Newton Contributory Retirement System

Actuarial Valuation and Review as of January 1, 2018

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April 25, 2018

Retirement Board
Newton Contributory Retirement System
1000 Commonwealth Ave
Newton Centre, MA 02459-1449

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2018. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and establishes the funding requirements for fiscal 2019 and later years.

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 Newton Contributory Retirement System. That assistance is gratefully acknowledged.

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 this 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 Newton Contributory Retirement System.

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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Newton Contributory Retirement System Actuarial Valuation and Review as of January 1, 2018

Section 1: Actuarial Valuation Summary

Purpose and Basis

This report was prepared by Segal Consulting to present a valuation of the Newton Contributory Retirement System as of January 1, 2018. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits and to provide information for required disclosures under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the System's benefit obligations. 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; and changes in plan provisions or applicable law.

The information presented in this report is based on:

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

Significant Issues

1. Segal Consulting ("Segal") strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and the principal balance. The funding policy adopted by the Newton Contributory Retirement System meets this standard and funds the unfunded actuarial accrued liability of the plan by June 30, 2030.
2. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 51.69%, compared to the prior year funded ratio of 50.88%. This ratio is one measure of funding status, and its history is a measure of funding progress. Using the market value of assets, the funded ratio is 53.26%, compared to 48.82% as of the prior valuation date. These measurements are not necessarily appropriate for assessing the sufficiency of assets to cover the estimated cost of settling the Newton Contributory Retirement System's benefit obligation or the need for or the amount of future contributions.
3. The actuarial value of assets as of December 31, 2017 was $340.8 million, or 97.1% of the market value of assets of $351.2 million (as reported in the Annual Statement). As of December 31, 2016, the actuarial value of assets was 104.2% of market value. During the plan year ended December 31, 2017, the market value rate of return was 16.61%. Because the actuarial value of assets gradually recognizes market value fluctuations, the actuarial rate of return for the plan year ended December 31, 2017 was 8.59%.
4. As indicated in Section 2 of this report, the total unrecognized investment loss as of December 31, 2017 was $10.3 million. This investment gain 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 losses derived from future experience. This implies that earning the assumed rate of investment return on a market value basis will result in investment gains on the actuarial value of assets in the next few years. The funding schedule shown in Section 2 does not reflect the deferred investment gains in accordance with the asset valuation method used in this valuation.
5. This actuarial report as of January 1, 2018 is based on financial and demographic data as of that date. Changes subsequent to that date are not reflected and will affect future actuarial costs of the plan.
6. The following actuarial assumptions were changed with this valuation:
   - The investment return assumption was lowered from 7.50% to 7.25%.
   - The mortality assumption for non-disabled participants was updated from the RP-2000 Employee and Healthy Annuitant Mortality Tables projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Tables projected generationally with Scale MP-2017.
   - The mortality assumption for disabled participants was updated from the RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017.
   - The salary increase assumption was revised from 3.5% per year for all employees to the following service-based assumption:

Years of Service	Groups 1 and 2	Group 4
0	7.00%	8.00%
1	6.50%	7.50%
2	6.00%	7.00%
3	5.50%	6.50%
4	5.25%	6.00%
5	5.00%	5.50%
6	4.75%	5.25%
7	4.50%	5.00%
8	4.25%	4.75%
9	4.00%	4.50%
10	3.75%	4.25%
11+	3.50%	4.00%

Changing these assumptions increased the unfunded liability by approximately $16.8 million and increased the normal cost by approximately $1.6 million.

The 2018 budgeted administrative expenses of $322,244 were added to the normal cost in addition to the net (3)(8)(c) assumption of $250,000. In prior valuations, administrative expenses were not included in the appropriation because the City separately funded these expenses.

7. The unfunded liability was expected to decrease from $307.7 million as of January 1, 2017 to $307.5 million as of January 1, 2018. The actual unfunded liability as of January 1, 2018 was $318.5 million. The greater than expected increase was due to the assumption changes described above, partially offset by an investment gain on an actuarial basis and a gain due to demographic experience as detailed on pages 19 and 23 in Section 2.
8. The funding schedule included in this report includes the allowance for net 3(8)(c) reimbursements and budgeted administrative expenses in the normal cost. The fiscal 2019 appropriation has been set equal to $28,308,728 as determined with the prior valuation. For fiscal 2020 and later years, each year's appropriation increases 9.60% with a final payment on the unfunded liability in 2030.
9. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have included a discussion of various risks that may affect the plan in Section 2.

10. Section 5 shows the disclosure information required by Governmental Standards Accounting Board (GASB) Statements No. 67 and 68.
    - The Net Pension Liability (NPL) is equal to the difference between the Total Pension Liability (TPL) and the Plan's Fiduciary Net Position. The Plan's Fiduciary Net Position is equal to the market value of assets and therefore, the NPL measure is very similar to an Unfunded Actuarial Accrued Liability (UAAL) on a market value basis. The NPL decreased from $330.0 million as of December 31, 2016 to $308.2 million as of December 31, 2017 and the Plan's Fiduciary Net Position as a percent of the TPL increased from 48.10% to 53.26%.
    - The NPL was measured as of December 31, 2017 and 2016 and determined based upon the results of the actuarial valuations as of January 1, 2018 and January 1, 2017, respectively.
    - The discount rate used to determine the TPL and NPL was 7.25% as of December 31, 2017 and 7.35% as of December 31, 2016.

Summary of Key Valuation Results

		2018	2017
Contributions for fiscal year beginning July 1:	• Actuarially Determined Contributions for fiscal year 2019 and 2018	$28,308,728	$25,829,131
	• Actuarially Determined Contributions as a percent of payroll	28.03%	26.42%
Actuarial accrued liability for plan year beginning January 1:	• Retired participants and beneficiaries	$375,909,255	$352,726,241
	• Inactive vested participants	2,936,346	3,557,413
	• Active participants	276,992,712	266,361,423
	• Inactive participants due a refund of employee contributions	3,531,855	3,827,029
	• Total	$659,370,168	$626,472,106
	• Normal cost including administrative expenses for plan year beginning January 1	14,592,776	12,367,791
Assets for plan year beginning January 1:	• Market value of assets (MVA)	$351,179,411	$305,870,392
	• Actuarial value of assets (AVA)	340,835,241	318,752,385
	• Actuarial value of assets as a percentage of market value of assets	97.05%	104.21%
Funded status for plan year beginning January 1:	• Unfunded actuarial accrued liability on market value of assets	$308,190,757	$320,601,714
	• Funded percentage on MVA basis	53.26%	48.82%
	• Unfunded actuarial accrued liability on actuarial value of assets	$318,534,927	$307,719,721
	• Funded percentage on AVA basis	51.69%	50.88%
Key assumptions:	• Net investment return	7.25%	7.50%
	• Inflation rate	2.75%	2.50%
GASB information:	• Discount rate	7.25%	7.35%
	• Total pension liability	$659,370,168	$635,859,393
	• Plan fiduciary net position	351,179,411	305,870,392
	• Net pension liability	308,190,757	329,989,001
	• Plan fiduciary net position as a percentage of total pension liability	53.26%	48.10%
Demographic data for plan year beginning January 1:	• Number of retired participants and beneficiaries	1,315	1,310
	• Number of inactive vested participants	29	34
	• Number of active participants	1,581	1,633
	• Number of inactive participants entitled to a refund of employee contributions	587	621
	• Total payroll	$95,610,249	$93,475,180
	• Average payroll	60,475	57,241

Notes: Calendar year 2017 payroll figures were increased by 10.90% for police sergeants and school custodians and by 1.7% for NMEA Laborers to reflect unsettled bargaining contracts.
Calendar year 2016 payroll figures were decreased for school clerical, firefighters and police officers to reflect retroactive contract settlements and were increased by 7.67% for police sergeants and school custodians to reflect unsettled bargaining contracts.

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 Newton Contributory 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 Newton Contributory Retirement System. The Newton Contributory Retirement System uses an "actuarial value of assets" that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan's assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, that does not mean that the previous assumptions were unreasonable.

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

- The actuarial valuation is prepared at the request of the Newton Contributory 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.
- Actuarial results in this report are not rounded, but that does not imply precision.
- If the Newton Contributory 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 Newton Contributory Retirement System should look to their other advisors for expertise in these areas.

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

Section 2: Actuarial Valuation Results

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 3, Exhibits A* and *B*.

PARTICIPANT POPULATION: 2010 – 2017

Year Ended December 31	Active Participants	Inactive Participants	Retired Participants and Beneficiaries	Total Non-Actives	Ratio of Non-Actives to Actives
2010	1,669	574	1,312	1,886	1.13
2011	1,610	561	1,319	1,880	1.17
2012	1,616	547	1,318	1,865	1.15
2013	1,666	542	1,327	1,869	1.12
2014	1,723	604	1,317	1,921	1.11
2015	1,732	622	1,305	1,927	1.11
2016	1,633	655	1,310	1,965	1.20
2017	1,581	616	1,315	1,931	1.22

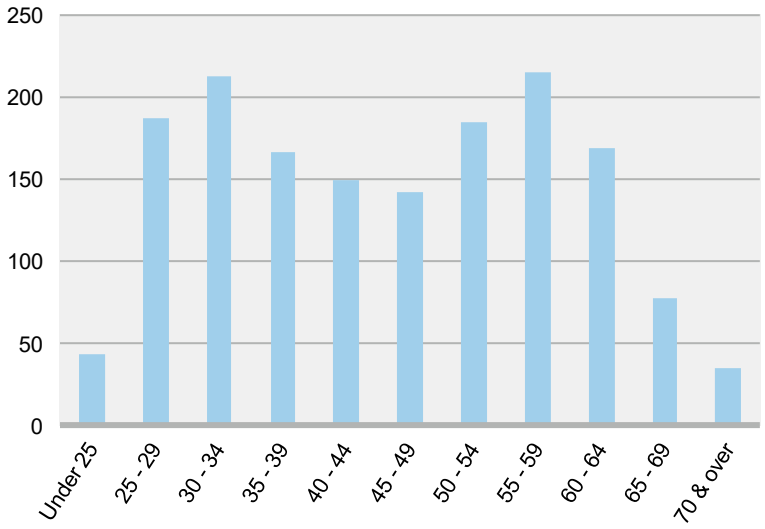
Active Participants

Plan costs are affected by the age, years of service and payroll of active participants. In this year's valuation, there were 1,581 active participants with an average age of 46.1, average years of service of 12.0 years and average payroll of $60,475. The 1,633 active participants in the prior valuation had an average age of 45.9, average service of 11.9 years and average payroll of $57,241.

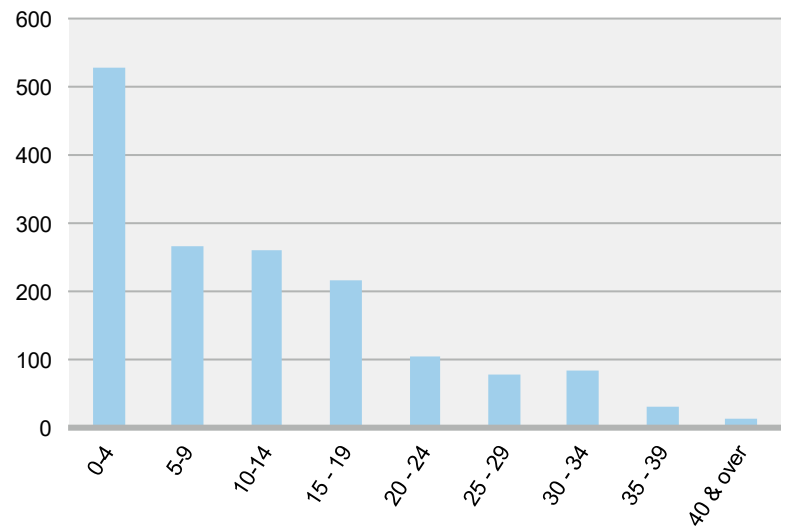
Among the active participants, there were none with unknown age and/or service information.

Distribution of Active Participants as of December 31, 2017

BY AGE



BY YEARS OF SERVICE



Inactive Participants

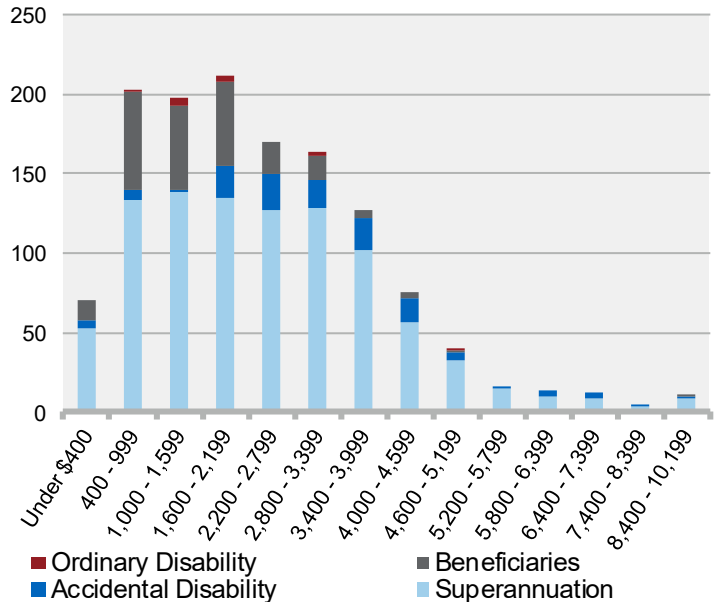
In this year's valuation, there were 29 participants with a vested right to a deferred or immediate vested benefit and 587 participants entitled to a return of their employee contributions.

Retired Participants and Beneficiaries

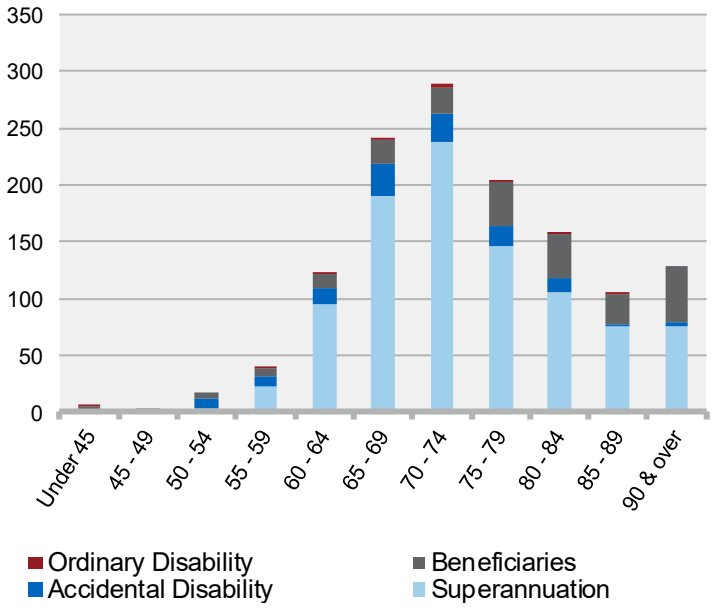
As of December 31, 2017, 1,091 retired participants and 224 beneficiaries were receiving total monthly benefits of $3,128,036, excluding COLAs reimbursed by the Commonwealth. For comparison, in the previous valuation, there were 1,067 retired participants and 243 beneficiaries receiving monthly benefits of $3,029,373, excluding COLAs reimbursed by the Commonwealth.

Distribution of Retired Participants and Beneficiaries as of December 31, 2017

BY TYPE AND MONTHLY AMOUNT



BY TYPE AND AGE

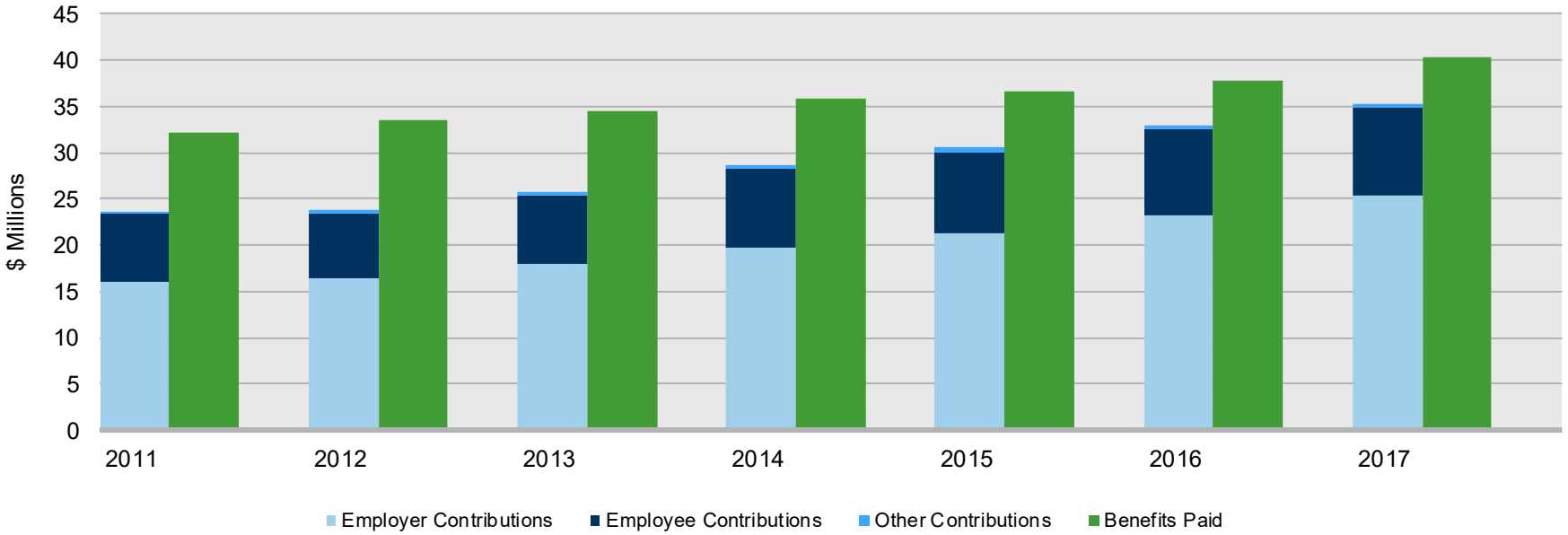


Financial Information

Retirement plan funding anticipates that, over the long term, both contributions and investment earnings (less investment fees and administrative expenses) 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 transactions for the valuation year, is presented in *Section 3, Exhibits C and D*.

COMPARISON OF CONTRIBUTIONS WITH BENEFITS
FOR YEARS ENDED DECEMBER 31, 2011 – 2017



Note: Excludes administrative expenses and administrative expense appropriation.

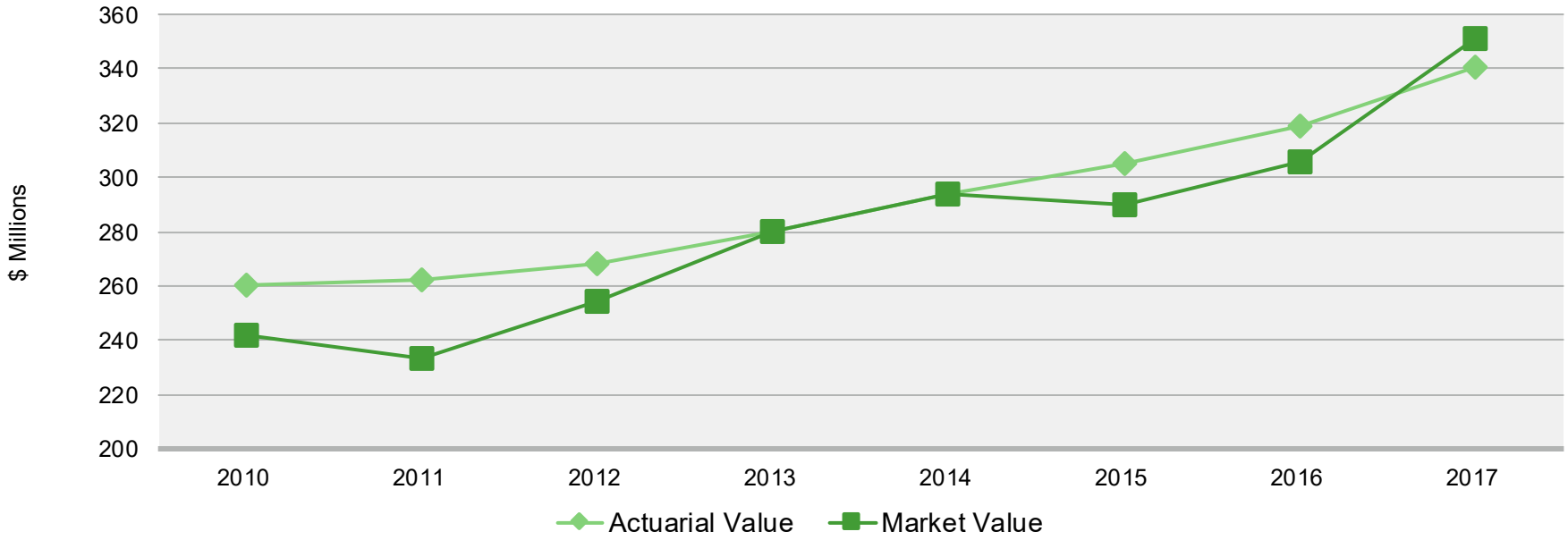
It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a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

DETERMINATION OF ACTUARIAL VALUE OF ASSETS FOR YEAR ENDED DECEMBER 31, 2017

1.	Actuarial value of assets as of December 31, 2016	$318,752,385
2.	Contributions, less benefit payments and expenses	-5,081,089
3.	Expected investment income on (1) and (2)	23,715,888
4.	Preliminary actuarial value of assets: (1) + (2) + (3)	$337,387,184
5.	Market value of assets, December 31, 2017	351,179,411
6.	Adjustment toward market value: 25% of [(5) - (4)]	3,448,057
7.	Adjustment to be within 20% corridor	0
8.	Final actuarial value of assets as of December 31, 2017: (4) + (6) + (7)	$340,835,241
9.	Actuarial value as a percentage of market value: (8) ÷ (5)	97.1%
10.	Amount deferred for future recognition: (5) - (8)	$10,344,170

Both the actuarial value and market value of assets are representations of the Newton Contributory 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 Newton Contributory 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.

ACTUARIAL VALUE OF ASSETS VS. MARKET VALUE OF ASSETS AS OF DECEMBER 31, 2010 – 2017



Actuarial Experience

To calculate an actuarially determined 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 net gain is $5,808,368, which includes $3,448,057 from investment gains and $2,360,311 in gains from all other sources. The net experience variation from individual sources other than investments was 0.4% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is on the following pages.

ACTUARIAL EXPERIENCE FOR YEAR ENDED DECEMBER 31, 2017

1	Net gain from investments	$3,448,057
2	Net gain from other experience	2,360,311
3	Net experience gain: 1 + 2 + 3	$5,808,368

Investment Experience

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 System's investment policy. The rate of return on the market value of assets was 16.61% for the year ended December 31, 2017.

For valuation purposes, the assumed rate of return on the actuarial value of assets was 7.50%. The actual rate of return on an actuarial basis for the 2017 plan year was 8.59%. Since the actual return for the year was greater than the assumed return, the Newton Contributory Retirement System experienced an actuarial gain during the year ended December 31, 2017 with regard to its investments.

INVESTMENT EXPERIENCE

		Year Ended December 31, 2017	
		Market Value	Actuarial Value
1	Net investment income	$50,390,108	$27,163,945
2	Average value of assets	303,329,848	316,211,841
3	Rate of return: 1 ÷ 2	16.61%	8.59%
4	Assumed rate of return	7.50%	7.50%
5	Expected investment income: 2 x 4	$22,749,739	$23,715,888
6	Actuarial gain/(loss): 1 – 5	$27,640,369	$3,448,057

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 actual market value investment return for the last seven years, including five-year averages.

Based upon this experience and future expectations, we have lowered the assumed rate of return from 7.50% to 7.25%.

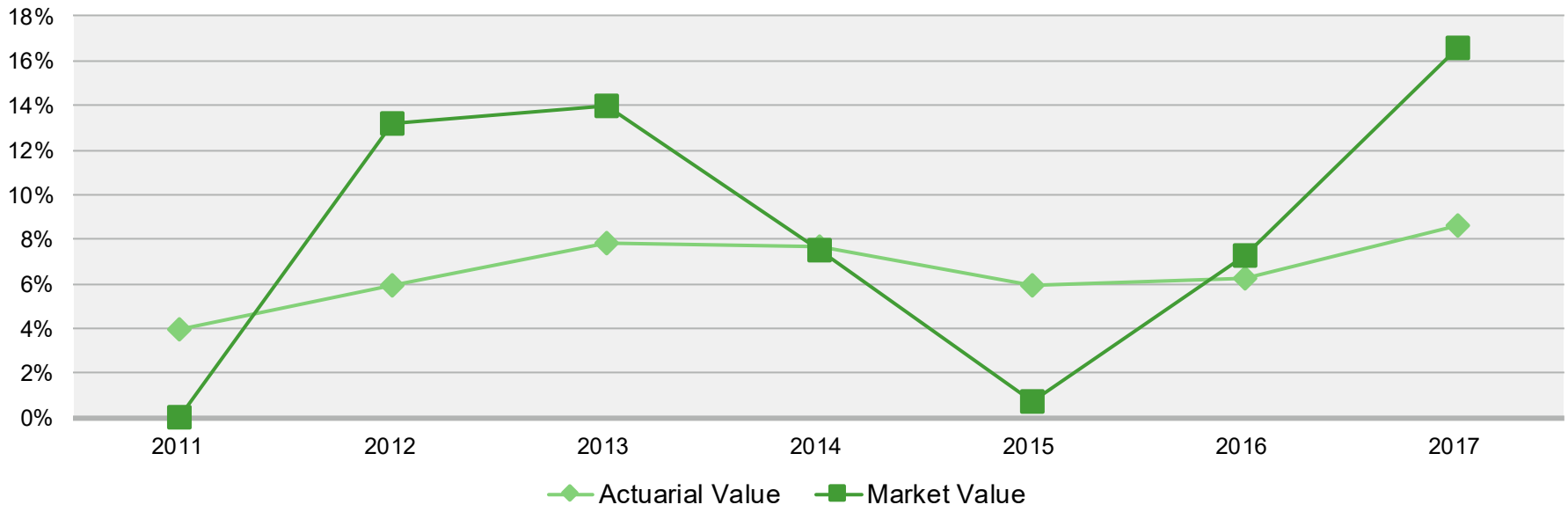
INVESTMENT RETURN – ACTUARIAL VALUE VS. MARKET VALUE: 2011 - 2017

Year Ended December 31	Actuarial Value Investment Return		Market Value Investment Return	
	Amount	Percent	Amount	Percent
2011	N/A	4.00%	N/A	0.01%
2012	N/A	5.95	N/A	13.20
2013	$20,598,786	7.81	$34,996,825	14.01
2014	21,161,289	7.66	20,748,803	7.50
2015	17,239,997	5.93	2,146,925	0.74
2016	18,841,702	6.23	20,972,368	7.30
2017	27,163,945	8.59	50,390,108	16.61
Total	$105,005,719		$129,255,029	
Most recent five-year average return		7.25%		9.18%

Note: Each year's yield is weighted by the average asset value in that year.

The actuarial asset valuation method gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

MARKET AND ACTUARIAL RATES OF RETURN FOR YEARS ENDED DECEMBER 31, 2011 - 2017



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 participants,
- retirement experience (earlier or later than projected),
- mortality (more or fewer deaths than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

The net gain from this other experience for the year ended December 31, 2017 amounted to $2,360,311, which is 0.4% of the actuarial accrued liability.

LIABILITY CHANGES DUE TO DEMOGRAPHIC EXPERIENCE FOR YEAR ENDED DECEMBER 31, 2017

More deaths than expected amongst retired members and beneficiaries	$613,488
Salary increases more than expected for continuing actives and service adjustments	-3,594,420
Fewer retirements than expected	3,475,193
Miscellaneous experience gain, primarily due to fewer disabilities than expected	1,866,050
Total	$2,360,311

Changes in the Actuarial Accrued Liability

The actuarial accrued liability as of January 1, 2018 is $659,370,168, an increase of $32,898,062, or 5.3%, from the actuarial accrued liability as of the prior valuation date. The liability is expected to grow each year with normal cost and interest, and to decline due to benefit payments made. Additional fluctuations can occur due to actual experience that differs from expected (as discussed in the previous subsection).

Actuarial Assumptions

The following actuarial assumptions were changed with this valuation:

- The investment return assumption was lowered from 7.50% to 7.25%.
- The mortality assumption for non-disabled participants was updated from the RP-2000 Employee and Healthy Annuitant Mortality Tables projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Tables projected generationally with Scale MP-2017.
- The mortality assumption for disabled participants was updated from the RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017.
- The salary increase assumption was revised from 3.5% per year for all employees to the following service-based assumption:

Years of Service	Groups 1 and 2	Group 4
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Changing these assumptions increased the unfunded liability by approximately $16.8 million and increased the normal cost by approximately $1.6 million.

The 2018 budgeted administrative expenses of $322,244 were added to the normal cost in addition to the net (3)(8)(c) assumption of $250,000. In prior valuations, administrative expenses were not included in the appropriation because the City separately funded these expenses.

Details on actuarial assumptions and methods are in *Section 4, Exhibit I*.

Plan Provisions

There were no changes in plan provisions since the prior valuation.

A summary of plan provisions is in *Section 4, Exhibit II*.

Development of Unfunded Actuarial Accrued Liability

DEVELOPMENT FOR YEAR ENDED DECEMBER 31, 2017

1	Unfunded actuarial accrued liability at beginning of year		$307,719,721
2	Normal cost at beginning of year		12,367,791
3	Total contributions		-35,286,384
4	Interest		
	• For whole year on 1 + 2	$24,006,563	
	• For half year on 3	-1,276,447	
	Total interest		22,730,116
5	Expected unfunded actuarial accrued liability		$307,531,244
6	Changes due to:		
	• Net gain from investments	-$3,448,057	
	• Net gain from other experience	-2,360,311	
	• Change in assumptions	16,812,051	
	Total changes		11,003,683
7	Unfunded actuarial accrued liability at end of year		$318,534,927

Actuarially Determined Contribution

The amount of the 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 contribution for fiscal 2019 is equal to the previously budgeted amount of $28,308,728. The detail of this calculation for the current and prior valuations is shown below.

ACTUARIALLY DETERMINED CONTRIBUTION FOR YEAR BEGINNING JULY 1

		2018		2017	
		Amount	% of Projected Payroll	Amount	% of Projected Payroll
1.	Total normal cost	$14,020,532	14.07%	$12,117,791	12.55%
2.	Administrative expenses (2018) and allowance for net 3(8)(c) reimbursements	572,244	0.57%	250,000	0.26%
3.	Expected employee contributions	-9,714,468	-9.75%	-9,328,400	-9.66%
4.	Employer normal cost: (1) + (2) - (3)	$4,878,308	4.90%	$3,039,391	3.15%
5.	Actuarial accrued liability	659,370,168		626,472,106	
6.	Actuarial value of assets	340,835,241		318,752,385	
7.	Unfunded actuarial accrued liability: (5) - (6)	$318,534,927		$307,719,721	
8.	Employer normal cost projected to July 1, 2018 and 2017, adjusted for timing	4,973,856	4.92%	3,095,750	3.17%
9.	Projected unfunded actuarial accrued liability	329,879,790		319,050,597	
10.	Payment on unfunded actuarial accrued liability	23,334,872	23.10%	22,733,381	23.25%
11.	Actuarially Determined Contribution: (8) + (10)	$28,308,728	28.03%	$25,829,131	26.42%
12.	Projected payroll	$100,999,282		$97,767,455	

Notes: The recommended contribution for fiscal 2018 does not include an allowance for administrative expenses.
Recommended contributions are assumed to be paid on August 1.
Recommended contributions are set equal to the budgeted amounts determined with the prior valuation.

The funding schedule included in this report includes the allowance for net 3(8)(c) reimbursements and an allowance for administrative expenses in the normal cost. The fiscal 2019 appropriation has been set equal to $28,308,728 as determined with the prior valuation. For fiscal 2020 and later years, each year's appropriation increases 9.60% with a final payment on the unfunded liability in 2030, if all assumptions are met.

The funding scheduled included in the prior valuation report also fully funded the Retirement System by June 30, 2030 with appropriations that increased 9.60% per year.

Because the total appropriation will increase faster than projected payroll, the appropriation as a percent of payroll is projected to increase.

Funding Schedule

APPROPRIATION INCREASES BY 9.6% PER YEAR AND SYSTEM IS FULLY FUNDED BY 2030

(1) Fiscal Year Ended June 30	(2) Normal Cost	(3) Amortization of Unfunded Actuarial Accrued Liability	(4) Appropriation: (2) + (3)	(5) Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(6) Percent Increase in Appropriation
2019	$4,973,856	$23,334,871	$28,308,728	$329,879,790	-
2020	5,132,670	25,893,695	31,026,365	328,914,973	9.60%
2021	5,296,490	28,708,406	34,004,897	325,151,829	9.60%
2022	5,465,474	31,803,892	37,269,367	318,114,636	9.60%
2023	5,639,783	35,207,443	40,847,226	307,266,645	9.60%
2024	5,819,583	38,948,977	44,768,559	292,003,096	9.60%
2025	6,005,045	43,061,297	49,066,341	271,643,482	9.60%
2026	6,196,345	47,580,365	53,776,710	245,422,983	9.60%
2027	6,393,665	52,545,609	58,939,274	212,482,983	9.60%
2028	6,597,193	58,000,251	64,597,444	171,860,580	9.60%
2029	6,807,124	63,991,675	70,798,799	122,476,971	9.60%
2030	7,023,654	63,493,882	70,517,536	63,124,619	-0.40%
2031	7,246,993	0	7,246,993	0	-89.72%

Notes: Recommended contributions are assumed to paid on August 1.
Assumes contribution of budgeted amount for fiscal year 2019.
Item (2) reflects 2.75% growth in payroll, plus an additional 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 impact of pension reform for future hires.
Projected unfunded actuarial accrued liability does not reflect deferred investment gains.

Risk

Since the actuarial valuation results are dependent on a given set of assumptions and data as of a specific date, there is a risk that emerging results may differ significantly as actual experience differs from the assumptions.

This report does not contain a detailed analysis of the potential range of future measurements, but does include a brief discussion of some risks that may affect the Plan. Upon request, a more detailed assessment of the risks can be provided to enable a better understanding of the risks specific to your Plan.

- Investment Risk (the risk that returns will be different than expected)

  The market value rate of return over the last 7 years has ranged from a low of 0.01% to a high of 16.61%.

- Longevity Risk (the risk that mortality experience will be different than expected)

  The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

- Contribution Risk (the risk that actual contributions will be different from actuarially determined contributions)

  Massachusetts General Law Chapter 32 requires payment of the actuarially determined contribution. If future experience matches current assumptions, we project the unfunded actuarial accrued liability will be paid off in 12 years.

- Demographic Risk (the risk that participant experience will be different than assumed)

  Examples of this risk include:

  - Actual retirements occurring earlier or later than assumed.
  - Disability retirement experience different than assumed.
  - More or less active participant turnover than assumed.
  - Salary increases greater or less than projected.

- Actual Experience Over the Last Five Years and Implications for the Future

  Past experience can help demonstrate the sensitivity of key results to the System's actual experience. Over the past five years:

  - The investment gain(loss) for a year has ranged from a loss of $20.1 million to a gain of $27.6 million. If all investment returns were equal to the assumed return over the last five years, the market value of assets as of the current valuation date would be approximately $365.3 million as opposed to the actual value of $351.2 million.
  - The non-investment gain(loss) for a year has ranged from a loss of $15.6 million to a gain of $4.1 million.
  - The funded percentage on the actuarial value of assets has ranged from a low of 50.8% to a high of 51.7% since 2014.

- Maturity Measures

  As pension plans mature, the cash needed to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Systems's asset allocation is aligned to meet emerging pension liabilities.

Section 3: Supplemental Information

EXHIBIT A – TABLE OF PLAN COVERAGE

Category	Year Ended December 31 2017	2016	Change From Prior Year
Active participants in valuation:			
• Number	1,581	1,633	-3.2%
• Average age	46.1	45.9	0.2
• Average years of service	12.0	11.9	0.1
• Total payroll	$95,610,249	$93,475,180	2.3%
• Average payroll	60,475	57,241	5.6%
• Member contributions	89,091,577	87,606,181	1.7%
• Total active vested participants	883	889	-0.7%
Inactive participants in valuation:			
• Inactive participants due a refund of employee contributions	587	621	-5.5%
• Inactive participants with a vested right to a deferred or immediate benefit	29	34	-14.7%
Retired participants:			
• Number in pay status	954	925	3.1%
• Average age	74.2	74.3	-0.1
• Average monthly benefit	$2,472	$2,420	2.1%
Disabled participants:			
• Number in pay status	137	142	-3.5%
• Average age	69.1	68.7	0.4
• Average monthly benefit	$3,057	$2,961	3.2%
Beneficiaries:			
• Number in pay status	224	243	-7.8%
• Average age	78.5	79.3	-0.8
• Average monthly benefit	$1,569	$1,523	3.0%

Notes: Calendar year 2017 payroll figures were increased by 10.90% for police sergeants and school custodians and by 1.7% for NMEA Laborers to reflect unsettled bargaining contracts.
Calendar year 2016 payroll figures were decreased for school clerical, firefighters and police officers to reflect retroactive contract settlements and were increased by 7.67% for police sergeants and school custodians to reflect unsettled bargaining contracts.

EXHIBIT B – PARTICIPANTS IN ACTIVE SERVICE AS OF DECEMBER 31, 2017
BY AGE, YEARS OF SERVICE, AND AVERAGE PAYROLL

		Years of Service								
Age	Total	0-4	5-9	10-14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 & over
Under 25	43	43	- -	- -	- -	- -	- -	- -	- -	- -
	$35,226	$35,226	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	187	165	22	- -	- -	- -	- -	- -	- -	- -
	$40,903	$39,021	$55,016	- -	- -	- -	- -	- -	- -	- -
30 - 34	212	110	82	20	- -	- -	- -	- -	- -	- -
	$55,888	$49,965	$61,338	$66,126	- -	- -	- -	- -	- -	- -
35 - 39	166	50	34	59	23	- -	- -	- -	- -	- -
	$63,991	$53,021	$63,008	$69,876	$74,193	- -	- -	- -	- -	- -
40 - 44	149	36	25	38	45	5	- -	- -	- -	- -
	$66,163	$44,352	$50,486	$74,385	$83,773	$80,600	- -	- -	- -	- -
45 - 49	142	33	21	23	41	22	2	- -	- -	- -
	$68,208	$49,535	$52,623	$67,270	$78,089	$92,921	$76,323	- -	- -	- -
50 - 54	185	36	25	26	29	34	21	14	- -	- -
	$66,681	$48,303	$51,937	$57,841	$70,294	$86,785	$79,843	$80,629	- -	- -
55 - 59	215	32	35	34	35	16	20	33	10	- -
	$64,778	$47,749	$56,025	$56,924	$57,363	$75,427	$74,507	$89,332	$85,027	- -
60 - 64	169	19	14	35	27	10	18	30	13	3
	$67,946	$49,315	$57,225	$52,752	$57,771	$69,098	$74,169	$87,336	$110,021	$87,431
65 - 69	78	3	7	22	11	8	13	4	6	4
	$62,022	$44,585	$43,685	$62,595	$53,096	$73,155	$56,662	$65,219	$87,894	$81,743
70 & over	35	2	1	3	4	8	5	4	1	7
	$52,814	$44,452	$121,000	$33,047	$68,144	$43,001	$31,291	$49,374	$80,370	$69,791
Total	1,581	529	266	260	215	103	79	85	30	14
	$60,475	$44,912	$57,281	$63,773	$70,421	$79,854	$70,223	$84,179	$96,276	$76,986

EXHIBIT C – SUMMARY STATEMENT OF INCOME AND EXPENSES ON AN ACTUARIAL VALUE BASIS

	Year Ended December 31, 2017	Year Ended December 31, 2016
Net assets at actuarial value at the beginning of the year	$318,752,385	$304,944,228
Contribution income:		
• Employer contributions	$25,419,350	$23,185,510
• Employer contributions	9,457,254	9,282,992
• Federal Grant Reimbursement contributions	409,780	381,215
Net contribution income	35,286,384	32,849,717
Investment income	27,163,945	$18,841,702
Total income available for benefits	$62,450,329	$51,691,419
Less benefit payments:		
• Pensions	-$39,918,760	-$37,884,721
• Net 3(8)(c) reimbursements	-448,713	1,459
Net benefit payments	-$40,367,473	-$37,883,262
Change in reserve for future benefits	$22,082,856	$13,808,157
Net assets at actuarial value at the end of the year	$340,835,241	$318,752,385

Note: Excludes administrative expenses and administrative expense appropriation.

EXHIBIT D – DEVELOPMENT OF THE FUND THROUGH DECEMBER 31, 2017

Year Ended December 31	Employer Contributions*	Employee Contributions	Federal Grant Reimbursements	Net Investment Return**	Benefit Payments	Actuarial Value of Assets at Year-End
2011	$16,056,552	$7,273,727	$303,331	$10,503,211	$32,184,128	$262,109,152
2012	16,508,453	6,951,141	313,189	15,799,687	33,594,167	268,087,455
2013	17,975,932	7,421,492	319,511	20,598,786	34,550,265	279,852,911
2014	19,693,552	8,661,238	347,380	21,161,289	35,872,446	293,843,924
2015	21,220,216	8,842,379	450,336	17,239,997	36,652,624	304,944,228
2016	23,185,510	9,282,992	381,215	18,841,702	37,883,262	318,752,385
2017	25,419,350	9,457,254	409,780	27,163,945	40,367,473	340,835,241

* Excludes administrative expense appropriation.

** Net of investment fees.

EXHIBIT E – DEPARTMENT BREAKOUTS

Department Code	Category	Active participants in valuation	Projected payroll for calendar 2018	Fiscal year ending 2020		
				Normal Cost, including 3(8)c reimbursements	Amortization of Unfunded Actuarial Accrued Liability	Total Appropriation
001	M.I.S.	11	$961,071	$24,732	$140,755	$165,487
002	Personnel	5	390,976	18,917	137,677	156,594
003	Human Services	4	293,032	2,721	54,548	57,269
004	Financial Information Systems	3	255,379	11,692	72,995	84,687
005	Jackson Homestead	3	186,368	13,215	29,198	42,413
006	Executive	5	527,089	34,616	173,459	208,075
007	Comptrollers	5	431,456	7,680	202,885	210,565
008	Retirement	2	224,361	-994	62,036	61,042
009	Assessing	11	922,309	22,319	315,576	337,895
010	Purchasing	5	369,368	22,142	107,420	129,562
011	Treasury	13	819,138	21,825	116,594	138,419
012	Law	12	1,167,609	36,248	302,431	338,679
013	City Clerk	10	645,342	11,973	81,506	93,479
014	Clerk of the Board	3	229,422	7,490	83,511	91,001
015	Board of Aldermen	21	208,522	22,320	60,220	82,540
016	Building	33	2,239,301	115,225	545,430	660,655
017	Elections	1	46,426	5,869	103,997	109,866
018	Planning	20	1,378,316	44,012	168,353	212,365
018F	Planning - Federally Funded	8	493,257	8,306	164,117	172,423
018P	Community Preservation Planning	1	100,934	10,088	10,404	20,492
019	Fire (Group 2 & 4)	187	16,993,532	1,660,311	5,541,293	7,201,604

Department Code	Category	Active participants in valuation	Projected payroll for calendar 2018	Fiscal year ending 2020		
				Normal Cost, including 3(8)c reimbursements	Amortization of Unfunded Actuarial Accrued Liability	Total Appropriation
019A	Fire (Civilian Personnel)	6	516,764	17,853	119,810	137,663
019S	Fire (Retired under Starck)	0	-	4,587	259,424	264,011
020	Police (Group 2 & 4)	106	9,238,703	864,147	3,971,958	4,836,105
020A	Police (Civilian Personnel)	36	2,360,110	35,359	378,153	413,512
020S	Police Superior	37	4,884,781	428,365	1,061,108	1,489,473
021	Police School Traffic Sup.	13	499,758	36,169	195,122	231,291
022	Sealer Weights & Measures	1	82,357	5,307	13,164	18,471
023	Inspectional Services	15	1,165,170	62,348	261,066	323,414
025	Health	45	2,796,571	117,234	579,915	697,149
026	Veterans	1	74,499	2,120	57,736	59,856
027	Library	57	3,311,178	89,491	934,147	1,023,638
028	School Custodian	85	4,956,760	159,301	1,361,120	1,520,421
029	School Cafeteria	0	-	3,124	182,124	185,248
030	School Teacher Aides	444	16,851,493	502,858	1,837,636	2,340,494
031	School Clerical	108	7,377,094	254,616	1,848,799	2,103,415
031A	School Committee	0	-	52	2,962	3,014
031B	School Budget Revolving	1	69,989	2,868	25,460	28,328
031C	School - Community Schools	9	596,457	39,970	71,154	111,124
031E	School Ed Ctr Preschool	10	249,107	8,794	11,147	19,941
031N	School NSHS Preschool	1	22,509	-4	1,132	1,128
031T		1	26,726	-96	177	81
032	Recreation	43	3,187,281	70,409	889,224	959,633

Department Code	Category	Active participants in valuation	Projected payroll for calendar 2018	Fiscal year ending 2020		
				Normal Cost, including 3(8)c reimbursements	Amortization of Unfunded Actuarial Accrued Liability	Total Appropriation
032A	Recreation - Arts in the Parks	2	142,196	6,911	5,981	12,892
033	Engineering	12	1,023,942	29,501	310,243	339,744
034	DPW	100	6,057,530	208,923	1,851,986	2,060,909
034A	DPW-Storm Water Management	10	606,397	18,793	78,612	97,405
034B	DPW 6 Man Hwy Crew	6	221,767	1,807	377	2,184
035	Water-Sewer (General Personnel)	11	757,093	13,058	153,144	166,202
035S	Sewer Personnel	14	807,200	10,439	264,525	274,964
035W	Water Personnel	22	1,317,506	17,397	394,842	412,239
036	Newton Housing Authority	22	1,554,399	20,262	297,042	317,304
	TOTAL	**1,581**	**$99,638,545**	**$5,132,670**	**$25,893,695**	**$31,026,365**

EXHIBIT F – CASHFLOW FORECAST

Plan Year Ending	MVA BOY	Administrative Expenses	Net 3(8)(c) Payments	Benefit Payments	Employee Contributions	Employer Contributions	Investment Returns	MVA EOY	Net Change in Plan Assets
2018	$351,179,411	$322,244	$250,000	$43,717,826	$9,714,468	$28,308,728	$25,212,589	$370,125,126	$18,945,715
2019	370,125,126	331,106	256,875	45,721,357	9,981,616	31,026,365	26,620,583	391,444,353	21,319,227
2020	391,444,353	340,211	263,939	47,789,220	10,256,110	34,004,897	28,208,017	415,520,006	24,075,654
2021	415,520,006	349,567	271,197	49,557,174	10,538,153	37,269,367	30,016,770	443,166,358	27,646,352
2022	443,166,358	359,180	278,655	51,113,204	10,827,953	40,847,226	32,103,689	475,194,186	32,027,828
2023	475,194,186	369,057	286,318	52,490,393	11,125,721	44,768,559	34,527,455	512,470,153	37,275,967
2024	512,470,153	379,207	294,192	53,688,855	11,431,679	49,066,341	37,352,097	555,958,016	43,487,863
2025	555,958,016	389,635	302,282	54,761,106	11,746,050	53,776,710	40,646,902	606,674,655	50,716,639
2026	606,674,655	400,350	310,595	55,816,192	12,069,066	58,939,274	44,483,084	665,638,942	58,964,288
2027	665,638,942	411,359	319,137	56,826,452	12,400,965	64,597,444	48,937,096	734,017,500	68,378,558
2028	734,017,500	422,672	327,913	57,734,652	12,741,992	70,798,799	54,097,324	813,170,379	79,152,878
2029	813,170,379	434,295	336,930	58,618,757	13,092,397	70,517,536	59,804,869	897,195,198	84,024,819
2030	897,195,198	446,238	346,196	59,377,615	13,452,438	7,246,993	63,587,116	921,311,695	24,116,497
2031	921,311,695	458,510	355,716	60,019,699	13,822,380	7,477,349	65,332,468	947,109,966	25,798,271
2032	947,109,966	471,119	365,499	60,570,897	14,202,495	7,714,942	67,203,630	974,823,518	27,713,553
2033	974,823,518	484,075	375,550	61,078,133	14,593,064	7,959,996	69,215,848	1,004,654,670	29,831,151
2034	1,004,654,670	497,387	385,877	61,454,602	14,994,373	8,212,746	71,386,956	1,036,910,878	32,256,208
2035	1,036,910,878	511,065	396,489	61,816,925	15,406,718	8,473,430	73,735,033	1,071,801,580	34,890,702
2036	1,071,801,580	525,119	407,392	62,163,315	15,830,403	8,742,292	76,275,348	1,109,553,796	37,752,217
2037	1,109,553,796	539,560	418,596	62,358,371	16,265,739	9,019,591	79,029,286	1,150,551,887	40,998,090
2038	1,150,551,887	554,398	430,107	62,535,405	16,713,047	9,305,586	82,019,902	1,195,070,512	44,518,626
2039	1,195,070,512	569,644	441,935	62,754,390	17,172,656	9,600,549	85,264,955	1,243,342,703	48,272,190
2040	1,243,342,703	585,309	454,088	62,916,781	17,644,904	9,904,757	88,784,932	1,295,721,117	52,378,414
2041	1,295,721,117	601,405	466,576	63,095,004	18,130,139	10,218,498	92,602,797	1,352,509,565	56,788,448
2042	1,352,509,565	617,944	479,407	63,242,099	18,628,717	10,542,067	96,742,300	1,414,083,201	61,573,636

Plan Year Ending	MVA BOY	Administrative Expenses	Net 3(8)(c) Payments	Benefit Payments	Employee Contributions	Employer Contributions	Investment Returns	MVA EOY	Net Change in Plan Assets
2043	1,414,083,201	634,937	492,590	63,294,851	19,141,007	10,875,772	101,232,956	1,480,910,558	66,827,357
2044	1,480,910,558	652,398	506,136	63,219,189	19,667,385	11,219,925	106,109,991	1,553,530,136	72,619,578
2045	1,553,530,136	670,339	520,055	63,106,345	20,208,238	11,574,851	111,409,163	1,632,425,650	78,895,514
2046	1,632,425,650	688,773	534,357	63,010,768	20,763,964	11,940,885	117,163,593	1,718,060,194	85,634,545
2047	1,718,060,194	707,714	549,052	62,873,225	21,334,974	12,318,370	123,409,028	1,810,992,575	92,932,381

Notes: Projected benefit payments are based on a closed group projection and do not include return of employee money for inactive non-vested participants.
Employee contributions, administrative expenses and net 3(8)(c) payments are projected to increase at 2.75% inflation assumption.
Employer contributions are as shown in on page 29.

EXHIBIT G – DEFINITIONS OF PENSION TERMS

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

Actuarial Accrued Liability for Actives:	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial Accrued Liability for Pensioners and Beneficiaries:	The single-sum value of lifetime benefits to existing pensioners and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the actuarially determined contribution.
Actuarial Gain or Loss:	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. Through the actuarial assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield in actuarial liabilities that are larger than projected. Actuarial gains will shorten the time required for funding of the actuarial balance sheet deficiency while actuarial losses will lengthen the funding period.
Actuarially Equivalent:	Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and Discounted according to an assumed rate (or rates) of return to reflect the time value of money.
Actuarial Present Value of Future Plan Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.

Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for compliance with GASB, such as the Actuarially Determined Contribution (ADC) and the Net Pension Liability (NPL).
Actuarial Value of Assets (AVA):	The value of the Fund's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ADC.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.
Actuarially Determined Contribution (ADC):	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Fund is calculated, including: Investment return - the rate of investment yield that the Fund will earn over the long-term future; Mortality rates - the death rates of employees and pensioners; life expectancy is based on these rates; Retirement rates - the rate or probability of retirement at a given age or service; Disability rates – the probability of disability retirement at a given age; Withdrawal rates - the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; Salary increase rates - the rates of salary increase due to inflation and productivity growth.
Closed Amortization Period:	A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or withdrawal.

Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula applied to the member's compensation and/or years of service.
Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Fund that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the Actuary.
Funded Ratio:	The ratio of the actuarial value of assets (AVA) to the actuarial accrued liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than the AVA.
GASB 67 and GASB 68:	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment Return:	The rate of earnings of the Fund 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.
Net Pension Liability (NPL):	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal Cost:	That portion of the Actuarial Present Value of pension plan benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment in respect of an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of employee contributions and employer Normal Cost unless otherwise specifically stated.
Open Amortization Period:	An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period with level percentage of payroll is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never decrease, but will become smaller each year, in relation to covered payroll, if the actuarial assumptions are realized.
Plan Fiduciary Net Position:	Market value of assets.

Total Pension Liability (TPL):	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.
Unfunded Actuarial Accrued Liability:	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.

Section 4: Actuarial Valuation Basis

EXHIBIT I – ACTUARIAL ASSUMPTIONS AND ACTUARIAL COST METHOD

Net Investment Return:

Funding: 7.25% (previously, 7.50%), net of investment expenses.

GASB 67/68: 7.25% (previously, 7.35%) as set by the City of Newton and its auditors.

The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the Plan's target asset allocation.

Salary Increases:

Years of Service	Groups 1 and 2	Group 4
0	7.00%	8.00%
1	6.50%	7.50%
2	6.00%	7.00%
3	5.50%	6.50%
4	5.25%	6.00%
5	5.00%	5.50%
6	4.75%	5.25%
7	4.50%	5.00%
8	4.25%	4.75%
9	4.00%	4.50%
10	3.75%	4.25%
11+	3.50%	4.00%

Previously, 3.50%.

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

Mortality Rates:

Pre-Retirement: RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Employee Mortality Table projected generationally from 2005 with Scale BB)

Healthy Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2005 with Scale BB)

Disabled Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB)

The mortality tables reasonably reflect the projected mortality experience of the Plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior year's assumptions over the four most recent valuations. The mortality tables were then adjusted to future years using generational projection under Scale MP-2017 to reflect future mortality improvement.

Termination Rates before Retirement:

	Groups 1 and 2 - Rate (%)				
	Mortality				
	Current		Previous		
Age	Male	Female	Male	Female	Disability
20	0.05	0.02	0.03	0.02	0.01
25	0.06	0.02	0.04	0.02	0.02
30	0.06	0.02	0.04	0.03	0.03
35	0.07	0.03	0.08	0.05	0.06
40	0.08	0.04	0.11	0.07	0.10
45	0.13	0.07	0.15	0.11	0.15
50	0.22	0.12	0.21	0.17	0.19
55	0.36	0.19	0.30	0.25	0.24
60	0.61	0.27	0.49	0.39	0.28

Notes: Mortality rates do not reflect generational projection.
70% of the disability rates shown represent accidental disability.
20% of the accidental disabilities will die from the same cause as the disability.
70% of the death rates shown represent accidental death.

Age	Group 4 - Rate (%)				
	Mortality				
	Current		Previous		
	Male	Female	Male	Female	Disability
20	0.05	0.02	0.03	0.02	0.10
25	0.06	0.02	0.04	0.02	0.20
30	0.06	0.02	0.04	0.03	0.30
35	0.07	0.03	0.08	0.05	0.30
40	0.08	0.04	0.11	0.07	0.30
45	0.13	0.07	0.15	0.11	1.00
50	0.22	0.12	0.21	0.17	1.25
55	0.36	0.19	0.30	0.25	1.20
60	0.61	0.27	0.49	0.39	0.85

Notes: Mortality rates do not reflect generational projection.
90% of the disability rates shown represent accidental disability.
60% of the accidental disabilities will die from the same cause as the disability.
90% of the death rates shown represent accidental death.

Withdrawal Rates:

Rate per year (%)			
Years of Service	Groups 1 and 2	Years of Service	Group 4
0	15.0	0 – 10	1.5
1	12.0	11+	0.0
2	10.0		
3	9.0		
4	8.0		
5	7.6		
6	7.5		
7	6.7		
8	6.3		
9	5.9		
10	5.4		
11	5.0		
12	4.6		
13	4.1		
14	3.7		
15	3.3		
16 – 20	2.0		
21 – 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 year's assumptions over the four most recent valuations.

Retirement Rates:

Age	Rate per year (%)		
	Groups 1 and 2		
	Male	Female	Group 4
45 – 49	- -	- -	1.0
50 – 51	1.0	1.5	2.0
52	1.0	2.0	2.0
53	1.0	2.5	5.0
54	2.0	2.5	7.5
55	2.0	5.5	15.0
56 – 57	2.5	6.5	10.0
58	5.0	6.5	10.0
59	6.5	6.5	15.0
60	12.0	5.0	20.0
61	20.0	13.0	20.0
62	30.0	15.0	25.0
63	25.0	12.5	25.0
64	22.0	18.0	30.0
65	40.0	15.0	100.0
66 – 67	25.0	20.0	- -
68	30.0	25.0	- -
69	30.0	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 year's assumptions over the four most recent valuations.

Retirement Rates for Inactive Vested Participants:	55 for participants hired prior to April 2, 2012. For participants hired April 2, 2012 or later, 60 for Group 1, 55 for Group 2, and 50 for Group 4. The retirement age for inactive vested participants was based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment.
Unknown Data for Participants:	Same as those exhibited by participants with similar known characteristics.
Family Composition:	80% 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.
Interest on Employee Contributions:	3.5%
Administrative Expenses:	$322,244 for calendar 2018 based on budgeted expenses provided by the System, increasing 2.75% per year.
Total Service:	Total creditable service reported in the data
2017 Salaries:	2017 salaries are equal to salaries provided in the data, annualized for new hires. 2017 salaries were increased by 10.90% for police sergeants and school custodians to reflect unsettled bargaining contracts retroactive to July 1, 2014 and by 1.7% for NMEA Laborers to reflect unsettled bargaining contracts retroactive to July 1, 2017.
Net 3(8)(c) Liability:	$250,000 for calendar year 2018, increasing 2.75% per year.
Actuarial Value of Assets:	A preliminary actuarial value is first determined by taking the actuarial value of assets at the beginning of the year and adding assumed investment earnings (at the assumed actuarial rate of return) and the net new money during the year (contributions less benefit payments). Twenty-five percent of the difference between the market value of assets as reported in the System's Annual Statement and the preliminary actuarial value of assets is added to the preliminary actuarial value. In order that the actuarial value not differ too significantly from the market value of assets, the final actuarial value of assets must be within 20% of the market value of assets.
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the attained age of the participant minus total creditable service. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined using the plan of benefits applicable to each participant.

Justification for Change in Actuarial Assumptions:

Based on past experience and future expectations, the following actuarial assumption were changed as of January 1, 2018:

- The investment return assumption was lowered from 7.50% to 7.25%.
- The mortality assumption for non-disabled participants was updated from the RP-2000 Employee and Healthy Annuitant Mortality Tables projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Tables projected generationally with Scale MP-2017.
- The mortality assumption for disabled participants was updated from the RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017.
- The salary increase assumption was revised from 3.5% per year for all employees to the following service-based assumption:

Years of Service	Groups 1 and 2	Group 4
0	7.00%	8.00%
1	6.50%	7.50%
2	6.00%	7.00%
3	5.50%	6.50%
4	5.25%	6.00%
5	5.00%	5.50%
6	4.75%	5.25%
7	4.50%	5.00%
8	4.25%	4.75%
9	4.00%	4.50%
10	3.75%	4.25%
11+	3.50%	4.00%

- The 2018 budgeted administrative expenses of $322,244 were added to the normal cost in addition to the net (3)(8)(c) assumption of $250,000.

EXHIBIT II – SUMMARY OF PLAN PROVISIONS

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

Plan Year: January 1 through December 31

Plan Status: Ongoing

Retirement Benefits:

Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. (Officers and inspectors of the State Police are classified as Group 3.)

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

	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

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

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

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

Accidental Disability Benefit:	For a job-connected disability, the benefit is 72 percent of the member's most recent annual pay plus an annuity based on his or her own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.
Death Benefits:	In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of death, a spouse's benefit will be paid equal to the amount the employee would have received under Option C. The surviving spouse of a member who dies with two or more years of credited service has the option of a refund of the employee's contributions or a monthly benefit regardless of eligibility to retire, if they were married for at least one year. There is also a minimum widow's pension of $250 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 $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.
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 $12,000 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:	There have been no changes in plan provisions since the last valuation.

Section 5: GASB Information

EXHIBIT 1 – NET PENSION LIABILITY

	December 31, 2017	December 31, 2016
Components of the Net Pension Liability		
Total Pension Liability	$659,370,168	$635,859,393
Plan Fiduciary Net Position	351,179,411	305,870,392
Net Pension Liability	308,190,757	329,989,001
Plan Fiduciary Net Position as a percentage of the Total Pension Liability*	53.26%	48.10%

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

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

Inflation:	2.75% (previously, 2.50%)
Salary Increases:	Based on years of service, ranging from 7.00% decreasing to 3.50% after 11 years of service for Group 1 and 2 employees and ranging from 8.00% decreasing to 4.00% after 11 years for Group 4 employees.
Investment Rate of Return:	7.25% (previously, 7.35%), net of pension plan investment expense, including inflation
Cost of Living Adjustment:	3% of first $12,000
Mortality Rates:	
Pre-Retirement:	RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Employee Mortality Table projected generationally from 2005 with Scale BB)
Healthy Retiree:	RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table projected generationally from 2005 with Scale BB)
Disabled Retiree:	RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017 (previously, RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB)

Target Asset Allocation

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

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

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

Discount rate. The discount rates used to measure the Total Pension Liability (TPL) were 7.25% and 7.35% as of December 31, 2017 and December 31, 2016, respectively. The projection of cash flows used to determine the discount rate assumed plan member contributions will be made at the current contribution rate and that employer contributions will be made at rates equal to the actuarially determined contribution rates. For this purpose, only employer contributions that are intended to fund benefits for current plan members and their beneficiaries are included. Projected employer contributions that are intended to fund the service costs for future plan members and their beneficiaries, as well as projected contributions from future plan members, are not included. Based on those assumptions, the Plan Fiduciary Net Position (FNP) was projected to be available to make all projected future benefit payments for current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the TPL as of both December 31, 2017 and December 31, 2016.

Discount Rate Sensitivity

Sensitivity of the Net Pension Liability to changes in the discount rate. The following presents the Net Pension Liability (NPL) of the Newton Contributory Retirement System as of December 31, 2017, which is allocated to all employers, calculated using the discount rate of 7.25%, as well as what the Newton Contributory Retirement System's NPL would be if it were calculated using a discount rate that is 1-percentage-point lower (6.25%) or 1-percentage-point higher (8.25%) than the current rate.

Net Pension Liability	1% Decrease (6.25%)	Current Discount Rate (7.25%)	1% Increase (8.25%)
Newton Contributory Retirement System's net pension liability as of December 31, 2017	$379,990,045	$308,190,757	$247,568,417

EXHIBIT 2 – SCHEDULE OF CHANGES IN NET PENSION LIABILITY LAST TWO YEARS

	December 31, 2017	December 31, 2016
Total Pension Liability		
Service cost	$14,020,532	$12,238,508
Interest	46,282,670	44,357,326
Change of benefit terms	0	0
Differences between expected and actual experience	-3,594,215	6,942,661
Changes of assumptions	7,169,261	0
Benefit payments, including refunds of member contributions	-40,367,473	-37,883,262
Net change in Total Pension Liability	$23,510,775	$25,655,233
Total Pension Liability – beginning	635,859,393	610,204,160
Total Pension Liability – ending	$659,370,168	$635,859,393
Plan Fiduciary Net Position		
Contributions – employer	$25,829,131	$23,566,725
Contributions – employee	9,457,254	9,282,992
Net investment income	50,390,107	20,972,368
Benefit payments, including refunds of member contributions	-40,367,473	-37,883,262
Net change in Plan Fiduciary Net Position	$45,309,019	$15,938,823
Plan Fiduciary Net Position – beginning	305,870,392	289,931,569
Plan Fiduciary Net Position – ending	$351,179,411	$305,870,392
Net Pension Liability – ending	$308,190,757	$329,989,001
Plan Fiduciary Net Position as a percentage of the Total Pension Liability	53.26%	48.10%
Covered employee payroll[1]	$96,567,809	$94,881,278
Plan Net Pension Liability as percentage of covered employee payroll	319.14%	347.79%

[1] Covered employee payroll for 2017 and 2016 as estimated in each year's January 1 funding valuation report.

Notes to Schedule:

Changes in Assumptions:

Effective January 1, 2017:

- An allowance of $250,000, increasing 2.50% per year for net 3(8)(c) reimbursements, was added.
- An allowance for administrative expenses of $317,750, increasing 2.50% per year, was added to the appropriation beginning in fiscal year 2019.

Effective January 1, 2018:

- The investment return assumption was lowered from 7.50% to 7.25%.
- The mortality assumption for non-disabled participants was updated from the RP-2000 Employee and Healthy Annuitant Mortality Table projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Employee and Healthy Annuitant Mortality Table projected generationally with Scale MP-2017.
- The mortality assumption for disabled participants was updated from the RP-2000 Healthy Annuitant Mortality Table set forward three years projected generationally from 2005 with Scale BB to the RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017.
- The salary increase assumption was revised from 3.5% per year for all employees to the following service-based assumption:

Years of Service	Groups 1 and 2	Group 4
0	7.00%	8.00%
1	6.50%	7.50%
2	6.00%	7.00%
3	5.50%	6.50%
4	5.25%	6.00%
5	5.00%	5.50%
6	4.75%	5.25%
7	4.50%	5.00%
8	4.25%	4.75%
9	4.00%	4.50%
10	3.75%	4.25%
11+	3.50%	4.00%

- The 2018 budgeted administrative expenses of $322,244 were added to the normal cost in addition to the net (3)(8)(c) assumption of $250,000.

Changes in Plan Provisions

None.

EXHIBIT 3 – SCHEDULE OF EMPLOYER CONTRIBUTIONS LAST FOUR FISCAL YEARS

Year Ended December 31	Actuarially Determined Contributions	Contributions in Relation to the Actuarially Determined Contributions	Contribution Deficiency / (Excess)	Covered-Employee Payroll	Contributions as a Percentage of Covered Employee Payroll
2014	$19,972,859	$20,040,932	-$68,073	$86,807,549	23.09%
2015	21,670,552	21,670,552	- -	92,136,867	23.52%
2016	23,566,725	23,566,725	- -	94,881,278	24.84%
2017	25,829,131	25,829,131	- -	96,567,809	26.75%

Notes: Based on the results of the actuarial valuation as of the prior January 1 (including assumptions and methods) which determined budgeted appropriation for the following fiscal year.
Actuarially determined contributions exclude expense assumption and contributions exclude appropriation for expenses.

EXHIBIT 4 – PENSION EXPENSE

Reporting Date for Employer under GASB 68	June 30, 2018	June 30, 2017
Components of Pension Expense		
Service cost	$14,020,532	$12,238,508
Interest on the Total Pension Liability	46,282,670	44,357,326
Expensed portion of current-period difference between expected and actual experience in the Total Pension Liability	-718,843	1,388,532
Expensed portion of current-period changes of assumptions	1,433,852	- -
Member contributions	-9,457,254	-9,282,992
Projected earnings on plan investments	-21,991,414	-21,124,988
Expensed portion of current-period differences between actual and projected earnings on plan investments	-5,679,739	30,524
Recognition of beginning of year deferred outflows of resources as pension expense	11,008,681	9,589,625
Recognition of beginning of year deferred inflows of resources as pension expense	-798,446	-798,446
Pension Expense	**$34,100,039**	**$36,398,089**

Deferred Outflows of Resources and Deferred Inflows of Resources

Deferred Outflows of Resources		
Changes in proportion and differences between employer's contributions and proportionate share of contributions[1]	$48,317	$15,608
Changes of assumptions	10,924,104	10,377,392
Net difference between projected and actual earnings on pension plan investments	0	11,829,978
Difference between expected and actual experience in the Total Pension Liability	4,635,672	6,494,278
Total Deferred Outflows of Resources	$15,608,093	$28,717,256
Deferred Inflows of Resources		
Changes in proportion and differences between employer's contributions and proportionate share of contributions[1]	$48,317	$15,608
Net difference between projected and actual earnings on pension plan investments	14,850,355	0
Difference between expected and actual experience in the Total Pension Liability	4,472,263	2,395,337
Total Deferred Inflows of Resources	$19,370,935	$2,410,945
Deferred outflows of resources and deferred inflows of resources related to pension will be recognized as follows:		
Reporting Date for Employer under GASB 68 Year Ended June 30:		
2018	N/A	$10,210,235
2019	$5,245,502	10,210,232
2020	-497,942	4,466,787
2021	-3,545,672	1,419,057
2022	-4,964,730	0
Thereafter	0	0

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

EXHIBIT 5 – DETERMINATION OF PROPORTIONATE SHARE

Employer Name	FY 2017 Total Appropriation	Percent of FY 2017 Total Appropriation	Share of NPL as of January 1, 2017	FY 2018 Total Appropriation	Percent of FY 2018 Total Appropriation	Share of NPL as of January 1, 2018
City of Newton	$23,329,608	98.993848%	$326,668,810	$25,573,143	99.008917%	$30,136,331
Newton Housing Authority	237,117	1.006152%	3,320,191	255,988	0.991083%	3,054,425
Grand Totals:	$23,566,725	100.0000%	$329,989,001	$25,829,131	100.0000%	$308,190,757

EXHIBIT 6 – DETERMINATION OF PROPORTIONATE SHARE

Employer Name	2018 Share of Cost Allocator (1)	Net Pension Liability (2)	Covered Employee Payroll (3)	Discount Rate Sensitivity		
				1% Decrease (6.25%) (4)	Current Discount Rate (7.25%) (5)	1% Increase (8.25%) (6)
City of Newton	99.0089%	$305,136,331	$95,190,276	$376,224,030	$305,136,331	$245,114,810
Newton Housing Authority	0.9911%	3,054,425	1,377,533	3,766,015	3,054,425	2,453,607
Grand Totals:	100.0000%	$308,190,756	$96,567,809	$379,990,045	$308,190,756	$247,568,417

Employer Name	Schedule of Contributions				Pension Expense		
	Statutory Required Contribution (7)	Contributions In Relation to the Statutory Required Contribution (8)	Contribution Deficiency/ (Excess) (9)	Contributions as a Percentage of Covered Employee Payroll (10)	Proportionate Share of Plan Pension Expense (11)	Net Amortization of Deferred Amounts from Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (12)	Total Employer Pension Expense (13)
City of Newton	$25,573,143	$25,573,143	$0	26.87%	$33,762,079	$5,251	$33,767,330
Newton Housing Authority	255,988	255,988	0	18.58%	337,960	-5,251	332,709
Grand Totals:	$25,829,131	$25,829,131	$0	26.75%	$34,100,039	$0	$34,100,039

Employer Name	Deferred Outflows of Resources					Deferred Inflows of Resources				
	Differences Between Expected and Actual Experience (14)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (15)	Changes of Assumptions (16)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (17)	Total Deferred Outflows of Resources (18)	Differences Between Expected and Actual Experience (19)	Net Difference Between Projected and Actual Investment Earnings on Pension Plan Investments (20)	Changes of Assumptions (21)	Changes in Proportion and Differences Between Employer Contributions and Proportionate Share of Contributions (22)	Total Deferred Inflows of Resources (23)
City of Newton	$4,589,729	$0	$10,815,837	$36,611	$15,442,177	$4,427,939	$14,703,176	$0	$11,706	$19,142,821
Newton Housing Authority	45,943	0	108,267	11,706	165,916	44,324	147,179	0	36,611	228,114
Grand Totals:	$4,635,672	$0	$10,924,104	$48,317	$15,608,093	$4,472,263	$14,850,355	$0	$48,317	$19,370,935

Employer Name	Deferred Inflows/(Outflows) Recognized In Future Pension Expense (Year Ended January 1)					
	2019 (24)	2020 (25)	2021 (26)	2022 (27)	2023 (28)	Thereafter (29)
City of Newton	$5,198,766	-$487,756	-$3,505,280	-$4,906,372	$0	$0
Newton Housing Authority	46,736	-10,186	-40,392	-58,358	0	0
Grand Totals:	$5,245,502	-$497,942	-$3,545,672	-$4,964,730	$0	$0

EXHIBIT 7 – NOTES TO REQUIRED SUPPLEMENTARY INFORMATION

Valuation date:	Actuarial determined contribution for fiscal 2018 is determined with the January 1, 2016 actuarial valuation.
Actuarial cost method:	Entry Age Normal Cost Method
Amortization method:	Total payments increase at 9.60% per year
Remaining amortization period:	13 years from July 1, 2016
Asset valuation method:	Sum of actuarial value at beginning of the year, contributions and investment earnings based on the actuarial interest assumption less benefit payments plus 25% of the market value at the end of the year in excess of that sum, plus additional adjustment toward market value as necessary so that final actuarial value is within 20% of market value.
Actuarial assumptions:	
• Investment rate of return	7.65% (funding)
• Discount rate	7.65% (funding)
• Inflation rate	2.5% for 2016 and later years
• Projected salary increases	3.5% for 2016 and later years.
• Cost of living adjustments	3% of first $12,000
Plan membership:	
• Retired participants and beneficiaries receiving benefits	1,305
• Inactive participants entitled to a return of their employee contributions	586
• Inactive participants with a vested right to a deferred or immediate benefit	36
• Active participants	1,732
• Total	3,659

APPENDIX A – GLOSSARY OF TERMS

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

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

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

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

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

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