Segal Consulting

Massachusetts Water Resources Authority

Actuarial Valuation and Review of Other Postemployment Benefits (OPEB) as of December 31, 2017

Segal Consulting

116 Huntington Ave., 8th Floor Boston, MA 02116-5744
T 617.424.7300 www.segalco.com

April 24, 2018

Mr. Robert Belkin
Massachusetts Water Resources Authority
100 First Avenue, Building 39
Charlestown Navy Yard
Boston, MA 02129

Dear Mr. Belkin:

We are pleased to submit this report on our actuarial valuation of postemployment welfare benefits as of December 31, 2017. The purpose of this report is to calculate an Actuarially Determined Contribution for the Massachusetts Water Resources Authority Other Postemployment Benefit (OPEB) plan for the fiscal year ending June 30, 2018. It summarizes the actuarial data used in the valuation and analyzes the experience and changes in assumptions since the prior valuation. The GASB Statements Number 74 and 75 disclosure information for the fiscal year ending June 30, 2018 will be provided in a separate report.

This report is based on information received from the Massachusetts Water Resources Authority and vendors employed by the Massachusetts Water Resources Authority. Segal Consulting does not audit the data provided. The accuracy and comprehensiveness of the data is the responsibility of those supplying the data. Segal, however, does review the data for reasonableness and consistency.

The measurements shown in this actuarial valuation may not be applicable for other purposes. Accordingly, additional determinations may be needed for other purposes, such as judging benefit security at termination of the plan, or determining short-term cash flow requirements.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: retiree group benefits program experience or rates of return on assets differing from that anticipated by the assumptions; changes in assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period); and changes in retiree group benefits program provisions or applicable law. Retiree group benefits models necessarily rely on the use of approximations and estimates, and are sensitive to changes in these approximations and estimates. Small variations in these approximations and estimates may lead to significant changes in actuarial measurements. An actuarial valuation is a measurement at a specific date – it is not a prediction of a plan's future financial condition. We have not been retained to perform an analysis of the potential range of financial measurements, except where otherwise noted.

The actuarial valuation has been completed in accordance with generally accepted actuarial principles and practices. The actuarial calculations were directed under our supervision. We are members of the American Academy of Actuaries and collectively meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of our knowledge, the information supplied in the actuarial valuation is complete and accurate. Further, in our opinion, the assumptions are reasonably related to the experience of and the expectations for the Plan.

We look forward to discussing this with you at your convenience.

Sincerely,

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

By:

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

Daniel J. Rhodes, FSA, MAAA
Vice President and Consulting Actuary

8694002v4/14860.001

Table of Contents

Massachusetts Water Resources Authority Actuarial Valuation and Review of Other Postemployment Benefits (OPEB) as of December 31, 2017

Section 1: Executive Summary

Important Information about Actuarial Valuations

An actuarial valuation is an estimate of future uncertain obligations of a postretirement benefits plan. As such, it will never forecast the precise future stream of benefit payments. It is an estimated forecast – the actual cost of the plan will be determined by the benefits and expenses paid, not by the actuarial valuation.

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. For example, a plan may provide health benefits to post-65 retirees that coordinate with Medicare. If so, changes in the Medicare law or administration may change the plan's costs without any change in the terms of the plan itself. It is important for the Massachusetts Water Resources Authority 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 plan. 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 not necessary to have perfect data for an actuarial valuation: the valuation is an estimated forecast, not a prediction. The uncertainties in other factors are such that even perfect data does not produce a "perfect" result. Notwithstanding the above, it is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets	Part of the cost of a plan will be paid from existing assets – the balance will need to come from future contributions and investment income. The valuation is based on the asset values as of the valuation date, provided by the Massachusetts Water Resources Authority. Some plans include assets, such as private equity holdings, real estate, or hedge funds, that are not subject to valuation by reference to transactions in the marketplace. A snapshot as of a single date may not be an appropriate value for determining a single year's contribution requirement, especially in volatile markets. Plan sponsors often use an "actuarial value of assets" that differs from market value to reflect gradually year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial Assumptions	In preparing an actuarial valuation, Segal starts by developing a forecast of the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. To determine the future costs of benefits, Segal collects claims, premiums, and enrollment data in order to establish a baseline cost for the valuation measurement, and then develops short- and long-term health care cost trend rates to project increases in costs in future years. This forecast also requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year, as well as forecasts of the plan's benefits for each of those events. In a funding valuation, the forecasted benefits are then discounted to a present value using the expected rate of return that will be achieved on the plan's assets. All of these factors are uncertain and unknowable. Thus, there will be a range of reasonable assumptions, and the results may vary materially based on which assumptions the actuary selects within that range. That is, there is no right answer (except with hindsight). It is important for any user of an actuarial valuation to understand and accept this constraint. The actuarial model necessarily uses approximations and estimates that may lead to significant changes in our results but will have no impact on the actual cost of the plan. In addition, the actuarial assumptions may change over time, and while this can have a significant impact on the reported results, it does not mean that the previous assumptions or results were unreasonable or wrong.

Given the above, the user of Segal's actuarial valuation (or other actuarial calculations) needs to keep the following in mind:

- The actuarial valuation is prepared for use by the Massachusetts Water Resources Authority. It includes information for compliance with accounting standards. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- If the Massachusetts Water Resources Authority 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.
- An actuarial valuation is a measurement at a specific date — it is not a prediction of a plan's future financial condition. Accordingly, Segal did not perform an analysis of the potential range of financial measurements, except where otherwise noted. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.
- Sections of this report may include actuarial results that are not rounded, but that does not imply precision.
- Critical events for a plan include, but are not limited to, decisions about changes in benefits and contributions. The basis for such decisions needs to consider many factors such as the risk of changes in plan enrollment, emerging claims experience and health care cost trend, and investment losses, not just the current valuation results.
- 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 Massachusetts Water Resources Authority should look to their other advisors for expertise in these areas.
- While Segal maintains extensive quality assurance procedures, an actuarial valuation involves complex computer models and numerous inputs. In the event that an inaccuracy is discovered after presentation of Segal's valuation, Segal may revise that valuation or make an appropriate adjustment in the next valuation.
- Segal's report shall be deemed to be final and accepted by the Massachusetts Water Resources Authority upon delivery and review. The Massachusetts Water Resources Authority should notify Segal immediately of any questions or concerns about the final content.

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

Purpose

This report presents the results of our actuarial valuation of the Massachusetts Water Resources Authority postemployment welfare benefit plan as of December 31, 2017. The purpose of this report is to calculate a recommended Actuarially Determined Contribution for the OPEB plan for the fiscal year ending June 30, 2018.

Highlights of the Valuation

- The unfunded actuarial accrued liability (UAAL) as of December 31, 2017 is $121,959,000 based on an actuarial accrued liability (AAL) of $146,339,000, an actuarial value of assets of $24,380,000. Going forward, net unfunded plan obligations will be expected to change due to normal plan operations, which consist of continuing accruals for active members, plus interest on the unfunded actuarial accrued liability, less employer contributions. Future valuations will analyze the difference between actual and expected unfunded actuarial accrued liabilities.
- As of December 31, 2017 the ratio of assets to the AAL (the funded ratio) is 16.66%. This funded percentage is not necessarily appropriate for assessing the sufficiency of OPEB assets to cover the estimated cost of settling the benefit obligations or the need for or the amount of future contributions.
- This is the first valuation of the Massachusetts Water Resources Authority postemployment welfare benefit plan completed by Segal Consulting. The prior valuation as of December 31, 2015 was completed by Stone Consulting, Inc.
- The discount rate used to determine the Actuarially Determined Contribution is the expected return on assets. Based on the investment of the OPEB Trust assets in the State Retiree Benefits Trust Fund, we recommend an expected return on assets of 7.0%. The prior valuation report used a partially funded discount rate of 7.0% determined in accordance with GASB Statements No. 43 and 45 based on an expected return on assets of 7.5% and a pay-as-you-go rate of 4.0%.
- The retirement rates used in this valuation were changed to match those used in the most recent actuarial valuation of the Massachusetts Water Resources Authority Employees' Retirement System and the mortality assumptions used were changed from the RP-2014 Mortality Tables based on combined blue collar and white collar experience to the RP-2014 Mortality Tables based on blue collar experience. In addition, the projection scale was updated from the MP-2016 Scale to the MP-2017 Scale. These changes lowered the liabilities.
- In the prior valuation, 80% of current active employees were assumed to elect retiree medical coverage. With this valuation, we have included only active employees with coverage and have assumed that 100% of these employees will elect retiree medical coverage.

- The UAAL of $121,959,000 as of December 31, 2017 represents a decrease of $2,043,000 from $124,002,000 as of December 31, 2016 as shown in the prior valuation report. The unfunded liability had been expected to increase $3,716,000 due to normal plan operations. The difference between the actual decrease and expected increase was the net effect of the following:
  - An actuarial experience gain due to changes in demographics, asset gains or losses, and changes in per capita costs, including differences in methodology, decreased obligations by $2,287,000.
  - Valuation assumption changes decreased obligations by $3,472,000. This was the net result of a decrease in obligations due to 1) changing the future trend on per capita health care costs and 2) updating the retirement and mortality assumptions, partially offset by an increase in obligations due to 3) using the Entry Age Normal methodology to value liabilities and 4) updating the enrollment assumptions. The complete set of assumptions is shown in Exhibit II.
- The Actuarially Determined Contribution (ADC) for fiscal year 2018 is $11,340,000. The ADC is calculated using a 30-year amortization of the UAAL, with payments increasing at 3.0% per year.
- A summary of the valuation results for the current and prior valuation are shown on page 11.

OPEB Trust Information

As of December 31, 2017, the Massachusetts Water Resources Authority has $24,379,552 in assets. The table below shows the increase in assets from December 31, 2016 to December 31, 2017.

Reconciliation of OPEB Balance from December 31, 2016 to December 31, 2017	
Balance as of December 31, 2016	$16,500,074
• Fiscal year 2017 OPEB contributions	4,876,050
• Net investment income	3,003,428
Balance as of December 31, 2017	$24,379,552

Notes: Balance as of December 31, 2016 does not match prior report.
Balances, contributions and net investment income based on Cash Account and State Retiree Benefits Trust Balance information provided by the Massachusetts Water Resources Authority.

Summary of Funding Schedules

This report includes two funding schedules for the Massachusetts Water Resources Authority. Both schedules are based on the 7.0% discount rate with one schedule (Funding Schedule 1) using a 30-year open amortization and one schedule (Funding Schedule 2) using a 30-year closed amortization. In both schedules, the employer contribution to the OPEB Trust is equal to 50% of the Actuarially Determined Contribution. With open amortization (Funding Schedule 1), the MWRA will pay projected benefits plus a contribution to the OPEB Trust through 2037. In fiscal 2038, a larger payment to the OPEB Trust will be made, at which point all benefit payments will be made from the Trust. The contribution to the OPEB Trust in fiscal 2039 will be the employer normal cost payment. With closed amortization (Funding Schedule 2), the MWRA will pay projected benefits plus a contribution to the OPEB Trust through 2036. In fiscal 2037, a larger payment to the OPEB Trust will be made, at which point all benefit payments will be made from the Trust. The contribution to the OPEB Trust in fiscal 2038 will be the employer normal cost payment. The open schedule is fully funded in 2038. The closed schedule is fully funded in 2037.

Other Considerations

This valuation does not include the potential impact of any future changes due to the Patient Protection and Affordable Care Act (PPACA) and the Health Care and Education Reconciliation Act (HCERA) of 2010 other than the excise tax on high cost health plans beginning in 2022 (reflected in this valuation) and those previously adopted as of the valuation date.

Employer decisions regarding plan design, cost sharing between the Employer and its retirees, actuarial cost method, amortization techniques, and integration with Medicare are just some of the decisions that affect the magnitude of OPEB obligations. We are available to assist you with any investigation of such options you may wish to undertake.

Calculations are based on the benefits provided under the terms of the substantive plan in effect at the time of the valuation and on the pattern of sharing costs between the employer and plan members. The projection of benefits does not incorporate the potential effect of legal or contractual funding limitations on the pattern of cost sharing between the employer and plan members in the future.

Actuarial calculations reflect a long-term perspective, and the methods and assumptions use techniques designed to reduce short-term volatility in accrued liabilities and the actuarial value of assets, if any.

The calculation of an accounting obligation does not, in and of itself, imply that there is any legal liability to provide the benefits valued, nor is there any implication that the Employer is required to implement a funding policy to satisfy the projected expense.

Actuarial valuations involve estimates of the value of reported amounts and assumptions about the probability of events far into the future, and the actuarially determined amounts are subject to continual revision as actual results are compared to past expectations and new estimates are made about the future.

Section 2: Valuation Results

Summary of Valuation Results – 7.0% Discount Rate

	December 31, 2017	December 31, 2016[1]
Actuarial Accrued Liability (AAL) by Participant Category		
1. Current retirees, beneficiaries and dependents	$53,020,834	$60,973,346
2. Current active employees	87,531,841	79,684,480
3. Current vested terminated employees	5,786,162	N/A[2]
4. Total AAL: (1) + (2) + (3)	$146,338,837	$140,657,826
5. Actuarial value of assets	24,379,552	16,656,000
6. Unfunded actuarial accrued liability (UAAL): (4) - (5)	$121,959,285	$124,001,826
7. Funded ratio: (5) / (4)	16.66%	11.84%
Actuarially Determined Contribution for fiscal year ending	**June 30, 2018**	**June 30, 2017**
8. Normal cost, including adjustment for interest	$4,475,732	$4,142,351
9. Amortization method for UAAL	30-year closed, increasing at 3.0% per year	30-year closed, increasing at 3.0% per year
10. Amortization payment on UAAL, including adjustment for interest	$6,923,858	$6,805,648
11. Total Actuarially Determined Contribution: (8) + (10)	$11,399,590	$10,947,999
12. Projected benefit payments	4,467,865	4,114,962

Note: Fiscal 2018 assumes payment at the end of the fiscal year and fiscal 2017 assumes payment in the middle of the year.

1 Figures provided by the prior actuary, based on a January 1, 2016 valuation projected to December 31, 2016.
2 Included in row 1.

Funding Schedules

Funding Schedule 1 - 7.0% Discount Rate, Fully Funded in 2038, 30 Year Open Amortization

Fiscal Year Ending June 30	(1) Normal Cost	(2) Amortization of UAAL	(3) Total Funding Requirement	(4) Projected Benefit Payments paid by MWRA	(5) Contributions to OPEB Trust	(6) Total Cost to MWRA: (4) + (5)	(7) Assets at Mid-Year	(8) AAL at Mid-Year	(9) UAAL at Mid-Year: (8) - (7)
2018	$4,475,732	$6,923,858	$11,399,590	$4,467,865	$5,699,795	$10,167,660	$24,379,552	$146,338,837	$121,959,285
2019	4,616,918	7,064,177	11,681,095	5,082,336	5,840,547	10,922,883	31,982,034	156,412,939	124,430,905
2020	4,762,559	7,162,356	11,924,915	5,955,915	5,962,457	11,918,372	40,262,286	166,422,554	126,160,268
2021	4,912,794	7,218,186	12,130,980	6,820,204	6,065,490	12,885,694	49,248,260	176,391,938	127,143,678
2022	5,067,768	7,229,800	12,297,568	7,706,618	6,148,784	13,855,402	58,969,830	186,318,084	127,348,254
2023	5,227,631	7,193,223	12,420,854	8,619,666	6,210,427	14,830,092	69,458,070	196,162,039	126,703,969
2024	5,392,537	7,105,829	12,498,366	9,516,275	6,249,183	15,765,458	80,744,250	205,908,834	125,164,584
2025	5,562,645	6,968,443	12,531,088	10,340,613	6,265,544	16,606,157	92,860,553	215,605,165	122,744,612
2026	5,738,119	6,784,932	12,523,051	11,134,841	6,261,526	17,396,367	105,841,921	225,354,116	119,512,195
2027	5,919,128	6,551,370	12,470,498	11,901,964	6,235,249	18,137,213	119,727,828	235,125,978	115,398,150
2028	6,105,847	6,271,279	12,377,126	12,624,195	6,188,563	18,812,758	134,558,568	245,023,098	110,464,530
2029	6,298,456	5,942,815	12,241,271	13,310,474	6,120,635	19,431,109	150,379,167	255,058,007	104,678,840
2030	6,497,141	5,568,528	12,065,669	13,975,997	6,032,835	20,008,832	167,236,943	265,322,964	98,086,021
2031	6,702,093	5,144,829	11,846,922	14,674,797	5,923,461	20,598,258	185,183,942	275,806,775	90,622,833
2032	6,913,511	4,667,891	11,581,402	15,408,537	5,790,701	21,199,238	204,274,094	286,495,983	82,221,889
2033	7,131,598	4,133,640	11,265,238	16,178,964	5,632,619	21,811,583	224,563,228	297,374,629	72,811,401
2034	7,356,564	3,537,735	10,894,299	16,987,912	5,447,150	22,435,062	246,109,081	308,423,998	62,314,917
2035	7,588,627	2,875,555	10,464,182	17,837,308	5,232,091	23,069,399	268,971,292	319,622,338	50,651,046
2036	7,828,010	2,142,182	9,970,192	18,729,173	4,985,096	23,714,269	293,211,400	330,944,558	37,733,158
2037	8,074,945	1,332,384	9,407,329	19,665,632	4,703,664	24,369,296	318,892,822	342,361,899	23,469,077
2038	8,329,669	440,592	8,770,261	0	16,357,452	16,357,452	346,080,828	353,841,579	7,760,751
2039	8,592,428	0	8,592,428	0	8,592,428	8,592,428	365,346,403	365,346,403	0

Notes: Assumes payment at the end of the fiscal year.

Normal cost is projected to increase 3.0% per year for inflation and 0.15% per year for mortality improvement and does not reflect the future impact of pension reform for new hires.

Assets are assumed to return 7.0% per year.

Funding Schedule 2 - 7.0% Discount Rate, Fully Funded in 2037, 30 Year Closed Amortization

Fiscal Year Ending June 30	(1) Normal Cost	(2) Amortization of UAAL	(3) Total Funding Requirement	(4) Projected Benefit Payments paid by MWRA	(5) Contributions to OPEB Trust	(6) Total Cost to MWRA: (4) + (5)	(7) Assets at Mid-Year	(8) AAL at Mid-Year	(9) UAAL at Mid-Year: (8) - (7)
2018	$4,475,732	$6,923,858	$11,399,590	$4,467,865	$5,699,795	$10,167,660	$24,379,552	$146,338,837	$121,959,285
2019	4,616,918	7,194,981	11,811,899	5,082,336	5,905,949	10,988,285	31,982,034	156,412,939	124,430,905
2020	4,762,559	7,434,065	12,196,624	5,955,915	6,098,312	12,054,227	40,329,938	166,422,554	126,092,616
2021	4,912,794	7,639,123	12,551,917	6,820,204	6,275,959	13,096,163	49,461,177	176,391,938	126,930,761
2022	5,067,768	7,806,094	12,873,862	7,706,618	6,436,931	14,143,549	59,415,361	186,318,084	126,902,723
2023	5,227,631	7,928,086	13,155,717	8,619,666	6,577,858	15,197,524	70,232,850	196,162,039	125,929,189
2024	5,392,537	7,998,932	13,391,469	9,516,275	6,695,734	16,212,009	81,953,339	205,908,834	123,955,495
2025	5,562,645	8,015,682	13,578,327	10,340,613	6,789,164	17,129,777	94,616,194	215,605,165	120,988,971
2026	5,738,119	7,978,509	13,716,628	11,134,841	6,858,314	17,993,155	108,262,093	225,354,116	117,092,023
2027	5,919,128	7,877,720	13,796,848	11,901,964	6,898,424	18,800,388	122,934,734	235,125,978	112,191,244
2028	6,105,847	7,711,691	13,817,538	12,624,195	6,908,769	19,532,963	138,675,951	245,023,098	106,347,147
2029	6,298,456	7,471,166	13,769,622	13,310,474	6,884,811	20,195,285	155,529,754	255,058,007	99,528,253
2030	6,497,141	7,151,263	13,648,404	13,975,997	6,824,202	20,800,199	173,538,541	265,322,964	91,784,423
2031	6,702,093	6,737,156	13,439,249	14,674,797	6,719,625	21,394,422	192,745,248	275,806,775	83,061,527
2032	6,913,511	6,210,740	13,124,251	15,408,537	6,562,125	21,970,662	213,188,249	286,495,983	73,307,734
2033	7,131,598	5,549,666	12,681,264	16,178,964	6,340,632	22,519,596	234,899,342	297,374,629	62,475,287
2034	7,356,564	4,726,011	12,082,575	16,987,912	6,041,287	23,029,200	257,901,097	308,423,998	50,522,901
2035	7,588,627	3,704,386	11,293,013	17,837,308	5,646,506	23,483,814	282,203,330	319,622,338	37,419,008
2036	7,828,010	2,439,196	10,267,206	18,729,173	5,133,603	23,862,776	307,798,355	330,944,558	23,146,203
2037	8,074,945	870,550	8,945,495	0	16,047,561	16,047,561	334,654,480	342,361,899	7,707,419
2038	8,329,669	0	8,329,669	0	8,329,669	8,329,669	353,841,579	353,841,579	0

Notes: Assumes payment at the end of the fiscal year.
Normal cost is projected to increase 3.0% per year for inflation and 0.15% per year for mortality improvement and does not reflect the future impact of pension reform for new hires.
Assets are assumed to return 7.0% per year.

Section 3: Supporting Information

EXHIBIT I – SUMMARY OF PARTICIPANT DATA AS OF DECEMBER 31, 2017 AND DECEMBER 31, 2015

	December 31, 2017	December 31, 2015[1]
Retirees, Beneficiaries and Dependents[2]		
• Number	746	605
• Average age	69.2	- -
Active Employees Covered for Medical Benefits[3]		
• Number	960	1,089
• Average age	51.9	- -
• Average years of service	17.5	- -
• Average age at hire	34.4	- -
Terminated Vesteds		
• Number	41	43
• Average age	55.1	- -

1 As reported in the January 1, 2016 Actuarial Valuation Report of the Massachusetts Water Resources Authority OPEB completed by Stone Consulting, dated June 12, 2017.
2 December 31, 2015 does not include spouses on a family contract.
3 December 31, 2015 includes all active employees.

EXHIBIT II – ACTUARIAL ASSUMPTIONS AND METHODS

Data:	Detailed census data, premium rates and summary plan descriptions for postemployment welfare benefits were provided by the Massachusetts Water Resources Authority.
Actuarial Cost Method:	Entry Age Normal – Level percentage of payroll (previously, Projected Unit Credit).
Per Capita Cost Development:	Per capita costs were based on the fully-insured premium rates effective July 1, 2017 (January 1, 2018 for Medicare Advantage plans). Premiums were combined by taking a weighted average based on the number of participants in each plan, and were then trended to the midpoint of the valuation year at assumed trend rates. Actuarial factors were applied to the premium to estimate individual retiree and spouse costs by age and by gender.
Valuation Date:	December 31, 2017
Roll-Forward Techniques:	The results of the December 31, 2017 actuarial valuation are used to determine the Actuarially Determined Contribution for the fiscal year ending June 30, 2018.
Expected Return on Assets:	7.0% (previously, 7.5%) The long-term expected rate of return on OPEB investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of investment expenses and inflation) are developed for each major asset class. These ranges are combined to produce a long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation.
Discount Rate:	7.0%. The discount rate is equal to the expected return on assets. (Previously, the discount rate was determined in accordance with GASB Statement No. 45.)

Salary Increases:

Years of Service	Rate
0	5.75%
1	5.25%
2	5.25%
3	5.00%
4	5.00%
5	4.50%
6	4.50%
7	4.25%
8	4.25%
9+	4.00%

Asset Valuation Method: Market Value

Mortality Rates:

Pre-Retirement: RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017 (previously, RP-2014 at 2006 Employee Mortality Table projected generationally with Scale MP-2016)

Healthy: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 (previously, RP-2014 Healthy Annuitant Mortality Table projected generationally with Scale MP-2016)

Disabled: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017 set forward 1 year (previously, RP-2000 Healthy Annuitant Mortality Table set forward 2 years projected generationally with Scale MP-2016)

The underlying tables with generational projection to the ages of participants as of the measurement date reasonably reflect the mortality experience of the plan as of the measurement date. The mortality tables were then adjusted to future years using generational projection to reflect future mortality improvement between the measurement date and those years.

Annuitant Mortality Rates:

	Rate per year (%)	
Age	Male	Female
60	0.85	0.57
70	1.97	1.40
80	5.19	3.82
90	14.64	11.19

Note: Rates shown are before generational projection.

Termination Rates Before Retirement:

	Rate per year (%)		
	Mortality		
Age	Male	Female	Disability
20	0.05	0.02	0.01
25	0.06	0.02	0.02
30	0.06	0.02	0.03
35	0.07	0.03	0.05
40	0.08	0.04	0.10
45	0.13	0.07	0.15
50	0.22	0.12	0.19
55	0.36	0.19	0.24
60	0.61	0.27	0.28

Notes: 55% of the disability rates shown represent accidental disability.
20% of the death rates shown represent accidental death.
Rates shown are before generational projection.

Withdrawal Rates:

Years of Service	Rate per year (%)
0	15.0
1	12.0
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

Retirement Rates:

	Rate per year (%)					
			Previously			
	Current		Hired Pre-April 2, 2012		Hired Post-April 1, 2012	
Age	Male	Female	All Employees Male	All Employees Female	All Employees Male	All Employees Female
50	0.750	1.125	1.00	1.50		
51	0.750	1.125	1.00	1.50		
52	0.750	1.500	1.00	2.00		
53	0.750	1.875	2.00	2.50		
54	1.500	1.875	2.00	2.50		
55	1.500	4.125	2.50	5.50		
56	1.875	4.875	2.50	6.50		
57	1.875	4.875	5.00	6.50		
58	3.750	4.875	6.50	6.50		
59	4.875	4.875	6.50	6.50		
60	9.000	3.750	12.00	5.00	30.00	30.00
61	15.000	9.750	20.00	13.00	20.00	10.00
62	22.500	11.250	30.00	15.00	15.00	12.00
63	18.750	9.375	25.00	12.50	25.00	10.00
64	16.500	13.500	22.00	18.00	20.00	15.00
65	30.000	11.250	40.00	15.00	25.00	13.00
66	18.750	15.000	25.00	20.00	20.00	18.00
67	18.750	15.000	25.00	20.00	50.00	40.00
68	22.500	18.750	30.00	25.00	30.00	25.00
69	22.500	15.000	30.00	20.00	30.00	25.00
70	100.000	100.000	100.00	100.00	100.00	100.00

Dependents:	For current retirees, the spouse date of birth was obtained from the companion pension data if applicable and available; otherwise, husbands were assumed to be three years older than their spouses. For future retirees, husbands were assumed to be three years older than their wives. For future retirees who elect to continue their health coverage at retirement, 75% were assumed to have an eligible spouse who also opts for health coverage at that time.
Per Capita Health Costs:	Calendar 2018 medical and prescription drug claims costs are shown in the table below for retirees and for spouses at selected ages. These costs are net of deductibles and other benefit plan cost sharing provisions.

	Non-Medicare Plans				Medicare Plans			
	Retiree		Spouse		Retiree		Spouse	
Age	Male	Female	Male	Female	Male	Female	Male	Female
45	$8,126	$10,194	$5,041	$7,609	N/A	N/A	N/A	N/A
50	9,645	10,986	6,737	8,821	N/A	N/A	N/A	N/A
55	11,455	11,826	9,015	10,211	N/A	N/A	N/A	N/A
60	13,603	12,747	12,069	11,842	N/A	N/A	N/A	N/A
65	16,156	13,733	16,156	13,733	$4,380	$3,723	$4,380	$3,723
70	18,725	14,799	18,725	14,799	5,076	4,012	5,076	4,012
75	20,179	15,930	20,179	15,930	5,471	4,319	5,471	4,319
80+	21,730	17,174	21,730	17,174	5,891	4,656	5,891	4,656

Weighted Average Annual Retiree Contribution Amounts:

	Retired on or before July 1, 1994 and surviving spouses	Retired after July 1, 1994 and before October 1, 2009	Retired after October 1, 2009
Non-Medicare:	$1,141	$1,688	$2,234
Medicare:	543	774	1,004

Health Care Cost Trend Rates:	Health care trend measures the anticipated overall rate at which health plan costs are expected to increase in future years. The rates shown below are "net" and are applied to the net per capita costs shown above. The trend shown for a particular plan year is the rate that is applied to that year's cost to yield the next year's projected cost.

Year Ending December 31	Medical/RX
2018	8.00%
2019	7.50%
2020	7.00%
2021	6.50%
2022	6.00%
2023	5.50%
2024 & later	5.00%

The trend rate assumption is the same as used in the Commonwealth of Massachusetts Postemployment Benefit Other than Pensions Actuarial Valuation as of January 1, 2017, dated November 10, 2017.

Retiree Contribution Increase Rate: Retiree contributions for medical and prescription drug coverage are expected to increase with medical and prescription drug trend.

Administrative Expenses: Administrative expenses are not added to fully-insured premium rates, as these expenses are a component of the rate.

Participation and Coverage Election:

- 100% of active employees with medical coverage are assumed to elect retiree medical coverage (previously, 80% of active employees, including those currently waiving medical coverage).
- 100% of active employees with medical coverage are assumed to elect life coverage (previously, 90% of active employees, including those currently waiving medical coverage).
- 100% of retirees over age 65 are assumed to remain with their current medical plan for life.
- For future retirees and current retirees under age 65, 100% are assumed to be eligible for Medicare and enroll in a Medicare plan upon reaching age 65.
- 80% of future and current terminated vesteds are assumed to elect retiree medical coverage with benefits assumed to commence at age 60, and to be eligible for Medicare and enroll in a Medicare plan upon reaching age 65.

The participation and coverage election assumptions were based on a review of recent experience.

Plan Design: Development of plan liabilities was based on the substantive plan of benefits in effect as described in Exhibit III.

Missing Participant Data:	With the exception of missing dates of birth for spouses (as noted on page 21), a missing census item for a given participant was assumed to equal the average value of that item over all other participants of the same status for whom the item is known.
Health Care Reform Assumption:	This valuation does not include the potential impact of any future changes due to the Patient Protection and Affordable Care Act (PPACA) and the Health Care and Education Reconciliation Act (HCERA) of 2010 other than the excise tax on high cost health plans beginning in 2022 (reflected with this valuation) and those previously adopted as of the valuation date. The excise tax calculation assumes that the current cost sharing provisions of the postretirement benefits will also apply to the additional cost of the plan due to the excise tax.
Demographic and Salary Scale Assumptions:	The demographic and salary scale assumptions used in this valuation, except for mortality, are the same as used in the Massachusetts Water Resources Authority Employees' Retirement System Actuarial Valuation and Review as of January 1, 2017, dated June 26, 2017, completed by Segal Consulting. The mortality assumptions were updated to reflect mortality tables and mortality scales recently published by the Society of Actuaries. A review of the demographic assumptions is beyond the scope of this assignment, however, we have no reason to doubt the reasonableness of the assumptions. The remaining demographic assumptions, such as percent married, relative ages of spouses and enrollment elections, were based on the experience of the Plan and the experience of similar plans.
Justification for Assumption Changes Since Prior Valuation:	Based on past experience and future expectations, the following actuarial assumptions were changed: • The per capita health care costs were updated to reflect recent experience. • The trend assumptions were revised to better reflect future expectations. • The impact of the excise tax on high cost health plans beginning in 2022 was recalculated with this valuation. • The retirement assumptions were changed to match those used in the Massachusetts Water Resources Authority Employees' Retirement System Actuarial Valuation and Review as of January 1, 2017. • The mortality assumptions were updated to reflect mortality tables and mortality scales recently published by the Society of Actuaries. • The funding method was changed to comply with the requirements of GASB Statement No. 74. • The discount rate was changed to the expected return on assets of 7.0%. • The participation and coverage election assumptions were to reflect future expectations.

EXHIBIT III – SUMMARY OF PLAN

This exhibit summarizes the major benefit provisions as included in the valuation. To the best of our knowledge, the summary represents the substantive plans as of the measurement date. It is not intended to be, nor should it be interpreted as, a complete statement of all benefit provisions.

Eligibility:	Retired and receiving a pension from the Massachusetts Water Resources Authority Employees' Retirement System. • Members hired before April 2, 2012 – Group 1 and Group 2 » Retirees with at least 10 years of creditable service are eligible at age 55; » Retirees with at least 20 years of creditable service are eligible at any age. – Group 4 » Retirees are eligible at age 55; » Retirees with at least 20 years of creditable service are eligible at any age. • Members hired on or after April 2, 2012 – Group 1 » Retirees with at least 10 years of creditable service are eligible at age 60. – Group 2 » Retirees with at least 10 years of creditable service are eligible at age 55. – Group 4 » Retirees are eligible at age 55; » Retirees with at least 10 years of creditable service are eligible at age 50.
Disability:	Accidental (job-related) Disability has no age or service requirement. Ordinary (non-job related) Disability has no age requirement but requires 10 years of creditable service.
Pre-Retirement Death:	Surviving spouses of members who die in active service on Accidental (job-related) Death are eligible at any age. Surviving spouses of members who die in active service on Ordinary (non-job related) Death are eligible after two years of service.
Post-Retirement Death:	Surviving spouse is eligible.

Benefit Types:	Medical and prescription drug benefits are provided to all eligible retirees through the Group Insurance Commission. The employer pays 50% of the retiree life insurance premium.
Duration of Coverage:	Lifetime.
Dependent Benefits:	Medical and Prescription Drugs.
Dependent Coverage:	Benefits are payable to a spouse for their lifetime, regardless of when the retirees dies.
MGL Chapter 32B, Section 18A:	Adopted
Retiree Life:	$1,000
Retiree Contributions:	Premium rates and retiree contributions are summarized below:

Non-Medicare Actives and Retirees	Monthly Premium (eff. 7/1/2017)	Retiree Contributions: Retired on or before July 1, 1994, and Surviving Spouses	Retiree Contributions: Retired after July 1, 1994 and before October 1, 2009	Retiree Contributions: Retired after October 1, 2009
Fallon Direct				
• Individual	$552.72	$55.27	$82.91	$110.54
• Family	$1,326.56	$132.66	$198.98	$265.31
Fallon Select				
• Individual	$734.49	$73.45	$110.17	$146.90
• Family	$1,762.72	$176.27	$264.41	$352.54
Harvard Pilgrim Independence				
• Individual	$821.36	$82.14	$123.20	$164.27
• Family	$2,004.09	$200.41	$300.61	$400.82
Harvard Primary Choice				
• Individual	$618.54	$61.85	$92.78	$123.71
• Family	$1,509.25	$150.92	$226.39	$301.85

Health New England				
• Individual	$546.24	$54.62	$81.94	$109.25
• Family	$1,354.24	$135.42	$203.14	$270.85
Neighborhood Health Plan				
• Individual	$552.11	$55.21	$82.82	$110.42
• Family	$1,463.10	$146.31	$219.46	$292.62
Tufts Navigator				
• Individual	$726.30	$72.63	$108.94	$145.26
• Family	$1,772.21	$177.22	$265.83	$354.44
Tufts Spirit				
• Individual	$551.34	$55.13	$82.70	$110.27
• Family	$1,327.27	$132.73	$199.09	$265.45
Unicare Basic/CIC				
• Individual	$1,035.18	$145.67	$195.09	$244.51
• Family	$2,422.06	$339.98	$455.67	$571.32
Unicare Community Choice				
• Individual	$518.77	$51.88	$77.82	$103.75
• Family	$1,245.10	$124.51	$186.77	$249.02
Unicare Plus				
• Individual	$690.78	$69.08	$103.62	$138.16
• Family	$1,650.35	$165.04	$247.55	$330.07

Medicare Retiree Plans	Monthly Premium (eff. 7/1/2017)	Retiree Contributions: Retired on or before July 1, 1994, and Surviving Spouses	Retiree Contributions: Retired after July 1, 1994 and before October 1, 2009	Retiree Contributions: Retired after October 1, 2009
Unicare OME/CIC	$379.31	$47.55	$65.98	$84.41
HPHC Medicare Enhance	$421.57	$42.16	$63.24	$84.31
Tufts Medicare Complement	$380.93	$38.09	$57.14	$76.19
Tufts Medicare Preferred*	$315.00	$31.50	$47.25	$63.00
Fallon Senior Plan*	$362.00	$36.20	$54.30	$72.40

* Premiums are effective January 1, 2018.

Plan Changes Since the Prior Valuation: None.

EXHIBIT IV – DEFINITION OF TERMS

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

Assumptions or Actuarial Assumptions:	The estimates on which the cost of the Plan is calculated including: (a) Investment return — the rate of investment yield that the Plan will earn over the long-term future; (b) Mortality rates — the death rates of employees and pensioners; life expectancy is based on these rates; (c) Retirement rates — the rate or probability of retirement at a given age; (d) Turnover rates — the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement.
Actuarial Accrued Liability (AAL):	Present value of all future benefit payments for current retirees and active employees taking into account assumptions about demographics, turnover, mortality, disability, retirement, health care trends, and other actuarial assumptions.
Unfunded Actuarial Accrued Liability (UAAL):	The extent to which the actuarial accrued liability of the Plan exceeds the assets of the Plan. There are many approaches to paying off the unfunded actuarial accrued liability, from meeting the interest accrual only to amortizing it over a specific period of time.
Normal Cost:	The amount of contributions required to fund the benefit allocated to the current year of service.
Actuarially Determined Contribution:	A target or recommended contribution to an OPEB plan for the reporting period based on the most recent measurement available.
Valuation Date:	The date at which the actuarial valuation is performed
Covered Employee Payroll:	The payroll of the employees that are provided OPEB benefits
Entry Age Actuarial Cost Method:	An actuarial cost method where the present value of the projected benefits for an individual is allocated on a level basis over the earnings or service of the individual between entry age and assumed exit age
Healthcare Cost Trend Rates:	The rate of change in per capita health costs over time
Discount Rate:	The interest rate used to determine the actuarial present value of projected benefit payments.
Expected Return on Assets:	The rate of earnings of the Plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Real Rate of Return:	The rate of return on an investment after removing inflation