
7. Unfunded actuarial accrued liability: (5) – (6)		25,366,672
8. Reallocated unfunded actuarial accrued liability		<u>537,782</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$25,904,454

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$592,540	4.57%
2. Projected unfunded actuarial accrued liability	26,889,522	
3. Payment on projected unfunded actuarial accrued liability	1,533,434	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$2,125,974	16.41%
8. Total FY17 Appropriation, payable on July 1	2,086,065	16.10%
9. Projected payroll	12,953,693	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$615,958	\$640,294
2. Payment on projected unfunded actuarial accrued liability	1,746,471	1,873,636
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$2,362,429	\$2,513,930
7. Total Appropriation, payable on July 1	2,318,753	2,467,453

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Acton Water Supply

3500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	8
2. Participants active during the year ended December 31, 2015	17
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$98,904
2. Administrative expenses		5,922
3. Expected employee contributions		<u>-112,147</u>
4. Employer normal cost: (1) + (2) + (3)		-\$7,321
5. Actuarial accrued liability		5,941,487
Retired participants and beneficiaries	\$2,749,428	
Active participants	2,972,751	
Inactive participants	219,308	
6. Actuarial value of assets		2,887,698
7. Unfunded actuarial accrued liability: (5) – (6)		3,053,789
8. Reallocated unfunded actuarial accrued liability		<u>67,536</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$3,121,325

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	-\$7,588	- 0.66%
2. Projected unfunded actuarial accrued liability	3,240,020	
3. Payment on projected unfunded actuarial accrued liability	183,183	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	5,530	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$181,125	15.67%
8. Total FY17 Appropriation, payable on July 1	177,725	15.38%
9. Projected payroll	1,155,844	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	-\$7,695	-\$7,799
2. Payment on projected unfunded actuarial accrued liability	209,206	224,439
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	5,530	5,530
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$207,041	\$222,170
7. Total Appropriation, payable on July 1	203,213	218,063

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Bedford Housing Authority

3600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	2
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$14,180
2. Administrative expenses		849
3. Expected employee contributions		<u>-11,306</u>
4. Employer normal cost: (1) + (2) + (3)		\$3,723
5. Actuarial accrued liability		543,082
Retired participants and beneficiaries	\$230,117	
Active participants	312,965	
Inactive participants	0	
6. Actuarial value of assets		248,297
7. Unfunded actuarial accrued liability: (5) – (6)		294,785
8. Reallocated unfunded actuarial accrued liability		<u>6,173</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$300,958

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$3,859	3.34%
2. Projected unfunded actuarial accrued liability	312,403	
3. Payment on projected unfunded actuarial accrued liability	17,534	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	6,925	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$28,318	24.48%
8. Total FY17 Appropriation, payable on July 1	27,786	24.02%
9. Projected payroll	115,658	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$4,017	\$4,181
2. Payment on projected unfunded actuarial accrued liability	18,631	19,988
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	6,925	6,925
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$29,573	\$31,094
7. Total Appropriation, payable on July 1	29,026	30,519

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Billerica Housing Authority

3700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	3
2. Participants active during the year ended December 31, 2015	6
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$32,953
2. Administrative expenses		1,973
3. Expected employee contributions		<u>-27,728</u>
4. Employer normal cost: (1) + (2) + (3)		\$7,198
5. Actuarial accrued liability		1,986,880
Retired participants and beneficiaries	\$777,113	
Active participants	1,209,767	
Inactive participants	0	
6. Actuarial value of assets		716,541
7. Unfunded actuarial accrued liability: (5) – (6)		1,270,339
8. Reallocated unfunded actuarial accrued liability		<u>22,585</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,292,924

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$7,461	2.50%
2. Projected unfunded actuarial accrued liability	1,342,090	
3. Payment on projected unfunded actuarial accrued liability	72,449	
4. Payment on 2002 ERI	9,765	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$89,675	29.99%
8. Total FY17 Appropriation, payable on July 1	87,992	29.43%
9. Projected payroll	298,990	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$7,775	\$8,102
2. Payment on projected unfunded actuarial accrued liability	85,605	91,838
3. Payment on 2002 ERI	9,765	9,765
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$103,145	\$109,705
7. Total Appropriation, payable on July 1	101,238	107,677

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Chelmsford Housing Authority

3800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	3
2. Participants active during the year ended December 31, 2015	24
3. Inactive participants entitled to a return of their employee contributions	8
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$169,439
2. Administrative expenses		10,146
3. Expected employee contributions		<u>-147,253</u>
4. Employer normal cost: (1) + (2) + (3)		\$32,332
5. Actuarial accrued liability		3,176,947
Retired participants and beneficiaries	\$761,522	
Active participants	2,292,399	
Inactive participants	123,026	
6. Actuarial value of assets		2,070,320
7. Unfunded actuarial accrued liability: (5) – (6)		1,106,627
8. Reallocated unfunded actuarial accrued liability		<u>36,112</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,142,739

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$33,513	2.22%
2. Projected unfunded actuarial accrued liability	1,186,194	
3. Payment on projected unfunded actuarial accrued liability	66,265	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$99,778	6.61%
8. Total FY17 Appropriation, payable on July 1	97,905	6.49%
9. Projected payroll	1,508,553	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$34,958	\$36,464
2. Payment on projected unfunded actuarial accrued liability	77,136	82,753
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$112,094	\$119,217
7. Total Appropriation, payable on July 1	110,022	117,013

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Chelmsford Water District

3900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 2 beneficiaries in pay status)	12
2. Participants active during the year ended December 31, 2015	21
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$127,176
2. Administrative expenses		7,615
3. Expected employee contributions		<u>-122,967</u>
4. Employer normal cost: (1) + (2) + (3)		\$11,824
5. Actuarial accrued liability		6,797,469
Retired participants and beneficiaries	\$2,927,492	
Active participants	3,869,977	
Inactive participants	0	
6. Actuarial value of assets		5,341,135
7. Unfunded actuarial accrued liability: (5) – (6)		1,456,334
8. Reallocated unfunded actuarial accrued liability		<u>77,266</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,533,600

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$12,256	0.94%
2. Projected unfunded actuarial accrued liability	1,591,919	
3. Payment on projected unfunded actuarial accrued liability	190,874	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$203,130	15.56%
8. Total FY17 Appropriation, payable on July 1	199,317	15.27%
9. Projected payroll	1,305,190	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$12,889	\$13,553
2. Payment on projected unfunded actuarial accrued liability	96,636	103,672
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$109,525	\$117,225
7. Total Appropriation, payable on July 1	107,500	115,058

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Dracut Housing Authority

4000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	6
2. Participants active during the year ended December 31, 2015	5
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$28,794
2. Administrative expenses		1,724
3. Expected employee contributions		<u>-29,441</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,077
5. Actuarial accrued liability		2,629,095
Retired participants and beneficiaries	\$1,758,947	
Active participants	870,148	
Inactive participants	0	
6. Actuarial value of assets		818,122
7. Unfunded actuarial accrued liability: (5) – (6)		1,810,973
8. Reallocated unfunded actuarial accrued liability		<u>29,885</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,840,858

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,116	0.36%
2. Projected unfunded actuarial accrued liability	1,910,860	
3. Payment on projected unfunded actuarial accrued liability	119,311	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$120,427	38.96%
8. Total FY17 Appropriation, payable on July 1	118,166	38.23%
9. Projected payroll	309,126	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$1,202	\$1,292
2. Payment on projected unfunded actuarial accrued liability	123,412	132,398
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$124,614	\$133,690
7. Total Appropriation, payable on July 1	122,310	131,218

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Dracut Water Supply

4100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 2 beneficiaries in pay status)	5
2. Participants active during the year ended December 31, 2015	15
3. Inactive participants entitled to a return of their employee contributions	3
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$60,933
2. Administrative expenses		3,649
3. Expected employee contributions		<u>-62,740</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,842
5. Actuarial accrued liability		4,029,467
Retired participants and beneficiaries	\$1,643,499	
Active participants	2,377,372	
Inactive participants	8,596	
6. Actuarial value of assets		1,641,939
7. Unfunded actuarial accrued liability: (5) – (6)		2,387,528
8. Reallocated unfunded actuarial accrued liability		<u>45,803</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$2,433,331

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$1,909	0.29%
2. Projected unfunded actuarial accrued liability	2,525,863	
3. Payment on projected unfunded actuarial accrued liability	159,474	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$161,383	24.17%
8. Total FY17 Appropriation, payable on July 1	158,353	23.72%
9. Projected payroll	667,699	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$2,074	\$2,248
2. Payment on projected unfunded actuarial accrued liability	163,012	174,882
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$165,086	\$177,130
7. Total Appropriation, payable on July 1	162,034	173,855

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for E. Chelmsford Water

4200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	2
2. Participants active during the year ended December 31, 2015	3
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$25,540
2. Administrative expenses		1,529
3. Expected employee contributions		<u>-18,546</u>
4. Employer normal cost: (1) + (2) + (3)		\$8,523
5. Actuarial accrued liability		755,357
Retired participants and beneficiaries	\$253,473	
Active participants	501,884	
Inactive participants	0	
6. Actuarial value of assets		468,867
7. Unfunded actuarial accrued liability: (5) – (6)		286,490
8. Reallocated unfunded actuarial accrued liability		<u>8,586</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$295,076

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$8,834	4.51%
2. Projected unfunded actuarial accrued liability	306,297	
3. Payment on projected unfunded actuarial accrued liability	17,824	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$26,658	13.62%
8. Total FY17 Appropriation, payable on July 1	26,158	13.37%
9. Projected payroll	195,680	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$9,184	\$9,549
2. Payment on projected unfunded actuarial accrued liability	19,870	21,317
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$29,054	\$30,866
7. Total Appropriation, payable on July 1	28,517	30,295

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for E. Middlesex Mosq Control

4300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	0
2. Participants active during the year ended December 31, 2015	6
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$40,124
2. Administrative expenses		2,403
3. Expected employee contributions		<u>-33,703</u>
4. Employer normal cost: (1) + (2) + (3)		\$8,824
5. Actuarial accrued liability		1,732,959
Retired participants and beneficiaries	\$0	
Active participants	1,732,959	
Inactive participants	0	
6. Actuarial value of assets		1,234,275
7. Unfunded actuarial accrued liability: (5) – (6)		498,684
8. Reallocated unfunded actuarial accrued liability		<u>19,698</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$518,382

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$9,146	2.27%
2. Projected unfunded actuarial accrued liability	538,095	
3. Payment on projected unfunded actuarial accrued liability	31,160	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$40,306	10.01%
8. Total FY17 Appropriation, payable on July 1	39,549	9.82%
9. Projected payroll	402,705	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$9,531	\$9,931
2. Payment on projected unfunded actuarial accrued liability	34,917	37,460
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$44,448	\$47,391
7. Total Appropriation, payable on July 1	43,626	46,515

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Greater Lowell RVTSD

4400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 7 beneficiaries in pay status)	75
2. Participants active during the year ended December 31, 2015	95
3. Inactive participants entitled to a return of their employee contributions	17
4. Inactive participants with a vested right to a deferred or immediate benefit	2

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$521,778
2. Administrative expenses		31,245
3. Expected employee contributions		<u>-454,191</u>
4. Employer normal cost: (1) + (2) + (3)		\$98,832
5. Actuarial accrued liability		25,028,529
Retired participants and beneficiaries	\$12,496,143	
Active participants	12,272,311	
Inactive participants	260,075	
6. Actuarial value of assets		10,952,244
7. Unfunded actuarial accrued liability: (5) – (6)		14,076,285
8. Reallocated unfunded actuarial accrued liability		<u>284,498</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$14,360,783

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$102,441	2.11%
2. Projected unfunded actuarial accrued liability	14,906,880	
3. Payment on projected unfunded actuarial accrued liability	951,211	
4. Payment on 2002 ERI	164,802	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$1,218,454	25.08%
8. Total FY17 Appropriation, payable on July 1	1,195,581	24.60%
9. Projected payroll	4,859,131	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$106,866	\$111,476
2. Payment on projected unfunded actuarial accrued liability	930,329	998,069
3. Payment on 2002 ERI	164,802	164,802
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$1,201,997	\$1,274,347
7. Total Appropriation, payable on July 1	1,179,775	1,250,787

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Groton-Dunstable RSD

4500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 3 beneficiaries in pay status)	68
2. Participants active during the year ended December 31, 2015	153
3. Inactive participants entitled to a return of their employee contributions	64
4. Inactive participants with a vested right to a deferred or immediate benefit	7

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$601,610
2. Administrative expenses		36,025
3. Expected employee contributions		<u>-442,070</u>
4. Employer normal cost: (1) + (2) + (3)		\$195,565
5. Actuarial accrued liability		21,844,283
Retired participants and beneficiaries	\$10,502,053	
Active participants	10,235,507	
Inactive participants	1,106,723	
6. Actuarial value of assets		12,476,147
7. Unfunded actuarial accrued liability: (5) – (6)		9,368,136
8. Reallocated unfunded actuarial accrued liability		<u>248,303</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$9,616,439

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$202,706	4.18%
2. Projected unfunded actuarial accrued liability	9,982,123	
3. Payment on projected unfunded actuarial accrued liability	544,666	
4. Payment on 2002 ERI	4,044	
5. Payment on 2003 ERI	15,319	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$766,735	15.81%
8. Total FY17 Appropriation, payable on July 1	752,342	15.51%
9. Projected payroll	4,850,208	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$210,768	\$219,149
2. Payment on projected unfunded actuarial accrued liability	645,524	692,526
3. Payment on 2002 ERI	4,044	4,044
4. Payment on 2003 ERI	15,319	15,319
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$875,655	\$931,038
7. Total Appropriation, payable on July 1	859,466	913,825

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Hudson Housing Authority

4600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	5
2. Participants active during the year ended December 31, 2015	6
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$38,783
2. Administrative expenses		2,322
3. Expected employee contributions		<u>-31,436</u>
4. Employer normal cost: (1) + (2) + (3)		\$9,669
5. Actuarial accrued liability		2,172,555
Retired participants and beneficiaries	\$1,413,256	
Active participants	759,299	
Inactive participants	0	
6. Actuarial value of assets		826,696
7. Unfunded actuarial accrued liability: (5) – (6)		1,345,859
8. Reallocated unfunded actuarial accrued liability		<u>24,695</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,370,554

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$10,022	3.02%
2. Projected unfunded actuarial accrued liability	1,422,672	
3. Payment on projected unfunded actuarial accrued liability	87,880	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$97,902	29.54%
8. Total FY17 Appropriation, payable on July 1	96,064	28.98%
9. Projected payroll	331,465	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$10,435	\$10,865
2. Payment on projected unfunded actuarial accrued liability	91,947	98,641
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$102,382	\$109,506
7. Total Appropriation, payable on July 1	100,489	107,481

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Lincoln Sudbury

4700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 2 beneficiaries in pay status)	38
2. Participants active during the year ended December 31, 2015	62
3. Inactive participants entitled to a return of their employee contributions	24
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$342,702
2. Administrative expenses		20,521
3. Expected employee contributions		<u>-274,726</u>
4. Employer normal cost: (1) + (2) + (3)		\$88,497
5. Actuarial accrued liability		13,509,284
Retired participants and beneficiaries	\$6,070,672	
Active participants	7,203,666	
Inactive participants	234,946	
6. Actuarial value of assets		5,879,617
7. Unfunded actuarial accrued liability: (5) – (6)		7,629,667
8. Reallocated unfunded actuarial accrued liability		<u>153,559</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$7,783,226

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$91,728	3.14%
2. Projected unfunded actuarial accrued liability	8,079,199	
3. Payment on projected unfunded actuarial accrued liability	505,691	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$597,419	20.44%
8. Total FY17 Appropriation, payable on July 1	586,204	20.05%
9. Projected payroll	2,923,175	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$95,490	\$99,404
2. Payment on projected unfunded actuarial accrued liability	521,707	559,694
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$617,197	\$659,098
7. Total Appropriation, payable on July 1	605,786	646,913

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Nashoba Vally THSD

4900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 2 beneficiaries in pay status)	20
2. Participants active during the year ended December 31, 2015	20
3. Inactive participants entitled to a return of their employee contributions	5
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$118,887
2. Administrative expenses		7,119
3. Expected employee contributions		<u>-86,333</u>
4. Employer normal cost: (1) + (2) + (3)		\$39,673
5. Actuarial accrued liability		4,197,643
Retired participants and beneficiaries	\$2,829,482	
Active participants	1,332,330	
Inactive participants	35,831	
6. Actuarial value of assets		1,075,270
7. Unfunded actuarial accrued liability: (5) – (6)		3,122,373
8. Reallocated unfunded actuarial accrued liability		<u>47,714</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$3,170,087

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$41,122	4.54%
2. Projected unfunded actuarial accrued liability	3,290,636	
3. Payment on projected unfunded actuarial accrued liability	205,122	
4. Payment on 2002 ERI	4,832	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$251,076	27.70%
8. Total FY17 Appropriation, payable on July 1	246,363	27.18%
9. Projected payroll	906,571	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$42,752	\$44,447
2. Payment on projected unfunded actuarial accrued liability	211,637	227,047
3. Payment on 2002 ERI	4,832	4,832
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$259,221	\$276,326
7. Total Appropriation, payable on July 1	254,429	271,217

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for N. Chelmsford Water

5000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	1
2. Participants active during the year ended December 31, 2015	8
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$44,502
2. Administrative expenses		2,665
3. Expected employee contributions		<u>-47,590</u>
4. Employer normal cost: (1) + (2) + (3)		-\$423
5. Actuarial accrued liability		2,215,915
Retired participants and beneficiaries	\$59,611	
Active participants	2,156,304	
Inactive participants	0	
6. Actuarial value of assets		1,607,163
7. Unfunded actuarial accrued liability: (5) – (6)		608,752
8. Reallocated unfunded actuarial accrued liability		<u>25,188</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$633,940

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	-\$438	- 0.08%
2. Projected unfunded actuarial accrued liability	658,047	
3. Payment on projected unfunded actuarial accrued liability	43,373	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$42,935	8.03%
8. Total FY17 Appropriation, payable on July 1	42,129	7.88%
9. Projected payroll	534,703	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	-\$382	-\$321
2. Payment on projected unfunded actuarial accrued liability	42,345	45,429
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$41,963	\$45,108
7. Total Appropriation, payable on July 1	41,187	44,274

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for North Middlesex RSD

5100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 7 beneficiaries in pay status)	91
2. Participants active during the year ended December 31, 2015	153
3. Inactive participants entitled to a return of their employee contributions	81
4. Inactive participants with a vested right to a deferred or immediate benefit	8

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$551,451
2. Administrative expenses		33,022
3. Expected employee contributions		<u>-430,265</u>
4. Employer normal cost: (1) + (2) + (3)		\$154,208
5. Actuarial accrued liability		21,490,070
Retired participants and beneficiaries	\$10,371,213	
Active participants	10,071,439	
Inactive participants	1,047,418	
6. Actuarial value of assets		10,587,733
7. Unfunded actuarial accrued liability: (5) – (6)		10,902,337
8. Reallocated unfunded actuarial accrued liability		<u>244,276</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$11,146,613

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$159,839	3.39%
2. Projected unfunded actuarial accrued liability	11,570,485	
3. Payment on projected unfunded actuarial accrued liability	724,660	
4. Payment on 2002 ERI	23,077	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$907,576	19.23%
8. Total FY17 Appropriation, payable on July 1	890,539	18.87%
9. Projected payroll	4,718,631	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$166,320	\$173,061
2. Payment on projected unfunded actuarial accrued liability	742,777	796,860
3. Payment on 2002 ERI	23,077	23,077
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$932,174	\$992,998
7. Total Appropriation, payable on July 1	914,940	974,640

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Shawsheen Valley RVS

5300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 4 beneficiaries in pay status)	42
2. Participants active during the year ended December 31, 2015	58
3. Inactive participants entitled to a return of their employee contributions	15
4. Inactive participants with a vested right to a deferred or immediate benefit	2

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$317,728
2. Administrative expenses		19,026
3. Expected employee contributions		<u>-268,935</u>
4. Employer normal cost: (1) + (2) + (3)		\$67,819
5. Actuarial accrued liability		13,141,202
Retired participants and beneficiaries	\$7,000,398	
Active participants	5,816,111	
Inactive participants	324,693	
6. Actuarial value of assets		5,204,140
7. Unfunded actuarial accrued liability: (5) – (6)		7,937,062
8. Reallocated unfunded actuarial accrued liability		<u>149,375</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$8,086,437

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$70,295	2.47%
2. Projected unfunded actuarial accrued liability	8,393,940	
3. Payment on projected unfunded actuarial accrued liability	477,924	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	17,379	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$565,598	19.91%
8. Total FY17 Appropriation, payable on July 1	554,980	19.54%
9. Projected payroll	2,840,750	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$73,267	\$76,361
2. Payment on projected unfunded actuarial accrued liability	541,025	580,418
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	17,379	17,379
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$631,671	\$674,158
7. Total Appropriation, payable on July 1	619,993	661,694

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for South Middlesex RVTS

5400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 4 beneficiaries in pay status)	41
2. Participants active during the year ended December 31, 2015	52
3. Inactive participants entitled to a return of their employee contributions	15
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$303,918
2. Administrative expenses		18,199
3. Expected employee contributions		<u>-240,329</u>
4. Employer normal cost: (1) + (2) + (3)		\$81,788
5. Actuarial accrued liability		12,389,639
Retired participants and beneficiaries	\$5,859,571	
Active participants	6,438,425	
Inactive participants	91,643	
6. Actuarial value of assets		5,636,537
7. Unfunded actuarial accrued liability: (5) – (6)		6,753,102
8. Reallocated unfunded actuarial accrued liability		<u>140,832</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$6,893,934

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$84,774	3.30%
2. Projected unfunded actuarial accrued liability	7,156,090	
3. Payment on projected unfunded actuarial accrued liability	438,324	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$523,098	20.34%
8. Total FY17 Appropriation, payable on July 1	513,278	19.95%
9. Projected payroll	2,572,296	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$88,230	\$91,825
2. Payment on projected unfunded actuarial accrued liability	462,746	496,439
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$550,976	\$588,264
7. Total Appropriation, payable on July 1	540,790	577,388

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Sudbury Water District

5500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	3
2. Participants active during the year ended December 31, 2015	8
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$67,801
2. Administrative expenses		4,060
3. Expected employee contributions		<u>-75,811</u>
4. Employer normal cost: (1) + (2) + (3)		-\$3,950
5. Actuarial accrued liability		4,079,734
Retired participants and beneficiaries	\$1,202,171	
Active participants	2,877,563	
Inactive participants	0	
6. Actuarial value of assets		2,274,734
7. Unfunded actuarial accrued liability: (5) – (6)		1,805,000
8. Reallocated unfunded actuarial accrued liability		<u>46,374</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,851,374

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	-\$4,094	- 0.51%
2. Projected unfunded actuarial accrued liability	1,921,776	
3. Payment on projected unfunded actuarial accrued liability	94,157	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$90,063	11.17%
8. Total FY17 Appropriation, payable on July 1	88,372	10.96%
9. Projected payroll	806,404	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	-\$4,128	-\$4,160
2. Payment on projected unfunded actuarial accrued liability	125,862	135,026
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$121,734	\$130,866
7. Total Appropriation, payable on July 1	119,483	128,447

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Tewksbury Housing Authority

5600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	6
2. Participants active during the year ended December 31, 2015	8
3. Inactive participants entitled to a return of their employee contributions	1
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$56,474
2. Administrative expenses		3,382
3. Expected employee contributions		<u>-40,824</u>
4. Employer normal cost: (1) + (2) + (3)		\$19,032
5. Actuarial accrued liability		2,531,762
Retired participants and beneficiaries	\$1,687,306	
Active participants	838,291	
Inactive participants	6,165	
6. Actuarial value of assets		1,145,048
7. Unfunded actuarial accrued liability: (5) – (6)		1,386,714
8. Reallocated unfunded actuarial accrued liability		<u>28,778</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,415,492

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$19,727	4.68%
2. Projected unfunded actuarial accrued liability	1,469,319	
3. Payment on projected unfunded actuarial accrued liability	76,967	
4. Payment on 2002 ERI	3,452	
5. Payment on 2003 ERI	5,551	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$105,697	25.05%
8. Total FY17 Appropriation, payable on July 1	103,713	24.58%
9. Projected payroll	421,964	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$20,508	\$21,320
2. Payment on projected unfunded actuarial accrued liability	93,897	100,734
3. Payment on 2002 ERI	3,452	3,452
4. Payment on 2003 ERI	5,551	5,551
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$123,408	\$131,057
7. Total Appropriation, payable on July 1	121,126	128,634

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Wayland Housing Authority

5700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	4
3. Inactive participants entitled to a return of their employee contributions	2
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$28,736
2. Administrative expenses		1,721
3. Expected employee contributions		<u>-25,809</u>
4. Employer normal cost: (1) + (2) + (3)		\$4,648
5. Actuarial accrued liability		1,296,995
Retired participants and beneficiaries	\$190,826	
Active participants	1,105,618	
Inactive participants	551	
6. Actuarial value of assets		753,012
7. Unfunded actuarial accrued liability: (5) – (6)		543,983
8. Reallocated unfunded actuarial accrued liability		<u>14,743</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$558,726

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$4,818	1.74%
2. Projected unfunded actuarial accrued liability	579,973	
3. Payment on projected unfunded actuarial accrued liability	28,232	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$33,050	11.97%
8. Total FY17 Appropriation, payable on July 1	32,430	11.74%
9. Projected payroll	276,148	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$5,033	\$5,257
2. Payment on projected unfunded actuarial accrued liability	37,996	40,763
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$43,029	\$46,020
7. Total Appropriation, payable on July 1	42,233	45,169

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Hopkinton Housing Authority

5800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$9,041
2. Administrative expenses		541
3. Expected employee contributions		<u>-6,259</u>
4. Employer normal cost: (1) + (2) + (3)		\$3,323
5. Actuarial accrued liability		1,082,130
Retired participants and beneficiaries	\$1,000,612	
Active participants	81,518	
Inactive participants	0	
6. Actuarial value of assets		618,993
7. Unfunded actuarial accrued liability: (5) – (6)		463,137
8. Reallocated unfunded actuarial accrued liability		<u>12,301</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$475,438

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$3,444	4.99%
2. Projected unfunded actuarial accrued liability	493,517	
3. Payment on projected unfunded actuarial accrued liability	28,056	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$31,500	45.66%
8. Total FY17 Appropriation, payable on July 1	30,909	44.80%
9. Projected payroll	68,991	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$3,579	\$3,720
2. Payment on projected unfunded actuarial accrued liability	32,060	34,394
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$35,639	\$38,114
7. Total Appropriation, payable on July 1	34,980	37,409

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Sudbury Housing Authority

6000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	4
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	2
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$14,059
2. Administrative expenses		842
3. Expected employee contributions		-9,462
4. Employer normal cost: (1) + (2) + (3)		\$5,439
5. Actuarial accrued liability		810,914
Retired participants and beneficiaries	\$766,487	
Active participants	42,806	
Inactive participants	1,621	
6. Actuarial value of assets		477,369
7. Unfunded actuarial accrued liability: (5) – (6)		333,545
8. Reallocated unfunded actuarial accrued liability		9,218
9. Total unfunded actuarial accrued liability: (7) + (8)		\$342,763

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$5,638	5.72%
2. Projected unfunded actuarial accrued liability	355,797	
3. Payment on projected unfunded actuarial accrued liability	19,055	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$24,693	25.04%
8. Total FY17 Appropriation, payable on July 1	24,229	24.57%
9. Projected payroll	98,607	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$5,858	\$6,086
2. Payment on projected unfunded actuarial accrued liability	23,192	24,881
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$29,050	\$30,967
7. Total Appropriation, payable on July 1	28,513	30,394

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Wilmington Housing Authority

6100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	4
2. Participants active during the year ended December 31, 2015	3
3. Inactive participants entitled to a return of their employee contributions	2
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$16,797
2. Administrative expenses		1,006
3. Expected employee contributions		<u>-12,439</u>
4. Employer normal cost: (1) + (2) + (3)		\$5,364
5. Actuarial accrued liability		543,774
Retired participants and beneficiaries	\$335,825	
Active participants	204,269	
Inactive participants	3,680	
6. Actuarial value of assets		247,052
7. Unfunded actuarial accrued liability: (5) – (6)		296,722
8. Reallocated unfunded actuarial accrued liability		<u>6,181</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$302,903

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$5,560	4.26%
2. Projected unfunded actuarial accrued liability	314,422	
3. Payment on projected unfunded actuarial accrued liability	16,324	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	3,554	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$25,438	19.47%
8. Total FY17 Appropriation, payable on July 1	24,960	19.10%
9. Projected payroll	130,663	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$5,781	\$6,012
2. Payment on projected unfunded actuarial accrued liability	19,669	21,101
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	3,554	3,554
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$29,004	\$30,667
7. Total Appropriation, payable on July 1	28,468	30,100

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Acton Housing Authority

6200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	5
2. Participants active during the year ended December 31, 2015	6
3. Inactive participants entitled to a return of their employee contributions	2
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$39,702
2. Administrative expenses		2,377
3. Expected employee contributions		<u>-35,398</u>
4. Employer normal cost: (1) + (2) + (3)		\$6,681
5. Actuarial accrued liability		1,900,710
Retired participants and beneficiaries	\$1,087,903	
Active participants	810,473	
Inactive participants	2,334	
6. Actuarial value of assets		989,358
7. Unfunded actuarial accrued liability: (5) – (6)		911,352
8. Reallocated unfunded actuarial accrued liability		<u>21,605</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$932,957

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$6,925	1.88%
2. Projected unfunded actuarial accrued liability	968,435	
3. Payment on projected unfunded actuarial accrued liability	62,509	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$69,434	18.85%
8. Total FY17 Appropriation, payable on July 1	68,131	18.50%
9. Projected payroll	368,372	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$7,231	\$7,551
2. Payment on projected unfunded actuarial accrued liability	62,408	66,952
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$69,639	\$74,503
7. Total Appropriation, payable on July 1	68,352	73,126

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Burlington Housing Authority

6300

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	1
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	1
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$13,596
2. Administrative expenses		814
3. Expected employee contributions		<u>-9,887</u>
4. Employer normal cost: (1) + (2) + (3)		\$4,523
5. Actuarial accrued liability		791,381
Retired participants and beneficiaries	\$157,682	
Active participants	486,481	
Inactive participants	147,218	
6. Actuarial value of assets		765,567
7. Unfunded actuarial accrued liability: (5) – (6)		25,814
8. Reallocated unfunded actuarial accrued liability		<u>8,996</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$34,810

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$4,688	4.33%
2. Projected unfunded actuarial accrued liability	36,133	
3. Payment on projected unfunded actuarial accrued liability	11,324	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$16,012	14.78%
8. Total FY17 Appropriation, payable on July 1	15,711	14.50%
9. Projected payroll	108,355	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$4,874	\$5,067
2. Payment on projected unfunded actuarial accrued liability	1,721	1,847
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$6,595	\$6,914
7. Total Appropriation, payable on July 1	6,473	6,786

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Ayer Housing Authority

6400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	1
4. Inactive participants with a vested right to a deferred or immediate benefit	1

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$12,672
2. Administrative expenses		759
3. Expected employee contributions		<u>-10,846</u>
4. Employer normal cost: (1) + (2) + (3)		\$2,585
5. Actuarial accrued liability		2,023,764
Retired participants and beneficiaries	\$1,661,470	
Active participants	287,887	
Inactive participants	<u>74,407</u>	
6. Actuarial value of assets		267,567
7. Unfunded actuarial accrued liability: (5) – (6)		1,756,197
8. Reallocated unfunded actuarial accrued liability		<u>23,004</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$1,779,201

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$2,679	2.40%
2. Projected unfunded actuarial accrued liability	1,846,859	
3. Payment on projected unfunded actuarial accrued liability	27,754	
4. Payment on 2002 ERI	3,550	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$33,983	30.50%
8. Total FY17 Appropriation, payable on July 1	33,345	29.93%
9. Projected payroll	111,412	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$2,794	\$2,912
2. Payment on projected unfunded actuarial accrued liability	124,523	133,589
3. Payment on 2002 ERI	3,550	3,550
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$130,867	\$140,051
7. Total Appropriation, payable on July 1	128,448	137,462

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Holliston Housing Authority

6500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	1
2. Participants active during the year ended December 31, 2015	1
3. Inactive participants entitled to a return of their employee contributions	2
4. Inactive participants with a vested right to a deferred or immediate benefit	2

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$8,900
2. Administrative expenses		533
3. Expected employee contributions		<u>-5,514</u>
4. Employer normal cost: (1) + (2) + (3)		\$3,919
5. Actuarial accrued liability		447,860
Retired participants and beneficiaries	\$117,603	
Active participants	107,397	
Inactive participants	222,860	
6. Actuarial value of assets		236,346
7. Unfunded actuarial accrued liability: (5) – (6)		211,514
8. Reallocated unfunded actuarial accrued liability		<u>5,091</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$216,605

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$4,062	7.18%
2. Projected unfunded actuarial accrued liability	224,842	
3. Payment on projected unfunded actuarial accrued liability	17,258	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$21,320	37.70%
8. Total FY17 Appropriation, payable on July 1	20,920	37.00%
9. Projected payroll	56,547	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$4,219	\$4,381
2. Payment on projected unfunded actuarial accrued liability	14,304	15,345
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$18,523	\$19,726
7. Total Appropriation, payable on July 1	18,181	19,361

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Littleton Housing Authority

6600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$10,148
2. Administrative expenses		608
3. Expected employee contributions		<u>-6,624</u>
4. Employer normal cost: (1) + (2) + (3)		\$4,132
5. Actuarial accrued liability		659,577
Retired participants and beneficiaries	\$572,325	
Active participants	87,252	
Inactive participants	0	
6. Actuarial value of assets		229,594
7. Unfunded actuarial accrued liability: (5) – (6)		429,983
8. Reallocated unfunded actuarial accrued liability		<u>7,497</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$437,480

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$4,283	5.92%
2. Projected unfunded actuarial accrued liability	454,116	
3. Payment on projected unfunded actuarial accrued liability	22,741	
4. Payment on 2002 ERI	4,832	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$31,856	44.03%
8. Total FY17 Appropriation, payable on July 1	31,258	43.20%
9. Projected payroll	72,357	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$4,449	\$4,622
2. Payment on projected unfunded actuarial accrued liability	28,798	30,895
3. Payment on 2002 ERI	4,832	4,832
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$38,079	\$40,349
7. Total Appropriation, payable on July 1	37,375	39,603

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Westford Housing Authority

6700

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	1
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$16,538
2. Administrative expenses		990
3. Expected employee contributions		-10,849
4. Employer normal cost: (1) + (2) + (3)		\$6,679
5. Actuarial accrued liability		856,895
Retired participants and beneficiaries	\$665,255	
Active participants	190,564	
Inactive participants	1,076	
6. Actuarial value of assets		411,865
7. Unfunded actuarial accrued liability: (5) – (6)		445,030
8. Reallocated unfunded actuarial accrued liability		9,740
9. Total unfunded actuarial accrued liability: (7) + (8)		\$454,770

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$6,923	6.21%
2. Projected unfunded actuarial accrued liability	472,064	
3. Payment on projected unfunded actuarial accrued liability	23,921	
4. Payment on 2002 ERI	6,805	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$37,649	33.79%
8. Total FY17 Appropriation, payable on July 1	36,942	33.15%
9. Projected payroll	111,435	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$7,192	\$7,471
2. Payment on projected unfunded actuarial accrued liability	29,581	31,735
3. Payment on 2002 ERI	6,805	6,805
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$43,578	\$46,011
7. Total Appropriation, payable on July 1	42,772	45,160

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Shirley Water District

6800

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 1 beneficiary in pay status)	1
2. Participants active during the year ended December 31, 2015	3
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$14,932
2. Administrative expenses		894
3. Expected employee contributions		<u>-18,108</u>
4. Employer normal cost: (1) + (2) + (3)		-\$2,282
5. Actuarial accrued liability		829,233
Retired participants and beneficiaries	\$71,458	
Active participants	757,775	
Inactive participants	0	
6. Actuarial value of assets		505,993
7. Unfunded actuarial accrued liability: (5) – (6)		323,240
8. Reallocated unfunded actuarial accrued liability		<u>9,426</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$332,666

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	-\$2,365	- 1.21%
2. Projected unfunded actuarial accrued liability	345,316	
3. Payment on projected unfunded actuarial accrued liability	22,013	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$19,648	10.03%
8. Total FY17 Appropriation, payable on July 1	19,279	9.84%
9. Projected payroll	195,953	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	-\$2,424	-\$2,484
2. Payment on projected unfunded actuarial accrued liability	22,271	23,893
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$19,847	\$21,409
7. Total Appropriation, payable on July 1	19,480	21,013

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Tyngsboro Housing Authority

6900

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	2
2. Participants active during the year ended December 31, 2015	3
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$18,268
2. Administrative expenses		1,094
3. Expected employee contributions		<u>-14,737</u>
4. Employer normal cost: (1) + (2) + (3)		\$4,625
5. Actuarial accrued liability		622,001
Retired participants and beneficiaries	\$387,479	
Active participants	234,522	
Inactive participants	0	
6. Actuarial value of assets		188,312
7. Unfunded actuarial accrued liability: (5) – (6)		433,689
8. Reallocated unfunded actuarial accrued liability		<u>7,070</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$440,759

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$4,794	3.13%
2. Projected unfunded actuarial accrued liability	457,520	
3. Payment on projected unfunded actuarial accrued liability	25,118	
4. Payment on 2002 ERI	4,340	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$34,252	22.40%
8. Total FY17 Appropriation, payable on July 1	33,609	21.98%
9. Projected payroll	152,941	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$4,991	\$5,196
2. Payment on projected unfunded actuarial accrued liability	28,964	31,073
3. Payment on 2002 ERI	4,340	4,340
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$38,295	\$40,609
7. Total Appropriation, payable on July 1	37,587	39,858

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Pepperell Housing Authority

7000

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	1
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$10,834
2. Administrative expenses		649
3. Expected employee contributions		<u>-8,191</u>
4. Employer normal cost: (1) + (2) + (3)		\$3,292
5. Actuarial accrued liability		283,525
Retired participants and beneficiaries	\$233,445	
Active participants	50,080	
Inactive participants	0	
6. Actuarial value of assets		138,030
7. Unfunded actuarial accrued liability: (5) – (6)		145,495
8. Reallocated unfunded actuarial accrued liability		<u>3,223</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$148,718

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$3,412	3.93%
2. Projected unfunded actuarial accrued liability	154,373	
3. Payment on projected unfunded actuarial accrued liability	6,243	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$9,655	11.12%
8. Total FY17 Appropriation, payable on July 1	9,474	10.91%
9. Projected payroll	86,851	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$3,549	\$3,691
2. Payment on projected unfunded actuarial accrued liability	10,199	10,942
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$13,748	\$14,633
7. Total Appropriation, payable on July 1	13,494	14,362

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Groton Housing Authority

7100

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	0
2. Participants active during the year ended December 31, 2015	1
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$4,205
2. Administrative expenses		252
3. Expected employee contributions		<u>-2,470</u>
4. Employer normal cost: (1) + (2) + (3)		\$1,987
5. Actuarial accrued liability		51,560
Retired participants and beneficiaries	\$0	
Active participants	51,560	
Inactive participants	0	
6. Actuarial value of assets		37,940
7. Unfunded actuarial accrued liability: (5) – (6)		13,620
8. Reallocated unfunded actuarial accrued liability		<u>586</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$14,206

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$2,060	7.38%
2. Projected unfunded actuarial accrued liability	14,746	
3. Payment on projected unfunded actuarial accrued liability	348	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$2,408	8.62%
8. Total FY17 Appropriation, payable on July 1	2,363	8.46%
9. Projected payroll	27,922	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$2,138	\$2,220
2. Payment on projected unfunded actuarial accrued liability	991	1,064
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$3,129	\$3,284
7. Total Appropriation, payable on July 1	3,071	3,223

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Tyngsboro Water District

7200

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	1
2. Participants active during the year ended December 31, 2015	7
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$23,686
2. Administrative expenses		1,418
3. Expected employee contributions		<u>-18,394</u>
4. Employer normal cost: (1) + (2) + (3)		\$6,710
5. Actuarial accrued liability		962,612
Retired participants and beneficiaries	\$239,567	
Active participants	723,045	
Inactive participants	0	
6. Actuarial value of assets		600,768
7. Unfunded actuarial accrued liability: (5) – (6)		361,844
8. Reallocated unfunded actuarial accrued liability		<u>10,942</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$372,786

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$6,955	3.54%
2. Projected unfunded actuarial accrued liability	386,962	
3. Payment on projected unfunded actuarial accrued liability	23,485	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$30,440	15.48%
8. Total FY17 Appropriation, payable on July 1	29,869	15.19%
9. Projected payroll	196,613	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$7,237	\$7,529
2. Payment on projected unfunded actuarial accrued liability	25,037	26,860
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$32,274	\$34,389
7. Total Appropriation, payable on July 1	31,677	33,753

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for North Reading Housing Authority

7400

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	1
2. Participants active during the year ended December 31, 2015	3
3. Inactive participants entitled to a return of their employee contributions	1
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$13,642
2. Administrative expenses		817
3. Expected employee contributions		<u>-8,541</u>
4. Employer normal cost: (1) + (2) + (3)		\$5,918
5. Actuarial accrued liability		284,166
Retired participants and beneficiaries	\$84,774	
Active participants	196,382	
Inactive participants	3,010	
6. Actuarial value of assets		151,091
7. Unfunded actuarial accrued liability: (5) – (6)		133,075
8. Reallocated unfunded actuarial accrued liability		<u>3,230</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$136,305

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$6,134	6.45%
2. Projected unfunded actuarial accrued liability	141,488	
3. Payment on projected unfunded actuarial accrued liability	4,929	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$11,063	11.63%
8. Total FY17 Appropriation, payable on July 1	10,855	11.41%
9. Projected payroll	95,115	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$6,371	\$6,616
2. Payment on projected unfunded actuarial accrued liability	9,402	10,086
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$15,773	\$16,702
7. Total Appropriation, payable on July 1	15,481	16,393

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for West Groton Water

7500

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	0
2. Participants active during the year ended December 31, 2015	2
3. Inactive participants entitled to a return of their employee contributions	0
4. Inactive participants with a vested right to a deferred or immediate benefit	0

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$10,211
2. Administrative expenses		611
3. Expected employee contributions		<u>-10,462</u>
4. Employer normal cost: (1) + (2) + (3)		\$360
5. Actuarial accrued liability		107,684
Retired participants and beneficiaries	\$0	
Active participants	107,684	
Inactive participants	0	
6. Actuarial value of assets		95,469
7. Unfunded actuarial accrued liability: (5) – (6)		12,215
8. Reallocated unfunded actuarial accrued liability		<u>1,224</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$13,439

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$373	0.32%
2. Projected unfunded actuarial accrued liability	13,950	
3. Payment on projected unfunded actuarial accrued liability	5,588	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	<u>0</u>	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$5,961	5.17%
8. Total FY17 Appropriation, payable on July 1	5,849	5.07%
9. Projected payroll	115,333	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$403	\$434
2. Payment on projected unfunded actuarial accrued liability	582	625
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	<u>0</u>	<u>0</u>
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$985	\$1,059
7. Total Appropriation, payable on July 1	967	1,039

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 3: Unit Results for the Middlesex County Retirement System

Unit Results (Continued)

Summary of Actuarial Valuation Results for Ayer-Shirley RSD

7600

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 0 beneficiaries in pay status)	9
2. Participants active during the year ended December 31, 2015	127
3. Inactive participants entitled to a return of their employee contributions	15
4. Inactive participants with a vested right to a deferred or immediate benefit	4

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost		\$449,258
2. Administrative expenses		26,902
3. Expected employee contributions		<u>-346,433</u>
4. Employer normal cost: (1) + (2) + (3)		\$129,727
5. Actuarial accrued liability		10,860,110
Retired participants and beneficiaries	\$2,138,001	
Active participants	8,352,705	
Inactive participants	369,404	
6. Actuarial value of assets		6,668,940
7. Unfunded actuarial accrued liability: (5) – (6)		4,191,170
8. Reallocated unfunded actuarial accrued liability		<u>123,446</u>
9. Total unfunded actuarial accrued liability: (7) + (8)		\$4,314,616

The actuarial factors projected to FY17 are as follows:

	Amount	% of Payroll
1. Projected employer normal cost	\$134,464	3.54%
2. Projected unfunded actuarial accrued liability	4,478,688	
3. Payment on projected unfunded actuarial accrued liability	299,571	
4. Payment on 2002 ERI	0	
5. Payment on 2003 ERI	0	
6. Payment on 2010 ERI	0	
7. Total FY17 Appropriation: (1) + (3) + (4) + (5) + (6)	\$434,035	11.43%
8. Total FY17 Appropriation, payable on July 1	425,887	11.22%
9. Projected payroll	3,796,109	

The actuarial factors projected to FY18 and FY19 are as follows:

	FY18	FY19
1. Projected employer normal cost	\$139,893	\$145,538
2. Payment on projected unfunded actuarial accrued liability	287,908	308,871
3. Payment on 2002 ERI	0	0
4. Payment on 2003 ERI	0	0
5. Payment on 2010 ERI	0	0
6. Total Appropriation: (1) + (2) + (3) + (4) + (5)	\$427,801	\$454,409
7. Total Appropriation, payable on July 1	419,892	446,008

Note: Recommended contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT A

Table of Plan Coverage

Category	Year Ended December 31		Change From Prior Year
	2015	2013	
Active participants in valuation:			
Number	9,072	9,082	-0.1%
Average age	48.2	48.3	N/A
Average years of service	11.6	11.7	N/A
Total payroll*	\$421,085,856	\$398,185,255	5.8%
Average payroll*	46,416	43,843	5.9%
Member contributions	398,738,544	354,110,505	12.6%
Number with unknown age	17	66	-74.2%
Inactive participants with a vested right to a deferred or immediate benefit	321	384	-16.4%
Inactive participants entitled to a return of their employee contributions	2,640	2,632	0.3%
Retired participants:			
Number in pay status	4,291	4,013	6.9%
Average age	73.5	73.7	N/A
Average monthly benefit	\$2,072	\$1,926	7.6%
Number with benefits in suspended status	0	2	-100.0%
Disabled participants:			
Number in pay status	434	446	-2.7%
Average age	66.1	66.1	N/A
Average monthly benefit	\$2,793	\$2,651	5.4%
Number with benefits in suspended status	0	1	-100.0%
Beneficiaries in pay status:			
Number in pay status	602	613	-1.8%
Average age	75.3	75.6	N/A
Average monthly benefit	\$1,213	\$1,073	13.0%
Number with benefits in suspended status	0	2	-100.0%

* Payroll figures are for the prior calendar year and reflect annualized salaries for participants hired during the year.

SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT B

Participants in Active Service as of December 31, 2015 By Age, Years of Service, and Average Payroll

Age	Years of Service									
	Total	0-4	5-9	10-14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 & over
Under 25	320	320	--	--	--	--	--	--	--	--
	\$28,120	\$28,120	--	--	--	--	--	--	--	--
25 - 29	684	606	77	1	--	--	--	--	--	--
	\$37,178	\$35,771	\$47,941	\$61,122	--	--	--	--	--	--
30 - 34	662	343	243	73	3	--	--	--	--	--
	\$46,177	\$38,735	\$52,970	\$458,410	\$49,087	--	--	--	--	--
35 - 39	627	237	131	194	63	2	--	--	--	--
	\$51,227	\$37,018	\$53,859	\$62,009	\$65,289	\$73,630	--	--	--	--
40 - 44	851	287	141	161	203	56	3	--	--	--
	\$50,715	\$32,468	\$42,656	\$60,876	\$67,683	\$72,143	\$81,667	--	--	--
45 - 49	1,342	389	253	209	229	169	84	9	--	--
	\$49,944	\$30,178	\$39,123	\$49,691	\$62,357	\$78,783	\$80,276	\$73,915	--	--
50 - 54	1,619	353	315	302	242	108	204	88	7	--
	\$48,845	\$33,446	\$33,444	\$40,268	\$51,266	\$70,177	\$81,018	\$85,610	\$75,820	--
55 - 59	1,490	232	239	334	312	122	115	102	27	7
	\$45,923	\$32,766	\$35,924	\$38,468	\$44,700	\$53,197	\$71,534	\$80,124	\$75,386	\$74,108
60 - 64	978	96	113	217	228	134	97	48	27	18
	\$46,222	\$32,393	\$37,058	\$40,889	\$42,263	\$50,725	\$57,548	\$70,435	\$78,934	\$83,749
65 - 69	365	27	45	73	72	51	59	23	10	5
	\$43,547	\$33,634	\$40,402	\$43,751	\$41,930	\$43,078	\$46,038	\$46,712	\$56,239	\$81,115
70 & over	117	1	11	20	25	15	21	11	5	8
	\$40,704	\$21,565	\$35,367	\$33,402	\$35,785	\$43,280	\$43,934	\$49,246	\$50,418	\$52,933
Unknown	17	12	2	--	--	1	--	1	--	1
	\$24,613	\$15,812	\$37,637	--	--	\$10,933	--	\$62,284	--	\$80,194
Total	9,072	2,903	1,570	1,584	1,377	658	583	282	76	39
	\$46,416	\$33,562	\$41,479	\$46,897	\$52,420	\$62,652	\$70,263	\$75,996	\$72,525	\$75,269

SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT C

Summary Statement of Income and Expenses on an Actuarial Value Basis

	Year Ended December 31, 2015	Year Ended December 31, 2014
Net assets at actuarial value at the beginning of the year	\$1,062,517,426	\$967,146,018
Contribution income:		
Employer contributions	\$99,792,642	\$93,368,685
Employee contributions	40,870,163	39,806,980
Federal grant reimbursement and other contributions	27,839	32,261
Less administrative expenses	<u>-3,290,167</u>	<u>-3,540,884</u>
Net contribution income	137,400,477	129,667,042
Net investment income	<u>75,500,265</u>	<u>90,787,044</u>
Total income available for benefits	\$212,900,742	\$220,454,086
Less benefit payments:		
Pensions	-\$128,332,401	-\$121,103,421
Net 3(8)(c) reimbursements	-4,490,003	-1,374,095
Refunds, annuities, & Option B refunds	-2,856,575	-2,447,953
Net transfers	1,331,189	-157,209
Workers' compensation settlements	<u>52,285</u>	<u>0</u>
Net benefit payments	-\$134,295,505	-\$125,082,678
Change in reserve for future benefits	\$78,605,237	\$95,371,408
Net assets at actuarial value at the end of the year	\$1,141,122,663	\$1,062,517,426

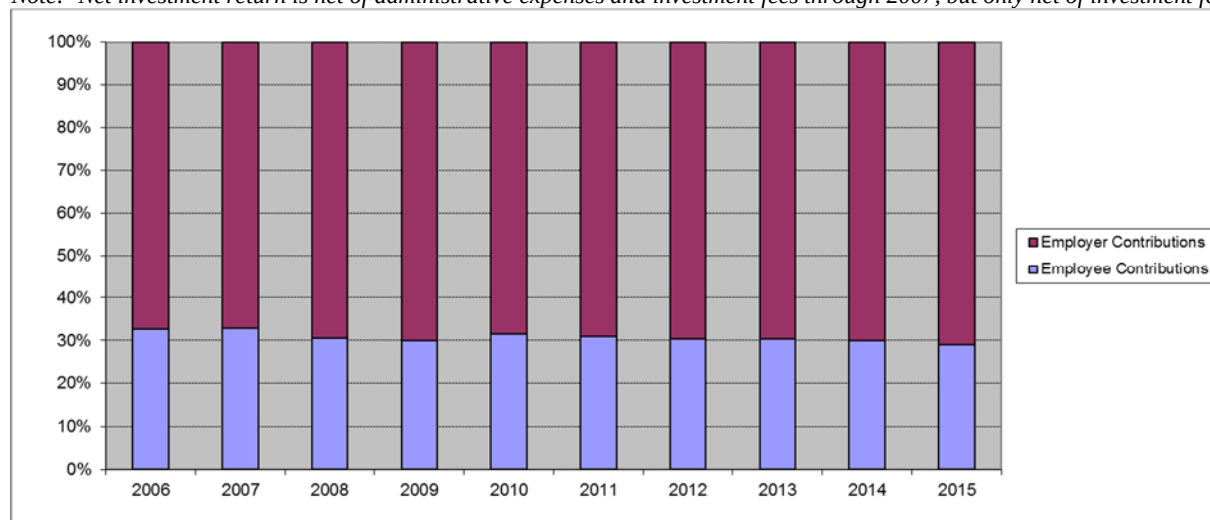
SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT D

Development of the Fund Through December 31, 2015 and Comparison of Employer and Employee Contributions

Year Ended December 31	Employer Contributions	Employee Contributions	Employee Contributions as a Percent of Total Contributions	Other Contributions	Net Investment Return	Administrative Expenses	Benefit Payments	Actuarial Value of Assets at End of Year
2006	\$59,949,757	\$29,202,011	32.67%	\$219,960	\$42,522,819	\$0	\$85,096,827	\$699,954,587
2007	64,408,516	31,581,761	32.81%	256,313	67,081,999	0	88,419,506	774,863,669
2008	71,923,886	31,686,242	30.54%	126,432	-68,010,444	2,930,164	92,969,048	714,690,573
2009	78,120,707	33,567,538	30.03%	91,414	92,107,036	2,814,190	95,775,164	819,987,914
2010	76,087,532	35,031,485	31.51%	59,431	20,487,695	3,042,747	101,242,424	847,368,886
2011	78,594,607	35,094,482	30.85%	67,607	10,333,913	3,075,272	106,060,828	862,323,395
2012	81,896,208	35,766,080	30.39%	37,240	15,213,243	3,051,893	116,194,523	875,989,750
2013	88,252,356	38,568,968	30.40%	34,756	88,945,014	3,170,834	121,473,992	967,146,018
2014	93,368,685	39,806,980	29.88%	32,261	90,787,044	3,540,884	125,082,678	1,062,517,426
2015	99,792,642	40,870,163	29.05%	27,839	75,500,265	3,290,167	134,295,505	1,141,122,663

Note: Net investment return is net of administrative expenses and investment fees through 2007, but only net of investment fees for 2008 and later.



Note: Other contributions have been included with employer contributions for purposes of this graph.

SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT E

Table of Amortization Bases

Type	Outstanding Balance as of July 1, 2016	Annual Fiscal 2017 Payment	Outstanding Balance as of July 1, 2017	Annual Fiscal 2018 Payment	Rate of Increase	Years Remaining as of July 1, 2016
2002 ERI	\$4,580,041	\$1,672,875	\$3,165,796	\$1,672,875	0.0%	3
2003 ERI	2,578,067	731,903	2,003,822	731,903	0.0%	4
2010 ERI	299,192	60,733	258,149	60,733	0.0%	6
Remaining unfunded liability	<u>1,394,957,732</u>	<u>84,139,046</u>	<u>1,414,083,240</u>	<u>90,292,470</u>	N/A	19
Total	\$1,402,415,032	\$86,604,557	\$1,419,511,007	\$92,757,981		

Notes: Recommended contributions are assumed to be paid in two equal installments on July 1 and December 31.

Recommended contribution for fiscal 2018 is calculated to increase 6.5% over fiscal 2017.

Fiscal 2017 appropriation is budgeted amount determined with prior valuation.

SECTION 4: Supplemental Information for the Middlesex County Retirement System

EXHIBIT F

Definitions of Pension Terms

The following list defines certain technical terms for the convenience of the reader:

Assumptions or actuarial assumptions:

The estimates on which the cost of the Plan is calculated including:

- (a) Investment return — the rate of investment yield that the Plan will earn over the long-term future;
- (b) Mortality rates — the death rates of employees and pensioners; life expectancy is based on these rates;
- (c) Retirement rates — the rate or probability of retirement at a given age;
- (d) Withdrawal rates — the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement.

Normal cost:

The amount of contributions required to fund the benefit allocated to the current year of service.

Actuarial accrued liability for actives:

The equivalent of the accumulated normal cost allocated to the years before the valuation date.

Actuarial accrued liability for pensioners:

The single-sum value of lifetime benefits to existing pensioners. This sum takes account of life expectancies appropriate to the ages of the pensioners and the interest that the sum is expected to earn before it is entirely paid out in benefits.

Unfunded actuarial accrued liability:

The extent to which the actuarial accrued liability of the Plan exceeds the assets of the Plan. There are many approaches to paying off the unfunded actuarial accrued liability, from meeting the interest accrual only to amortizing it over a specific period of time.

SECTION 4: Supplemental Information for the Middlesex County Retirement System

Amortization of the unfunded actuarial accrued liability:

Payments made over a period of years equal in value to the Plan's unfunded actuarial accrued liability.

Investment return:

The rate of earnings of the Plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.



SECTION 5: Reporting Information for the Middlesex County Retirement System

EXHIBIT I

Summary of Actuarial Valuation Results

The valuation was made with respect to the following data supplied to us:

1. Retired participants as of the valuation date (including 602 beneficiaries in pay status)	5,327
2. Participants active during the year ended December 31, 2015 (including 17 participants with unknown age) with total accumulated contributions of \$398,738,544 and projected 2016 payroll of \$439,644,322	9,072
3. Inactive participants entitled to a return of their employee contributions as of December 31, 2015	2,640
4. Inactive participants with a vested right to a deferred or immediate benefit as of December 31, 2015	321

The actuarial factors as of January 1, 2016 are as follows:

1. Normal cost	\$58,449,136
2. Administrative expenses	3,500,000
3. Expected employee contributions	<u>-42,068,898</u>
4. Employer normal cost: (1) + (2) + (3)	\$19,880,238
5. Actuarial accrued liability	2,492,161,766
Retired participants and beneficiaries	\$1,254,052,923
Active participants	1,193,429,619
Inactive participants	44,679,224
6. Actuarial value of assets (\$1,104,482,897 at market value)	1,141,122,663
7. Unfunded actuarial accrued liability: (5) – (6)	1,351,039,103

The actuarial factors projected to July 1, 2016 are as follows:

1. Projected employer normal cost, adjusted for timing	\$20,606,111
2. Projected unfunded actuarial liability	1,402,415,032
3. Payment on projected unfunded actuarial accrued liability, adjusted for timing	86,604,557
4. Recommended contribution: (1) + (3)	<u>\$107,210,668</u>
5. Projected payroll	\$447,271,930
6. Total recommended contribution as a percentage of projected payroll: (4) ÷ (5)	23.97%

Note: Recommended contributions are assumed to be paid on July 1 and December 31.

SECTION 5: Reporting Information for the Middlesex County Retirement System

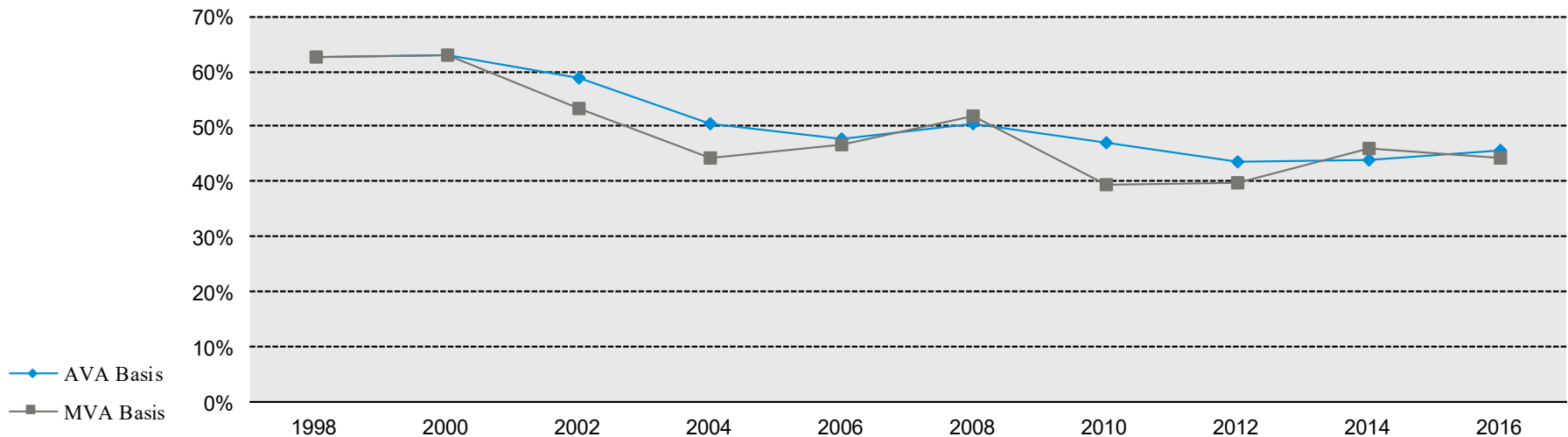
EXHIBIT II

Funded Ratio

A critical piece of information regarding the Plan's financial status is the funded ratio. This ratio compares the actuarial value of assets to the actuarial accrued liabilities of the Plan as calculated. High ratios indicate a well-funded plan with assets sufficient to cover the plan's actuarial accrued liabilities. Lower ratios may indicate recent changes to benefit structures, funding of the plan below actuarial requirements, poor asset performance, or a variety of other factors.

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

The chart below depicts a history of the funded ratios for this plan. On a market value basis, the funded ratio has decreased from 46.18% as of January 1, 2014 to 44.32% as of January 1, 2016. On an actuarial value basis, the funded ratio has increased from 44.05% as of January 1, 2014 to 45.79% as of January 1, 2016. The chart below depicts a history of the funded ratios for this plan.



SECTION 5: Reporting Information for the Middlesex County Retirement System

EXHIBIT III

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.

SECTION 5: Reporting Information for the Middlesex County Retirement System

Termination Rates before Retirement:

Groups 1 and 2 - Rate (%)

Age	Mortality				Disability
	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.

SECTION 5: Reporting Information for the Middlesex County Retirement System

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.

SECTION 5: Reporting Information for the Middlesex County Retirement System

Withdrawal Rates:

Years of Service	Rate per year (%)	
	Groups 1 and 2	Group 4
0	15.0	1.5
1	12.0	0.0
2	10.0	
3	9.0	
4	8.0	
5 – 9	7.6	
10 – 14	5.4	
15 – 19	3.3	
20 – 24	2.0	
25 - 29	1.0	
30+	0.0	

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

SECTION 5: Reporting Information for the Middlesex County Retirement System

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.

SECTION 5: Reporting Information for the Middlesex County Retirement System

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 5: Reporting Information for the Middlesex County Retirement System

EXHIBIT IV

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

SECTION 5: Reporting Information for the Middlesex County Retirement System

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

SECTION 5: Reporting Information for the Middlesex County Retirement System

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.

SECTION 5: Reporting Information for the Middlesex County Retirement System

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.