January 1, 2016

Actuarial Valuation Report

Massachusetts Water Resources Authority
Other Post-Employment Benefits

Lawrence B. Stone

stoneconsulting,inc
5 West Mill Street, Suite 4
Medfield, Massachusetts 02052
T: 508.359.9600 F: 508.359.0190
Lstone@stoneconsult.com

TABLE OF CONTENTS

PAGE

SECTION I - MANAGEMENT SUMMARY

Introduction 1
Summary of Actuarial Results 2
Change from Prior Valuation 3
Valuation Methodology and Assumptions 5
Data 12
Funding 12
Calculation of Net OPEB Obligation 16
Implementation 18
Recommendations and Comments 18

SECTION II - ACTUARIAL VALUATION DETAILS

Population Data 21
Summary of Results 24
Schedule of Funding Progress Other Post-Employment Benefits (Dollars in Thousands) 24
Funding Schedule 25
Sensitivity Analysis 26
Actuarial Methods and Assumptions 28
Principal Plan Provisions Recognized in Valuation 34
Glossary 34

SECTION I - MANAGEMENT SUMMARY

Introduction

This report presents the results of the actuarial valuation of the Massachusetts Water Resources Authority (MWRA) Other Post-employment Benefits as of January 1, 2016. The valuation was performed for the purpose of measuring the actuarial accrued liabilities associated with these benefits and calculating a funding schedule. These results are used in satisfying the requirements under the Governmental Accounting Standards Board Statement No. 45.

The valuation was based on participant data as of January 1, 2016 supplied by MWRA. The provisions reflected in the valuation are based on Chapter 32B of the General Laws of the Commonwealth of Massachusetts and related statutes and the benefits provided by the Authority.

This actuarial valuation involves estimates about the probabilities of events as well as the projection of amounts far into the future. Our figures should be considered a “best estimate” of the future events and not a prediction. As such, actual results are unlikely to mirror our results. All amounts determined in this valuation will be subject to continual review as actual results are compared to past estimates and new estimates are made about future events.

We, Lawrence Stone and Kevin Gabriel, are consultants for Stone Consulting, Inc. and are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We are pleased to present the results of this valuation. We are available to respond to any questions on the content of this report. Please note that this report is meant to be used in its entirety. Use of excerpts of this report may result in inaccurate or misleading understanding of the results.

Respectfully submitted,

STONE CONSULTING, INC.
June 12, 2017

Lawrence B. Stone
Member, American Academy of Actuaries

Kevin K. Gabriel, FSA, MAAA
Member, American Academy of Actuaries

5 West Mill Street, Suite 4 • Medfield, MA 02052
Tel. (508) 359-9600 • Fax. (508) 359-0190 • E-mail: Lstone@stoneconsult.com

Summary of Actuarial Results

The actuarial values in this report were calculated consistent with the Governmental Accounting Standards Board (GASB) Statement No. 45, Accounting and Financial Reporting by Employers for Postemployment Benefits Other Than Pensions, issued June 2004. Values at a single discount rate are presented. The 7.50% discount rate used represents the expected rate of return for a funded plan with a longer-term investment horizon. The MWRA has created an OPEB irrevocable trust or its equivalence and has put assets into it. Additionally, MWRA has indicated its intent to fund the trust. Based on this information, we have assumed that the MWRA plan is a partially funded plan as described in the Governmental Accounting Standards Board's Statement Number 45. For a partially funded plan, such as that for MWRA, the GASB Statement No. 45 calls for the use of a discount rate in between a fully funded and the rate that would be used for an unfunded plan and that reflects the extent to which the plan is funded. The rate we used for MWRA is 7.00%. This rate was derived assuming that the discount for an unfunded plan would be 4.00%. The OPEB liability is extremely sensitive to the discount rate assumption. Use of the unfunded rate instead of the funded rate causes the Annual Required Contribution (ARC), Accrued Actuarial Liability (AAL), and the Normal Cost to increase dramatically.

The valuation was run as of 1/1/2016. However, the results were used for the 2017 Fiscal Year. As such, all figures were adjusted to the middle of that year (January 1, 2017).

The summary results are as follows:

- Actuarial Accrued Liability ("AAL") is the "price" attributable to benefits earned in past years. The total AAL as of January 1, 2016 projected to 2017 (at the 7.00% discount rate) is $140,657,826. This is made up of approximately $79.7 million for current active MWRA employees and approximately $61 million for MWRA retirees, spouses and survivors.

- The Normal Cost is the "price" attributable to benefits earned in the current year. The Normal Cost as of January 1, 2016 projected to 2017 (at the 7.00% discount rate) is approximately $4.1 million.

- Based on a 30-year funding schedule at a 7.00% discount rate, the Fiscal 2017 contribution would be $10,947,999. This figure is referred to as the Annual Required Contribution (ARC). These compare to the pay-as-you-go contribution of the existing costs for current retirees of $3,978,084. For an illustration of how payment of the ARC impacts the funding of the plan over time, please refer to the "Illustrative Funding Schedule" discussion beginning on page 12 and the accompanying table on page 24. The following table shows the breakdown of the Actuarial Accrued Liability between future retirees and current retirees, as well as the normal cost, at MWRA's partially funded rate:

Actuarial Results as of January 1, 2016 Projected to FY 2017	7.00% Rate
Current Actives	$79,684,480
Current Retirees, Beneficiaries, Vesteds and Survivors	$60,973,346
Total AAL	$140,657,826
Funding	$16,656,000
Total Unfunded AAL (UAAL)	$124,001,826
Normal Cost	$4,142,351
Amortization of UAAL (30 Year)	$6,805,648
ARC	$10,947,999

Change from Prior Valuation

MWRA's last valuation of its OPEB liability was done as of January 1, 2014. The following table provides a comparison of some of the key figures:

Category	1/1/2016 Figure projected to FY 2017 (7.00%)	1/1/2014 Figure Projected to FY 2017 (6.50%)	% Change
AAL	$140.7 million	$191.1 million	-26.4%
Assets	$16.7 million	$16.7 million	-0.3%
UAAL	$124.0 million	$174.4 million	-28.9%
Normal Cost	$4.1 million	$6.4 million	-35.1%
Amortization Cost	$6.8 million	$9.4 million	-27.3%
ARC	$10.9 million	$15.7 million	-30.4%
Pay-As-You-Go for Year 1	$4.1 million	$5.5 million	-25.4%

The following addresses the reasons behind these changes:

1) Change in Discount Rate from 6.50% to 7.00% decreased the Normal Cost by 10% and decreased the AAL by 7%.
2) Changes in claims and trend rates decreased the Normal Cost by 2% and decreased the AAL by 2%.
3) Change in the participation rate from 90% to 80% decreased the Normal Cost by 11% and decreased the AAL by 7%.
4) The change in the population (including plans in which people were enrolled) decreased the Normal Cost by 6% and decreased the AAL by 10%.

The following table summarizes the changes in assumptions between the two valuations:

	Current Val (1/1/2016) (7.00%)	Prior Val (1/1/2014) (6.50%)
Mortality	Generational Projection with RP-2014	Generational Projection with RP-2000
Retiree Participation	80%	90%
Participating Spouse %	75%	80%
Plans Pre-65	75% MC/25% IND	80% MC/20% IND
Plans Post-65(Medicare Only)	75% IND/25% MC/<1%COM	80% IND/20% MC/<1%COM
Family % Pre-65/Post-65	55%/57.5%	50%/35%
Claims age 65 COMMC Blended (Pre-65/Post-65)	$20,688/$21,106	$17,731/$15,540
Claims age 65 COMIND Blended (Pre-65/Post-65)	$26,128/$26,650	$23,248/$20,001
Claims age 65 MEDMC/MEDIND (Pre-65/Post-65)	$3,654/$3,863	$3,875/$3,771
Cumulative Trend Years 1-10		
Commercial MC	80%	72%
Commercial IND	92%	90%
Medicare MC	84%	48%
Medicare IND	77%	76%
# Actives	1,089	1,086
# Retirees and Vested Terms (1)	732	591
# Retirees and Spouses with Med	491	502

(1) The 2016 valuation number includes spouses without insurance. These people were not included in the prior year's figure. The figure for 2016 without spouses would be 648.

Table abbreviations:
- COM: Commercial / MED: Medicare
- IN: Indemnity / MC: Managed Care

Valuation Methodology and Assumptions

VALUATION METHOD

The valuation of the other post-employment benefits is based upon the projected unit credit actuarial cost method. Under this method, future health care benefit costs (including Medicare reimbursements) are projected using assumed rates of annual health care cost increases (health care cost trend rates). The cost of future expected life insurance death benefits is added to the projected medical cost. The actuarial value of the future expected benefits is allocated proportionately over a health plan member's working lifetime.

A normal cost (or service cost) is determined for each year of the member's creditable service and is equal to the value of the future expected benefits divided by the total expected number of years of service. This is similar to a normal cost in a retirement actuarial valuation. The Actuarial Accrued Liability is the accumulated value of prior normal costs, similar to the actuarial accrued liability in a retirement actuarial valuation, and represents the liability associated with prior service.

GASB Statement No. 45

The actuarial cost method used in this valuation is consistent with the Governmental Accounting Standards Board (GASB) Statement No. 45, Accounting and Financial Reporting by Employers for Postemployment Benefits Other Than Pensions, issued June 2004. It is one of the allowable cost methods specified in that accounting standard, and is the cost method most similar to the prescribed method of accounting for these benefits in the private sector described in the Financial Accounting Standards Board Statement 106 (FAS 106).

Difference Between FAS 106 and GASB Statement No. 45

The GASB Statement No. 45 differs in one important regard from the actuarial cost method described in the private sector accounting standard. In the FAS 106 methodology, benefits are considered to be fully earned in the first 10 years of service, since members become vested in the retirement benefits in 10 years. Compared to the FAS 106 method, the GASB Statement No. 45 attribution method produces a lower accrued liability for future retirees. The cost of the benefit is spread over the expected working lifetime of the employee. This makes the cost of the benefit associated with the years of service the employee is providing. This is more appropriate for the public sector due to the relative permanence of public entities compared to private entities. There are other significant differences between the GASB Statement No. 45 and FAS 106, most noticeably in the choice of discount rate. The GASB Statement No. 45 discount rate assumption is discussed below.

ACTUARIAL ASSUMPTIONS

Details of the assumptions used in this valuation are shown in Section II. Here we present a brief discussion of the assumptions selected.

Demographic and Financial Assumptions

These include discount rates of 7.00% and 7.50% as well as mortality, disability, withdrawal and retirement rates. The 7.50% discount rate applies to the scenario of a fully funded program. A fully funded program is one in which the employer contributes 100% of the ARC each year. The 7.00% discount rate applies to the scenario of a partially funded program. A partially funded program is one where the employer pays more than the pay-as-you-go cost but less than the full funding amount. GASB Statement No. 45 indicates that the discount rate for a post-employment benefit plan should be based on the degree to which the plan is funded. Note that, for a completely unfunded plan, the rate of return on the employer's general assets should be used. This would typically be about 4.00% for an employer such as MWRA. For a partially funded plan, a rate between these two amounts that reflects the degree to which the plan is funded should be used. The rate we have used for this scenario is 7.00%. While, for a fully funded plan, GASB statement No. 45 allows one to use a long-term investment rate such as what would be used for a defined benefit pension fund. This latter rate is typically around 7.5% however the actual number used is a function of the investment strategy employed by the fund manager.

DERIVATION OF THE PARTIALLY FUNDED RATE

This rate is based on an analysis of the difference between the ARC for various interest rates and the pay-as-you-go amounts compared to the cash contribution made by the MWRA. We developed actual figures at certain key interest rates first. This group of figures was then used to develop a cubic polynomial approximation to the entire curve relating the discount rate to the difference between the ARC and the amount funded. The table on the following page shows the data we used along with the approximation developed by the polynomial:

Discount Rate	ARC	Paid	ARC-Paid	Difference	Polynomial
4.00%	$15,621,733	$3,978,084	$11,643,649	$0	$0
4.25%	$14,440,707	$3,978,084	$10,462,623	$1,181,026	$1,132,009
4.50%	$13,421,627	$3,978,084	$9,443,543	$2,200,106	$2,153,559
4.75%	$12,537,235	$3,978,084	$8,559,151	$3,084,497	$3,064,375
5.00%	$11,765,422	$3,978,084	$7,787,338	$3,856,311	$3,864,182
5.50%	$11,415,963	$3,978,084	$7,437,879	$4,205,770	$4,222,370
6.00%	$11,088,159	$3,978,084	$7,110,075	$4,533,573	$4,552,703
6.50%	$10,780,263	$3,978,084	$6,802,179	$4,841,470	$4,855,145
7.00%	$10,509,433	$3,978,084	$6,531,349	$5,112,299	$5,129,663
7.25%	$10,217,977	$3,978,084	$6,239,893	$5,403,755	$5,376,221

We also used another method to supplement the cubic polynomial method. The cubic polynomial method tends to understate the interest rate. The first dollar contributed over the pay-as-you-go amount has a greater effect than the last dollar to achieve full funding. The supplemental method takes that into account.

Based on a plan to contribute approximately $4.9 million in Fiscal 2017 and 50% of the fully funded ARC each year thereafter, consideration of both the polynomial approximation and the supplemental method gives a figure of approximately 7.00% that we are recommending. MWRA should keep in mind that, if future additional contributions are less than its planned amount, the discount rate used for future valuations will be lower. This will increase the liability and OPEB cost calculations.

It should be noted that all of these rates could change significantly in the future due to changes in the economic environment. The rate used for calculation of the fully funded rate, as well as future investment returns on assets is based on future investment decisions. The rate we have selected reflects the current allocation of MWRA's assets. If a significantly different type of asset allocation is decided upon by the OPEB trust, the amounts in this report should be recalculated.

We generally recommend that a public sector entity adopt a funding policy. This is particularly necessary for MWRA, which is funding its OPEB benefits. If MWRA has not already done so, we recommend that this policy be formalized. The GASB statement does not have a requirement for a formal funding policy document but indicates that a funding policy should be adopted. Thus, we recommend that the Authority detail its intent with either a written document or in the minutes of a meeting. We recommend that MWRA continue to do so if it does not create a written document.

The discount rate would change if the Authority were to alter the rate at which it is funding benefits. Such a change would lead to a lower discount rate should the funding level be reduced, or a higher discount rate, should the rate of funding be increased. Based on the current economic scenario and a reasonable funding plan, this would mean the valuation rate could fall to as low as 4.00% or as high as 7.50%.

- Current health care costs by age

Initial health care cost assumptions were derived from premium rates for the various health care plans in-force at January 1, 2016. Typically, we analyze the plans offered in terms of four different categories: whether the plan offered is Commercial (not integrated with Medicare) or supplemental to Medicare and whether the plan is Indemnity (where reimbursements are a function of billed charges) or Managed Care (where reimbursements are a function of negotiated contracts). Grouping the plans in this manner allows us to maintain a reasonable degree of granularity in our analysis. At the same time, it avoids the problem of a lack of credibility that often arises if one attempts to analyze every plan separately.

As of January 1, 2016, MWRA, which participates in the Massachusetts Group Insurance Commission (GIC) program, had medical plans in all of these four categories (meaning there were enrollees in these plans): seven Commercial Managed Care plans, one Commercial Indemnity Plan, two Medicare Managed Care plans, and two Medicare Indemnity. Please refer to the "Plan Definition Table" on page 21 for more details. Note that other plans were offered but they did not have retiree enrollment.

For all of these plan categories, weighted-average costs for each plan grouping were calculated based on the actual MWRA active and retiree population enrollments. For plan categories with more than one plan, costs were based on an average weighted by enrollment. In order to capture the effect of aging on health care costs, an assumption is required for the increase in health care costs as a person ages. We based our aging assumption on a study sponsored by the Society of Actuaries Health Section in August 2003. The effect of this aging assumption is illustrated in the table of "Initial Claim Costs" in the Actuarial Methods and Assumptions section of this report. This method was applied only to the Commercial plans, since these plans incorporate both retirees and active employees. By age-grading the claim costs, we account for the subsidy of older employees by younger employees implicit in a flat premium rate (also referred to as the "Attributed Cost" of each employee). That is, the cost of an active 20-year old employee, for example, is much less than the cost of a retired 80-year old employee. But, the premiums charged the Authority are flat – the same for both of these people. Thus, the 20-year old in our example is overcharged and the 80-year old is undercharged by a flat rate premium. Age-grading makes this subsidy mismatch between expected claims and premium amounts explicit in the claim costs at each age. For the purposes of the GASB valuation, this subsidy needs to be taken into account in determining the retiree liability and normal cost.

Medicare plans were also age-graded. While there is no subsidy between actives and retirees in these plans, there is still an escalating cost by age that needs to be reflected. In particular, it should be noted that from one year to the next, the cost of a person in these plans (as well as commercial plans) increases due to two factors: (1) year-over-year medical trends and (2) the fact that the person ages one more year. Without age-grading the Medicare costs, we would understate the rate of increase in costs and so end up with smaller liabilities and associated annual costs.

- Cost trends

The claim rates developed using the methodology described above must be projected over the life of each retiree. For this purpose we use trend rates calculated to reflect the general rate of increase in Health Care costs. We developed different trends for each of the categories of plans for which we also developed claim costs. These factors were applied to the premium-based claim rates.

It should be noted that premium rate increases typically include factors other than health care cost increases, such as aging of the covered population, that are reflected elsewhere in our valuation methodology. Therefore, premium rate increases are not themselves a proxy for health care trends. However, they do give some indication of the level of expected cost increases.

As is the standard in post-retirement medical valuations, initially higher rates of health care cost trend are assumed to decrease over time to an ultimate rate consistent with long-term economic assumptions. Our general set of trend assumptions has Commercial Managed Care trends that begin at 9% and scale down to 5% by year eight and Commercial Indemnity trends that begin at 10% and grade down to 5% by year 19. For Medicare, the Managed Care trends begin 8% at and scale down to 5% at year 6 while the Indemnity trends begin at 9% and grade down to 5% by year 28. These patterns are a change in our former assumptions, which had indemnity trends at an ultimate level of 6%. These different sets of trend rate reflect our belief that (1) Managed Care plans, with their negotiated pay levels and tighter controls, will exhibit lower trends than unmanaged Indemnity plans; and (2) Commercial plans will be subject to modestly higher trends than Medicare plans due to cost shifting induced by cutbacks in the federal government's payment of Medicare costs. These were the trends we used for our work except for the first year, where we used the actual premium changes for 2016.

These trend rates should be thought of not as a forecast but as a reasonable progression of rates based on historic patterns. Our new assumptions reflect the belief that ultimate trends for all plans must converge but that indemnity trends will be less reactive to prices. For many years, health care cost increases have been particularly volatile, and this actuarial assumption should be reviewed and, most likely, reset every year or two. Implicit in our health care cost trend assumptions is that the general rate of medical inflation will moderate due to economic pressure on insurers, employers, employees, retirees, government entities, and health care providers. As expectations of future health care cost increases change, they will be reflected in future valuations, resulting in actuarial gains/losses. These will be incorporated in the future costs and funding schedules. In this manner, there is a systematic means of adjusting to changes in the health care environment.

- Sensitivity analysis

The effect of increasing health care costs is extremely significant in an actuarial valuation of post-employment health benefits. As experience emerges the trend assumptions we have used are unlikely to be realized exactly. To illustrate the effect of different trend rates on the actuarial valuation results, we have included a sensitivity analysis of the effect on the actuarial accrued liability, normal cost and annual required contribution of a 1% increase or decrease in the health care cost trend assumption to the base (7.00%) discount scenario. We have also included a sensitivity analysis of the effect on the actuarial accrued liability, normal cost and annual required contribution of a 0.50% increase or decrease in the base (7.00%) discount rate assumption.

- Timing

All values discussed in this report are based on a January 1, 2016 valuation. The first fiscal year of the valuation is used for FY 2017, that is July 1, 2016 to June 30, 2017. It is permissible, under GASB Statement No. 45, to use these values, without adjustment for interest or any other timing factor for a limited future time period. For an entity such as MWRA, which will be doing a valuation every two years, the standard allows use of data "not more than twenty-four months before the beginning of the first of two years for which the valuation provides the ARC." This means that it is acceptable for us to use the January 1, 2016 results without adjustment when discussing the 2017 Fiscal year. For this valuation, we have adjusted the figures for timing and brought them to the middle of the 2017 Fiscal Year. These adjusted numbers appear in the Exhibits on pages 15 and 16. We believe this is acceptable if it is done consistently. <u>If there are no significant plan changes or demographic changes or cash contributions that differ from those assumed, you will be able to use the results for both fiscal years</u>.

- Medicare

Medicare eligibility is an important assumption with regard to future costs. For those entities that have adopted Section of 18 of Chapter 32B of the code (as has MWRA), we will assume that active employees who were hired after March 31, 1986 will be Medicare eligible due to their mandated participation in the Medicare program. Active employees prior to that employment date are assumed to be 85% Medicare eligible. Thus, we assume that 85% of those not Medicare eligible through the

Authority will obtain coverage through other employment or through their spouse. Such an assumption only applies to those hired by the Authority prior to 4/1/1986. All employees hired after that date are automatically Medicare eligible. Eventually, this 85% assumption will no longer be necessary.

- Medicare Changes

The Medicare Prescription Drug, Improvement and Modernization Act of 2003 introduced significant changes to the Medicare program and its interaction with employer-sponsored post-retirement benefits. Medicare beneficiaries are able to participate in a voluntary, prescription drug coverage program. In order to encourage employers, including public-sector employers, to continue providing prescription drug coverage to retirees, the Act provides for a cash subsidy to employers whose prescription drug coverage is deemed to be actuarially equivalent to the new Medicare Part D drug coverage. This cash subsidy can be used to offset partially the cost of retiree medical benefits, including potentially reducing the accrued liability for a portion of the drug benefits provided by a retiree medical plan. The Act may have additional impact on retiree plan choices, as Medicare-eligible retirees may opt for the Part D coverage rather than an employer's plan options. Such changes, if they occur, may affect the selection of future actuarial assumptions.

GASB has indicated that the subsidy should not be included as part of the OPEB valuation. The reason being that the subsidy is considered general governmental revenue and as such is not earmarked towards the funding of OPEB benefits.

- Health plan coverage election

Assumptions must also be made regarding the participation in health plans when active members retire and when those already retired turn age 65. Using data supplied by MWRA, Stone Consulting modeled the behavior of employees as they moved from being active to being retired or moved from being an under age 65 retiree to being an age 65+ retiree. Such modeling involved an analysis of the distribution of the plans chosen by current retirees, the possible plans available to those who will retire in the future, and our opinions about the likely future course of retiree medical care. For this analysis, all departments were combined, since the plans available to all MWRA retirees are the same, regardless of department.

This model is applicable to actives and to retirees not yet age 65, since both of these groups will have the option to select plans at key ages. It should be kept in mind that these percentages are applicable even to actives not currently enrolled in a medical plan. The reason for this is that these people could change their behavior and enroll in a plan at retirement. The likelihood that they (or other actives) elect to do so is controlled by the participation assumption (see below). Some retiree groupings do not require any modeling. For example, retirees over age 65 are assumed to remain in the plans they have already selected. If they have opted out of MWRA coverage, we assume they will continue to do so. Similarly, those retirees under age 65 already in Medicare plans are assumed to remain in those plans for life. These are people who are disabled or have certain medical conditions that qualify them for Medicare early. Pre age 65 retirees in Commercial plans are assumed to stay in their current plan until age 65. At that point, they may migrate to a different plan. We have modeled their possible choices at age 65 and reflected them in our assumptions. Active employees over age 65, once they retire, are assumed to make the same sorts of selections as retirees at age 65.

The following table shows the way we modeled the choices at each of the key ages.

MWRA Participant Behavior at Key Ages

Status	Age	Pre-65 Retirement	65+ Retirement
Active	Under 65	Commercial Managed Care: 75% Commercial Indemnity: 25%	Medicare Managed Care: 25% Medicare Indemnity: 75% Commercial Managed Care: <1%
Active	65+	NA	Medicare Managed Care: 25% Medicare Indemnity: 75% Commercial Managed Care: <1%
Retired	Under 65	Current Plan	Medicare Managed Care: 25% Medicare Indemnity: 75% Commercial Managed Care: <1% Or Actual Plan if already in Medicare
Retired	65+	NA	Current Plan

Participation

In addition to determining the choices that retirees will make among plans, there is also the issue of whether the retiree will elect coverage at all. The rate at which retirees elect coverage is called the "Participation" Rate. Stone Consulting reviewed MWRA retiree data to determine the historical frequency at which retirees elect to take medical coverage. Based on this review, we assumed that 80.0% of future eligible retirees and spouses of retirees will elect health plan coverage. For Life Insurance, we assumed that 90% MWRA of future retirees will elect coverage. These percentages reflect both actual MWRA participation to date as well as the likelihood that future participation rates will tend to drift up as alternative sources of coverage become less common.

It is also necessary to reflect the participation rate of spouses in the Medical plans. Spouses will not participate at the same rate as employees for various reasons. These can include the availability of coverage from their own employer and the cost of the spouse coverage on top of the employee's coverage. We examined the number of spouses covered both pre-65 and post-65 and determined the implied percentage of spouses participating. Such analysis took into account that spouses may "participate" by virtue of being covered under family plans. The participation rate we developed was 75%. We should also note that our expected frequency of spouses for an employee who is retiring typically is 80%. In other words, we typically expect 8 out of 10 retiring employees to have a spouse. However not all of these spouses will opt to participate. Thus, effectively 64% of active employees will have a spouse that participates in the retiree plan.

Data

The participant census data for the valuation study was supplied by MWRA. Participants include MWRA active employees, retirees, disability retirees, and surviving spouses. We should note that, like many Massachusetts governmental entities, MWRA does allow inactive former employees with 10 or more years of service to qualify for a vested post-retirement health benefit.

The participant census data was not audited by Stone Consulting, Inc. However, it was checked for reasonableness. Summaries of active participants and MWRA retiree census data are included in Section II.

Funding

There are alternative ways to plan for the payment of post-retirement health and life insurance benefits: continue to fund on a pay-as-you go method, contribute on an ad-hoc basis to a fund for this purpose, or develop a funding schedule in which the unfunded amount is amortized over some number of years. With the funding schedule, the normal cost must continue to be paid each year to keep current.

There is no legal requirement to prefund these other post-employment benefit liabilities. Nor does GASB Statement No. 45 require actual prefunding; however, its accounting requirements will serve to highlight the substantial unfunded accrued liabilities associated with these benefits.

ILLUSTRATIVE FUNDING SCHEDULE

The GASB Statement No. 45 is designed to account for non-pension post-employment benefits using an approach similar to the accounting for retirement benefits. It develops an Annual Required Contribution ("ARC") that is based on the Normal Cost plus an amortization of the Unfunded Actuarial Accrued Liability ("UAAL"). To the extent that actual contributions equal to the ARC are made by the employer to the post-employment health benefit plan, no additional liability will be required to be shown on MWRA's statement of assets. Employer contributions may be in the form of benefit or premium payments or contributions to a fund set aside for future benefit payments. Such a fund must meet the requirements set out in the accounting standard.

We have calculated an illustrative funding schedule for the other post-employment benefits, consistent with the GASB Statement No. 45. This funding schedule is based on the assumption that MWRA funds 100% of the ARC and begins with MWRA's Fiscal Year 2017. Since this schedule assumes full funding, the "funded" rate of 7.50% is used. In line with MWRA's funding policy, the schedule assumes a 30-year <u>open</u> amortization. This means that the UAAL for any year is scheduled to be paid off over 30 years. The full schedule is shown in Section II.

Development of Fully Funded Funding Schedule and Annual Required Contribution

The contribution amount under a fully funded scenario using the 7.50% discount rate for Fiscal 2017 is $10,391,779. Part of this comes from the amortization of the January 1, 2016 Unfunded Actuarial Accrued Liability of $114,324,604. This amount is equal to the base AAL of $131,034,604 less the funding to date of $16,656,000. The UAAL is amortized over a rolling thirty years at the rate of assumed payroll increase due to inflation (3.00%). This means that the amortization period for every year is 30 years. The funding contribution is the amortization payment plus the projected normal cost. As noted earlier, under the GASB Statement No. 45, thirty years is the maximum amortization period allowed. Shorter periods of time and/or other amortization patterns could be considered. The thirty-year funding schedule shown produces the lowest possible initial fiscal year contribution under the GASB parameters. It should be noted that the contribution is assumed to be made at the beginning of the fiscal year, so the first contribution is assumed to be made July 1, 2017. The amount of the amortization payment in the first year is $6,621,438. This figure also uses a 3.00% increasing amortization. For the purposes of this schedule, we have not adjusted the January 1, 2016 liability for timing by applying interest to bring it to any future date. Yearly contributions will increase, as both normal cost and amortization payments increase each year. The remaining part of the ARC is the cost of the current year's benefit accrual, the normal cost, of $3,770,341. Note that these figures have all been adjusted to the 2017 Fiscal Year.

Cash Flow Consideration

We have analyzed the cash flow of a funded other post-employment medical trust by comparing the expected payouts of claims over the thirty-year period to expected contribution levels. If the actuarial assumptions are met, the funded amounts will be sufficient to cover annual benefit payments each year. Prior to adopting a funding schedule we recommend additional analysis be conducted to examine the effects of potential actuarial gains and losses on the cash flow.

FUNDING VERSUS PAY-AS-YOU-GO VERSUS PARTIAL FUNDING

Currently, most Massachusetts governmental entities are paying for their post-employment medical benefits on a pay-as-you-go basis. This means that no amount in excess of the actual cost for the year is paid. All such entities must report figures for GASB Statement No. 45 based on the unfunded discount rate. Up until Fiscal 2015 MWRA elected to follow this course of action. However, starting in Fiscal Year 2015, MWRA began funding its OPEB liability. There was a one-time additional payment of $10.8 million in FY 2015. Thereafter, MWRA's additional contribution will be 50% of the fully funded ARC. The exception to this is FY 2016, where we have used a figure of $5.1 million. Thus, MWRA will become a partially funded system.

As can be seen in the funding schedule, the retiree medical plan's normal cost will increase each year, so that by the time the initial unfunded liability is fully amortized, the required annual contribution will be substantially higher than is illustrated here for the first year. The pay-as-you-go costs will also increase dramatically as more and more employees retire. A projection of annual expected retiree pay-as-you-go costs is included with the funding schedule.

It is very important to understand that, in order to utilize the higher discount rate that goes with the partially funded scenario, there must be a "Funding Policy." That is, the Authority must intend to continue to make payments and, in the future, must actually make them. Thus, it will be necessary for MWRA to establish a long-term policy in order to reduce the interest rate. As the figures above illustrate clearly, there is an iterative relationship between the degree of funding and the amounts that must be shown as liabilities, amortization payments, and normal cost figures. Lower funding levels lead to higher amounts for these key figures.

The partial subsidy of prescription drug benefit costs that is available under the Medicare Prescription Drug, Improvement and Modernization Act of 2003 is a potential source of funds for a portion of the retiree medical costs. To the extent that this subsidy reimburses MWRA for drug benefits it would already be paying for, the additional cash from the subsidy could be used to help pre-fund future benefits. The magnitude of any future subsidy is only a small portion of the additional cost to fund. Other plan design changes, such as a carve-out of prescription drug coverage or an Employer Group Waiver Plan (EGWP), may yield greater opportunities for savings.

DETERMINATION OF THE NET OPEB OBLIGATION (NOO)

The Statement does not require MWRA to put its entire Actuarial Accrued Liability on its books immediately as a liability. Rather, a cost is applied to its net assets each year. Over time this cost, which is called the OPEB Cost, will add up to the total liability. The total liability at any point in time is called the Net OPEB Obligation (NOO). For the first year of funding, the OPEB Cost and ARC are identical. Amounts contributed toward the cost of other post-employment benefits must then be deducted. These amounts include:

1) actual premiums paid;

2) the extra implied costs or "implicit subsidy" associated with covering retirees;

3) any additional amounts paid during the year.

The Net OPEB Cost is the OPEB Cost less these amounts. For year one, where there was no prior NOO on the financial statement, the Net OPEB Cost was the same as the Net OPEB Obligation. Starting with year two, the OPEB Cost must recognize not only the Normal Cost and Amortization Cost for the year but also add interest on the prior year's NOO as well as subtract the Annual Required Contribution (ARC) adjustment to prevent double counting the amortization of the prior year's NOO. The interest and the ARC adjustments somewhat offset each other so the net impact is not large. The total contributions are then subtracted from the OPEB Cost and the result is added to the prior year's NOO. In this manner, the difference between each year's ARC and the contributions are accumulated.

The unfunded actuarial accrued liability as of January 1, 2016 projected to 2017 under the assumption of partial funding, would be $124,001,826. This is the case as of this date, since MWRA has made some payments above the pay-as-you-go level but has not funded the full ARC. The following chart illustrates the ARC, Pay-As-You-Go Cost, Annual OPEB Cost, and Net OPEB Obligation for the years 2009 through 2017 under the partially funded scenario. It reflects a contribution for Fiscal 2017 of $4.9 million. It also assumes an intent to continue funding at an amount equal to 50% of that year's fully funded ARC. The Annual OPEB cost is the ARC plus an adjustment for interest not included in the ARC calculation. The Net OPEB Obligation is the accumulation of the Annual OPEB Cost minus any contributions. This is the amount that is subtracted from the Net Assets on MWRA's balance sheet. The rate used for interest is the 7.00% partially funded rate. Relevant figures have been adjusted for timing to bring them to the end of the Fiscal year.

Calculation of Net OPEB Obligation

"Funding" Schedule at 7.00% (reflects values at end year starting in 2015)

Fiscal Year	UAAL	Normal Cost	Amort. (2)	ARC	Interest on NOO	ARC Adjust.	OPEB Cost	Total Contribs.(3)	Change in NOO	NOO(4)
2008(1)	NA	NA	NA	$15,120,000	$0	$0	$15,120,000	$1,694,000	$13,426,000	$13,426,000
2009(1)	$180,833,263	$10,668,006	$6,886,336	$17,554,342	$570,605	$511,272	$17,613,675	$1,805,756	$15,807,919	$29,233,919
2010(1)	$197,796,344	$11,121,396	$7,774,169	$18,895,565	$1,242,442	$1,149,132	$18,988,875	$2,150,963	$16,837,912	$46,071,830
2011(1)	$192,096,039	$9,391,532	$8,041,730	$17,433,262	$1,958,053	$1,928,708	$17,462,607	$3,293,314	$14,169,293	$60,241,123
2012(1)	$206,688,224	$10,206,776	$8,944,030	$19,150,806	$2,560,248	$2,606,817	$19,104,236	$3,985,758	$15,118,478	$75,359,601
2013(1)	$179,595,209	$7,330,213	$7,151,566	$14,481,779	$3,202,783	$2,878,751	$14,805,811	$2,813,306	$11,992,505	$87,352,106
2014(1)	$194,558,218	$7,641,747	$7,979,030	$15,620,777	$3,712,465	$3,436,119	$15,897,122	$3,492,720	$12,404,402	$99,756,508
2015	$166,492,689	$5,624,956	$8,938,671	$14,563,627	$6,484,173	$5,355,734	$15,692,066	$14,851,926	$840,140	$100,596,648
2016	$167,744,437	$5,990,578	$9,005,875	$14,996,453	$6,538,782	$5,400,840	$16,134,395	$9,804,447	$6,329,949	$106,926,597
2017	$124,001,826	$4,142,351	$6,805,648	$10,947,999	$7,484,682	$5,868,501	$12,564,360	$9,115,860	$3,448,500	$110,375,097

[1] Figures for 2008-2016 (boxed area) from MWRA financial statements.
[2] A 30-year open amortization is used for all years starting in 2015
[3] For all years, Total Contributions are equal to the attributed premiums paid including the implicit subsidy plus additional contributions made by MWRA. The schedule we used for these additional amounts was as follows:

2017: $ 5.1 million (includes approximately $124k actually contributed in FY 2016 but not shown on MWRA's financial statements for 2016)
2017+ (not shown): An additional amount equal to 50% of the fully funded ARC
Note that amounts will need to be recalculated if cash contributions are different from these expected amounts.

[4] NOO = Net OPEB Obligation

Calculation of Net OPEB Obligation (Alternative Presentation)

	Fiscal 2017	Fiscal 2016	Fiscal 2015[1]	Fiscal 2014[1]	Fiscal 2013[1]	Fiscal 2012[1]	Fiscal 2011[1]
AAL	$140,657,826	$178,544,437	$166,492,689	$194,558,218	$179,595,209	$206,688,224	$192,096,039
Assets	$16,656,000	$10,800,000	$0	$0	$0	$0	$0
UAL	$124,001,826	$167,744,437	$166,492,689	$194,558,218	$179,595,209	$206,688,224	NA
Service Cost	$4,142,351	$5,990,578	$5,624,956	$7,641,747	$7,330,213	$10,206,776	$9,391,532
Amortization of unfunded accrued liability	$6,805,648	$9,005,875	$8,938,671	$7,979,030	$7,151,566	$8,944,030	$8,041,730
ARC	$10,947,999	$14,996,453	$14,563,627	$15,620,777	$14,481,779	$19,150,806	$17,433,262
Interest on NOO (+)	$7,484,862	$6,538,782	$6,484,173	$3,712,465	$3,202,783	$2,560,248	$1,958,053
ARC Adjustment (-)	$5,868,501	$5,400,840	$5,355,734	$3,436,119	$2,878,751	$2,606,817	$1,928,708
OPEB Cost	$12,564,360	$16,134,395	$15,692,066	$15,897,123	$14,805,811	$19,104,236	$17,462,607
Premiums and Implicit Subsidy Paid	$4,114,962	$4,704,447	$4,051,926	$3,492,720	$2,813,306	$3,985,758	$3,293,314
Cash contributions[2]	$5,000,898	$5,100,000	$10,800,000	$0	$0	$0	$0
Total Contributions	$9,115,860	$9,804,447	$14,851,926	$3,492,720	$2,813,306	$3,985,758	$3,293,314
Change in NOO	$3,448,500	$6,329,949	$840,140	$12,404,402	$11,992,505	$15,118,478	$14,169,293
NOO Beginning of Fiscal Year	$106,926,597	$100,596,648	$99,756,508	$87,352,106	$75,359,601	$60,241,123	$46,071,830
NOO End of Fiscal Year	$110,375,097	$106,926,597	$100,596,648	$99,756,508	$87,352,106	$75,359,601	$60,241,123

(1) Boxed area for Fiscal Years 2011 through 2016 based on MWRA's financial statements.

(2) See footnote (3) on prior page.

Implementation

According to the GASB Statement No. 45, its provisions are effective for MWRA fiscal years beginning after December 15, 2007. The timing is due to MWRA being a "Tier 2" government under GASB 45. In the first fiscal year of adoption, Fiscal 2008, MWRA recorded a liability of $13,426,000 on its balance sheet. MWRA's contributions (including benefit payments) for other post-employment benefits were less than the Annual Required Contribution ("ARC") determined in accordance with the GASB standard and described above. By the end of Fiscal 2016, MWRA had recorded a figure of $106,926,597 for its NOO.

This report provides similar information for FY 2017. This liability would also reflect interest on any prior funding deficiencies. The total actuarial liability is determined by a valuation to be performed at least every two years. The total actuarial liability is reduced by any assets set aside to pre-fund the post-retirement benefits, with the resulting unfunded actuarial liability being amortized according to a funding schedule similar to that illustrated in this report.

To be considered a funded system, the plan assets must be "segregated and restricted in a trust, or equivalent arrangement, in which (a) employer contributions to the plan are irrevocable, (b) assets are dedicated to providing benefits to retirees and their beneficiaries, and (c) assets are legally protected from creditors of the employers or plan administrator, for the payment of benefits in accordance with the terms of the plan." (GASB 45, p. 47, "Plan Assets"). MWRA has informed us that its trust fund satisfies the GASB Statement Number 45 requirements for such funds.

For FY2018 and after, GASB Statement Number 75 would apply. Some of the assumptions and methodologies used to comply with GASB Statement 75 differ from the ones used in this valuation. The new statement requires that the entire Unfunded Actuarial Accrued Liability (called a Net OPEB Liability) be reflected in the Authority's Statement of Net Assets. Additionally, an expense amount is developed and will be shown on the financial statement. GASB Statement 75 is comparable to GASB Statement 68 for retirement plans.

Recommendations and Comments

Post-employment medical benefits are a significant long-term liability that is only now starting to be addressed by Massachusetts governmental employers. In managing this liability, any governmental entity needs to consider the parameters that can significantly influence the level of the liability. To facilitate such a review, we recommend that MWRA maintain a continuing group that is cognizant of the relevant financial and employee benefits issues raised by GASB Statement No. 45 that will provide leadership to the Authority. We would recommend that the group review the following:

FUNDING POLICY

As previously discussed, the funding policy is critical to the valuation not only because it impacts the funds backing the liability but also because it impacts the discount rate that is used to calculate all of the relevant figures. MWRA needs to bear in mind that it is the formulation of a funding policy that is essential, not simply the contribution of funds. Of course, if a funding policy is developed, it needs to be implemented, not just formulated. We recommend that the Authority review its funding policy each year, especially now that it is funding.

PLAN DESIGN

One of the major factors influencing costs is the design of the plans that MWRA offers to retirees. To the extent that any part of these plans changes materially, costs may either increase or decrease.

In order to keep costs under control, the Authority should review the design of all its medical plans annually. Changes in plan characteristics such as deductibles, coinsurance levels, out-of-pocket maximums, and covered services can help mitigate the impacts of ever-increasing medical costs or amplify these costs. In addition, the Authority should review the networks it is using to be sure that it is getting the most competitive reimbursement levels available.

CONTRIBUTION LEVELS

The extent to which the Authority subsidizes the cost of retiree benefits is one of the most significant factors in the ultimate costs. Currently, retired MWRA is a participant in the Massachusetts GIC. Authority employees and their spouses pay between 10% and about 20% of the premium cost (100% for the CIC piece if applicable) for their retiree medical insurance depending upon their date of retirement. These contribution levels are on the low side for Massachusetts governmental entities. The lower end of employee contribution rates is in the 10%-15% range. The average contribution rate is around 25%. 50% is the highest amount that can be asked of retirees. Contribution levels (like benefit levels) have a double impact on costs. First off, there is a direct relationship between contributions and costs in that higher contribution levels mean that more of the cost of the plan is borne by the Authority. Secondly, higher contribution levels lead to higher participation rates because the plan becomes less costly to the retiree. In the case of governmental entities where a substantial portion of the medical costs are paid by the employer, participation rates tend to be very high. MWRA's participation level of 80.0% is in line with its contribution requirements.

In general, a well subsidized plan will have many participants enrolled at a high cost. Also, to the extent that other employers are cutting back or eliminating their programs, there is increased likelihood that a favorably subsidized plan will be elected by retirees, since no coverage or only more expensive coverage may be available from other sources such as their spouse's employer. There was a definite move toward reducing the subsidies paid by Massachusetts public entities that seems to have slowed recently.

EILIGIBILITY

The extent to which retirees are eligible for benefits is another variable that directly impacts costs. MWRA should review its eligibility criteria each year to be sure that they are in accord with Authority goals for controlling costs and for providing well-deserved benefits for those who have worked for the Authority. Retirement system policies can also affect the eligibility for benefits. In the case of MWRA, the Authority does pay for medical benefits for those who reach ten years of service even if such people do not retire from the Authority immediately upon separation from service. This will produce a higher liability and ARC for MWRA than if only those actually retiring from the Authority were covered.

In addition to reviewing the above items regularly, we recommend that the Authority continue working toward an organized method of keeping its data. This is an issue faced by virtually all public entities with respect to GASB Statement No. 45. Some of the typical issues are:

- Be sure that it has a record of those eligible for coverage who do not take coverage. This should cover not only actives who are not enrolled but retired employees who opted out.

- To the extent possible, make sure that all databases can be tied together by a single identifier, such as social security number or employee number. Some entities keep certain data by, for example, social security number, but organize other data on some other basis. This greatly increases the time and effort to tie all the relevant pieces of data together. This need is particularly acute when the records for those in the Authority are not kept by MWRA directly. It is helpful when consistent names are used in the databases, as well as full social security numbers, so that duplicates from the various databases can be checked against each other.

SECTION II - ACTUARIAL VALUATION DETAILS

Population Data

A. DISTRIBUTION BY AGE: RETIREES, BENEFICIARIES, AND SURVIVORS
(Includes retirees with life only or no coverage)

Age	Total
0-19	0
20-24	0
25-29	0
30-34	0
35-39	2
40-44	1
45-49	15
50-54	30
55-59	59
60-64	110
65-69	204
70-74	151
75-79	90
80-84	54
85-89	15
90-94	1
95-99	0
100+	0
TOTAL	732

Includes retirees who are eligible for medical or with life coverage in addition to terminated vesteds, beneficiaries, and survivors with medical coverage.

B. ACTIVE PARTICIPANTS

OF PARTICIPANTS*

Current Plan	Mandatory Medicare Eligible	Pre-Mandatory Medicare Eligible	Total
No Medical/ Unknown	128	1	129
Indemnity	87	2	89
Managed Care	864	7	871
TOTAL	1,079	10	1,089

* "Pre-Mandatory Medicare eligible" means hired March 31, 1986 or before. "Mandatory Medicare eligible" means hired after March 31, 1986. Employees hired March 31, 1986 or before do not contribute to Medicare.

C. PLAN DEFINITION TABLE(1)

Name of Plan	Type of Plan	Ind Rate	Retirees Enrolled	Fam Rate	Retirees Enrolled	EE Cont % (2)
Fallon Select	Commercial Managed Care	$652.35	1	$1,565.65	0	10%/15%/20%
HP Independence	Commercial Managed Care	$746.40	21	$1,821.20	13	10%/15%/20%
HP Primary Choice	Commercial Managed Care	$597.10	1	$1,456.95	1	10%/15%/20%
NHP Prime	Commercial Managed Care	$468.85	0	$1,242.40	1	10%/15%/20%
Tufts Navigator	Commercial Managed Care	$656.60	20	$1,603.20	19	10%/15%/20%
Unicare Community Choice	Commercial Managed Care	$470.40	4	$1,131.75	1	10%/15%/20%
Unicare Plus	Commercial Managed Care	$653.05	5	$1,560.65	6	10%/15%/20%
Unicare Basic With CIC	Commercial Indemnity	$970.76	21	$2,272.63	12	10%/15%/20%
Fallon Senior Plan	Medicare Managed Care	$300.95	2	$300.95	NA	10%/15%/20%
Tufts Medicare Complement	Medicare Managed Care	$352.50	81	$352.50	NA	10%/15%/20%
HP Medicare Enhance	Medicare Indemnity	$390.70	53	$390.70	NA	10%/15%/20%
Unicare OME With CIC	Medicare Indemnity	$385.37	229	$385.37	NA	10%/15%/20%
Life ($5,000)	Life	$6.50	404	NA	NA	10%/15%/20%

(1) Rates at 1/1/2016. Only plans with retiree enrollment shown.
(2) Retirees pay 100% of the CIC piece of the indemnity plans.

C. DISTRIBUTION BY AGE AND SERVICE: ACTIVE PARTICIPANTS

Age Group	0-4	5-9	10-15	15-19	20-24	25-29	30-34	35-39	40+	Total
0-19	0	0	0	0	0	0	0	0	0	0
20-24	10	0	0	0	0	0	0	0	0	10
25-29	40	4	0	0	0	0	0	0	0	44
30-34	24	10	2	0	0	0	0	0	0	36
35-39	21	10	11	1	0	0	0	0	0	43
40-44	33	21	8	12	9	2	0	0	0	85
45-49	33	13	11	25	43	26	0	0	0	151
50-54	43	14	19	25	40	97	11	1	0	250
55-59	25	12	16	27	36	85	14	1	0	216
60-64	17	5	19	19	30	67	11	5	0	173
65-69	11	3	3	7	11	21	4	2	0	62
70-74	0	2	0	1	3	6	1	0	1	14
75-79	1	0	0	3	0	1	0	0	0	5
80-84	0	0	0	0	0	0	0	0	0	0
85-89	0	0	0	0	0	0	0	0	0	0
90-94	0	0	0	0	0	0	0	0	0	0
95-99	0	0	0	0	0	0	0	0	0	0
100+	0	0	0	0	0	0	0	0	0	0
TOTAL	258	94	89	120	172	305	41	9	1	1,089

Summary of Results

Grand Total Actives	
- Already in Medicare	0
- Pre-Mandatory Medicare Coverage	10
- Post-Mandatory Medicare Coverage	1,079
Total	1,089
Retired, Disabled, Survivors and Beneficiaries	689
Terminated Vesteds	43

	At 7.00% discount rate projected to FY 2017
Active Employees	$79,684,480
Current Retirees	$60,973,346
TOTAL	$140,657,826
Funding to date as of January 1, 2016	$16,656,000
UAAL as of January 1, 2016	$124,001,826
Normal (Service) Cost as of January 1, 2016	$4,142,351
30-yr amortization of UAAL	$6,805,648
ARC	$10,947,999

Expected Claims

- Fiscal 2017 : $3,978,084

Schedule of Funding Progress Other Post-Employment Benefits (Dollars in Thousands)

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) [Projected Unit Credit] (b)	Unfunded AAL (UAAL) (b-a)	Funded Ratio (a/b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll (b-a)/c)
1/1/2006	$0	$154,449	$154,449	0%	$72,476	213.1%
1/1/2008	$0	$180,833	$180,833	0%	$79,298	228.0%
1/1/2010	$0	$192,096	$192,096	0%	$81,372	236.1%
1/1/2012	$0	$179,595	$179,595	0%	$82,679	217.2%
1/1/2014	$0	$166,493	$166,493	0%	$85,993	193.6%
1/1/2016	$10,827	$131,430	$120,604	8.2%	$96,118	115.9%

Funding Schedule

30 Years at 7.50% with a 30-Year open amortization

Fiscal Year	Normal Cost[1]	Amortization[2]	Contribution	Year-End UAAL	Projected Annual Benefit Cost[3]
2017	$3,770,341	$6,621,438	$10,391,779	$115,780,904	$4,124,565
2018	$4,053,117	$6,705,784	$10,758,900	$117,255,754	$4,700,204
2019	$4,357,100	$6,791,204	$11,148,304	$118,749,392	$5,414,222
2020	$4,683,883	$6,877,712	$11,561,595	$120,262,056	$5,995,430
2021	$5,035,174	$6,965,322	$12,000,496	$121,793,989	$6,531,967
2022	$5,412,812	$7,054,049	$12,466,861	$123,345,435	$7,074,686
2023	$5,818,773	$7,143,905	$12,962,678	$124,916,645	$7,617,905
2024	$6,255,181	$7,234,906	$13,490,087	$126,507,869	$8,186,402
2025	$6,724,320	$7,327,067	$14,051,386	$128,119,363	$8,650,015
2026	$7,228,644	$7,420,401	$14,649,044	$129,751,384	$9,227,984
2027	$7,770,792	$7,514,924	$15,285,716	$131,404,195	$9,705,730
2028	$8,353,601	$7,610,651	$15,964,253	$133,078,059	$10,092,832
2029	$8,980,121	$7,707,598	$16,687,719	$134,773,246	$10,625,728
2030	$9,653,630	$7,805,780	$17,459,410	$136,490,026	$10,948,296
2031	$10,377,653	$7,905,212	$18,282,865	$138,228,675	$11,159,469
2032	$11,155,977	$8,005,911	$19,161,887	$139,989,472	$11,579,130
2033	$11,992,675	$8,107,892	$20,100,567	$141,772,698	$11,658,753
2034	$12,892,126	$8,211,173	$21,103,299	$143,578,639	$12,085,333
2035	$13,859,035	$8,315,769	$22,174,804	$145,407,585	$12,339,499
2036	$14,898,463	$8,421,698	$23,320,161	$147,259,829	$12,667,178
2037	$16,015,847	$8,528,976	$24,544,823	$149,135,667	$12,984,837
2038	$17,217,036	$8,637,620	$25,854,656	$151,035,400	$13,305,209
2039	$18,508,314	$8,747,649	$27,255,963	$152,959,333	$13,610,861
2040	$19,896,437	$8,859,079	$28,755,516	$154,907,773	$13,888,429
2041	$21,388,670	$8,971,929	$30,360,598	$156,881,032	$14,145,343
2042	$22,992,820	$9,086,216	$32,079,036	$158,879,428	$14,365,608
2043	$24,717,282	$9,201,958	$33,919,240	$160,903,280	$14,474,444
2044	$26,571,078	$9,319,176	$35,890,253	$162,952,912	$14,563,684
2045	$28,563,909	$9,437,886	$38,001,795	$165,028,653	$14,560,270
2046	$30,706,202	$9,558,108	$40,264,310	$167,130,836	$14,535,117

[1]Assumes 7.50%%% annual increase in normal cost and a static group of actives.

[2]Assumes 3.00%% annual increase in the open amortization payment.

[3]The Pay-As-You-Go amount is for the current group of actives and retirees and is shown for the calendar year. It does not include any future hires. It is not directly comparable to the funding contribution but it included for illustrative purposes only. It does illustrate in the short-term, the estimated amount of claims costs for retirees. However, the retiree amount is expected to grow as new employees retire or become disabled.

Sensitivity Analysis

The results of any actuarial valuation are sensitive to the assumptions used. That is, a change in an actuarial assumption will produce a change in the actuarial accrued liability and/or normal cost each year of the valuation. To illustrate this sensitivity, we performed valuations in which we changed two different inputs: the trend rate and the discount rate.

TREND RATE SENSITIVITY

For postretirement medical plans in particular, the calculated actuarial values are highly sensitive to the assumed rate of health care cost trend. This is due to the compounding effect of the annual trend rates assumed for medical costs, as opposed to pension valuations where benefit levels typically remain fixed.

The following table illustrates the effect on our valuation results of a 1% increase or decrease in the assumed rates of health care cost trend in each year. The base scenario uses the unfunded discount rate of 7.00% and uses the figures adjusted to FY 2017.

Health Care Cost Trend Rates

	As Reported (7.00%)	+1% Each Year	-1% Each Year
Liability for:			
▪ Current Actives(Future Retirees)	$79,684,480	$95,793,891	$67,054,476
▪ Current Retirees, Beneficiaries, and Survivors	$60,973,346	$68,884,545	$54,373,948
Total AAL	$140,657,826	$164,678,436	$121,428,424
Normal Cost	$4,142,351	$5,093,787	$3,414,640
Annual Required Contribution for Fiscal Year 2017:	$10,947,999	$13,217,769	$9,164,912

The cumulative effect of a 1% increase in health care cost trend increases the AAL by approximately 17%, the normal cost by 23%, and the ARC by 21%. A 1% decrease in trend would decrease the AAL by14%, the normal cost by 18% and the ARC by 16%.

There is the likelihood – based on historical experience – of significant deviations from the smooth rates of health care cost increase typically projected in any actuarial valuation. Therefore, emerging experience under the plan is likely to differ from the assumptions made as of any valuation date. This will produce actuarial gains and losses each year, even if the underlying assumptions remain reasonable for the future. Amortization of gains and losses will affect the updated funding schedule calculated at any point in the future.

DISCOUNT RATE SENSITIVITY

We also examined the sensitivity of the various key numbers to changes in the discount rate. For this testing, we varied the discount rate by 0.50%, or in other words, we used rates of 6.50% and 7.50%. The following table shows the results we obtained. It also uses figures adjusted to fiscal year 2017.

	Discount Rates		
	As Reported (7.00%)	Minus 0.50% (6.50%)	Plus 0.50% (7.50%)
Liability for:			
▪ Current Actives(Future Retirees)	$79,684,480	$86,929,697	$73,278,690
▪ Current Retirees, Beneficiaries, and Survivors	$60,973,346	$64,532,032	$57,755,915
Total AAL	$140,657,826	$151,461,729	$131,034,604
Normal Cost	$4,142,351	$4,568,198	$3,770,341
Annual Required Contribution for Fiscal Year 2017:	$10,947,999	$11,569,443	$10,391,779

Thus, the cumulative effect of a 0.50% decrease in the discount rate is to increase the AAL by approximately 8%, the normal cost by 10%, and the ARC by 6%. A 0.50% increase in the discount rate would decrease the AAL by 7%, the normal cost by 9% and the ARC by 5%. It is prudent, and GASB Statement No. 45 requires, an updated actuarial valuation be performed periodically. For an entity of MWRA's size, a new valuation will be required at least every two years.

Actuarial Methods and Assumptions

ACTUARIAL METHODS

Actuarial Cost Method

Costs are attributed between past and future service using the Projected Unit Credit cost method. For attribution purposes, benefits are assumed to accrue over all employee service until decrement.

Interest Rate / Discount Rate

7.00% per year discount rate for the partially funded program.

Amortization Method

Open 30 year amortization. Uses level percentage of payroll (using a 3.00% annual rate of increase).

Asset Valuation Method

Market value of assets.

ACTUARIAL ASSUMPTIONS

Valuation Date

January 1, 2016

Mortality

- Actives: The RP-2014 at 2006 Mortality Tables (Sex-distinct) for Employees projected using generational mortality and scale MP-2016.
- Retirees: The RP-2014 Mortality Tables (Sex-distinct) for Healthy Annuitants projected using generational mortality and scale MP-2016.
- Disabled: The RP-2000 Mortality Tables (Sex-distinct) for Healthy Annuitants projected using generational mortality and scale MP-2016. Set forward 2 years

No additional mortality projection is assumed other than as described above.

Actuarial Methods and Assumptions (Continued)

Withdrawal Prior to Retirement

Based on years of service. Same for both pre and post-April 1, 2012 hires.

Years of Service	All Employees
0	15.00%
1	12.00%
2	10.00%
3	9.00%
4	8.00%
5	7.60%
6	7.50%
7	6.70%
8	6.30%
9	5.90%
10	5.40%
11	5.00%
12	4.60%
13	4.10%
14	3.70%
15	3.30%
16	2.00%
17	2.00%
18	2.00%
19	2.00%
20	2.00%
21	1.00%
22	1.00%
23	1.00%
24	1.00%
25	1.00%
26	1.00%
27	1.00%
28	1.00%
29	1.00%
30+	0.00%

Actuarial Methods and Assumptions (Continued)

Eligibility for Vested Post-Retirement Medical Benefits upon Withdrawal

10 years of Service; assumed that individuals who withdraw prior to age 40 will elect a return of pension contributions and therefore be ineligible for retiree medical coverage

Disability Prior to Retirement

The rates shown at the following sample ages illustrate the assumption regarding the incidence of disability. Disability is assumed to be 55% ordinary and 45% accidental.

Age	All Employees
20	0.01%
25	0.02%
30	0.03%
35	0.06%
40	0.10%
45	0.15%
50	0.19%
55	0.24%
60	0.28%

Medicare Eligibility

- Employees: 100% if hired March 31, 1986 or after; 85% if hired pre-March 31, 1986
- Spouses: 100%

Age	Commercial Managed Care Individual	Commercial Managed Care Blended[1]	Commercial Indemnity Individual	Commercial Indemnity Blended[1]	Medicare Managed Care	Medicare Indemnity
55	$7,838.68	$14,111.94	$9,990.46	$17,822.65	$2,492.24	$2,635.00
60	$9,354.96	$16,841.68	$11,922.96	$21,270.17	$2,974.32	$3,144.70
65	$11,491.60	$21,106.29	$14,646.12	$26,650.12	$3,653.65	$3,862.94
70	$13,321.91	$24,467.98	$16,978.87	$30,894.80	$4,235.58	$4,478.21
75	$15,072.52	$27,683.27	$19,210.04	$34,954.63	$4,792.17	$5,066.68
80	$16,641.28	$30,564.57	$21,209.43	$38,592.73	$5,290.94	$5,594.03
85	$17,490.15	$17,490.15	$22,291.33	$22,291.33	$5,560.84	$5,879.38

(1) Blended rates below 65 are 55% Family and 45% Individual. Blended rates 65 and higher are 55% Family and 45% Individual. Individual rates are used for all participants 81 and higher.

Actuarial Methods and Assumptions (Continued)

Rates of Retirement

Based on gender, group, and hire date.

	Hired Pre-April 2, 2012		Hired Post-April 1, 2012	
Age	All Employees Male	All Employees Female	All Employees Male	All Employees Female
50	1.00%	1.50%	-	-
51	1.00%	1.50%	-	-
52	1.00%	2.00%	-	-
53	1.00%	2.50%	-	-
54	2.00%	2.50%	-	-
55	2.00%	5.50%	-	-
56	2.50%	6.50%	-	-
57	2.50%	6.50%	-	-
58	5.00%	6.50%	-	-
59	6.50%	6.50%	-	-
60	12.00%	5.00%	30.00%	30.00%
61	20.00%	13.00%	20.00%	10.00%
62	30.00%	15.00%	15.00%	12.00%
63	25.00%	12.50%	25.00%	10.00%
64	22.00%	18.00%	20.00%	15.00%
65	40.00%	15.00%	25.00%	13.00%
66	25.00%	20.00%	20.00%	18.00%
67	25.00%	20.00%	50.00%	40.00%
68	30.00%	25.00%	30.00%	25.00%
69	30.00%	20.00%	30.00%	25.00%
70	100.00%	100.00%	100.00%	100.00%

Actuarial Methods and Assumptions (Continued)

Trend Rates by Plan

Year	Commercial Managed Care	Commercial Indemnity	Medicare Managed Care	Medicare Indemnity
2016	5.25%	3.25%	12.99%	0.10%
2017	8.00%	9.00%	7.00%	8.00%
2018	7.50%	8.50%	6.50%	7.50%
2019	7.00%	8.00%	6.00%	7.00%
2020	6.50%	7.50%	5.50%	6.50%
2021	6.00%	7.00%	5.00%	6.00%
2022	5.50%	6.50%	5.00%	6.00%
2023	5.00%	6.00%	5.00%	6.00%
2024	5.00%	6.00%	5.00%	6.00%
2025	5.00%	6.00%	5.00%	6.00%
2026	5.00%	5.75%	5.00%	6.00%
2027	5.00%	5.75%	5.00%	6.00%
2028	5.00%	5.75%	5.00%	5.75%
2029	5.00%	5.50%	5.00%	5.75%
2030	5.00%	5.50%	5.00%	5.75%
2031	5.00%	5.50%	5.00%	5.75%
2032	5.00%	5.25%	5.00%	5.75%
2033	5.00%	5.25%	5.00%	5.50%
2034	5.00%	5.00%	5.00%	5.50%
2035	5.00%	5.00%	5.00%	5.50%
2036	5.00%	5.00%	5.00%	5.50%
2037	5.00%	5.00%	5.00%	5.50%
2038	5.00%	5.00%	5.00%	5.25%
2039	5.00%	5.00%	5.00%	5.25%
2040	5.00%	5.00%	5.00%	5.25%
2041	5.00%	5.00%	5.00%	5.25%
2042	5.00%	5.00%	5.00%	5.25%
2043	5.00%	5.00%	5.00%	5.00%

Plan Enrollment Rates

These are the rates are which retirees select medical plans, given that they enroll in a medical plan. The selection patterns follow the table on page 11.

Projections

The January 1, 2016 valuation was adjusted for timing to show end of the year figures when determining the funding schedule.

Actuarial Methods and Assumptions (Continued)

Participation Rates

Current retirees and spouses are assumed to continue the same coverage they have as of the valuation date. No future election of coverage is assumed for those retirees and spouses who currently have not elected coverage.

Medical All Retirees: 80.0% of the active employees eligible for post-employment medical benefits are assumed to elect Medical Coverage immediately upon retirement.

Life All Retirees: 90% of active employees eligible for post-employment medical benefits are assumed to elect Life Insurance coverage immediately upon retirement.

For all Retirees: For the Authority plans 75% of spouses are assumed to participate.

Participants with no or unknown current coverage (e.g. active employees who do not currently participate in MWRA's medical plans) are assumed to elect retiree coverage at the same rates as currently covered active employees. Medicare-eligible retirees currently under age 65 are assumed to elect a Medicare plan option at age 65.

Expenses

Administrative expenses are included in the per capita medical cost assumption.

Section 9 ½ of Chapter 32B

No current or future payments or receipts are assumed due to past service or future service with other Chapter 32 entities.

PPACA

This valuation does not include any potential impact from the Patient Protection and Affordable Care Act (PPACA) other than those already adopted as of the valuation date. This includes new plans or taxes including the so-called "Cadillac Tax" high-cost health plans. The Cadillac Tax on benefits plans whose richness exceeds set levels will not begin until 2018. Prior to this time, the law may be amended or changes may be made in the benefit plan such that the law will not be applicable. In view of these uncertainties, we have elected not to try to estimate the Act's impact on costs and trends.

Contribution Timing

Contributions are assumed to be made at the beginning of the year.

Principal Plan Provisions Recognized in Valuation

ELIGIBILITY FOR BENEFITS

Current retirees, beneficiaries and spouses of MWRA are eligible for medical benefits, as are current employees or spouses who retire with a benefit from the MWRA. Survivors of MWRA employees and retirees are also eligible for medical benefits.

MEDICAL BENEFITS

Various medical plans offered by MWRA to its own employees.

LIFE INSURANCE

MWRA retirees are eligible for a $5,000 life insurance benefit offered by MWRA though the Massachusetts GIC. Retirees pay 10% to 20% of the $6.50 cost depending upon the person's retirement date.

RETIREE CONTRIBUTIONS

Based on data provided by MWRA.

Glossary

- Actuarial Accrued Liability: The portion, as determined by a particular Actuarial Cost Method, of the present value of benefits which is not provided for by future Normal Costs.

- Actuarial Assumptions: Assumptions as to the occurrence of future events affecting Other Post-employment Benefits such as: mortality rates, disability rates, withdrawal rates, and retirement rates, the discount assumption, and the trend rates.

- Actuarial Cost Method: A procedure for determining the Actuarial Present Value of Total Projected benefits and for developing an actuarially equivalent allocation of such value to time periods, usually in the form of a Normal and an Actuarial Accrued Liability.

- Amortization Payment: The portion of the OPEB contribution designed to pay interest and to amortize the Unfunded Actuarial Accrued Liability.

- Annual OPEB Cost: The accrual-basis measure of the periodic cost of an employer's participation in a defined-benefit OPEB plan.

- Annual Required Contribution (ARC): The employer's periodic contributions to a defined benefit OPEB plan, calculated in accordance with the parameters defined in GASB 45. This is defined as the sum of the Normal Cost and the Amortization payment.

- Commercial Plans: Plans designed to cover the medical expenses of those not otherwise covered by Medicare.

- GASB: The Governmental Accounting Standards Board is the organization that establishes financial reporting standards for state and local governments.

- Investment return Assumptions (Discount Rate): The rate used to adjust a series of future benefit payments to reflect the time value of money. Under GASB 45, this rate is related to the degree to which the OPEB program is funded.

- Healthcare Cost Trend Rate: The rate of change in per capita health claims costs over time as a result of factors such as medical inflation, utilization of healthcare services, the intensity of the delivery of services, technological developments, and cost-shifting.

- Medicare Plans: Medical plans sold to those over 65 who are also covered by Medicare. These plans are supplemental to the Medicare plan, which is considered primary.

- Net OPEB Obligation: The cumulative difference, since the effective date of GASB 45, between the annual OPEB cost and the employer's contributions to the plan.

- Normal Cost: The portion of the Actuarial Present value of plan benefits that is allocated to a valuation year by the Actuarial Cost Method.

- OPEB: Other Post-Employment Benefits, other than pensions. This does not include plans such as severance plans or sick-time buyouts.

- Pay-As-You-Go: The amount of benefits paid out to plan participants during the year.

- Per Capita Claims Cost: The current average annual cost of providing postretirement health care benefits per individual.

- Unfunded Actuarial Accrued Liability: The portion of the Actuarial Accrued Liability that is not covered by plan assets. For a plan that is completely unfunded, this amount is equivalent to the Actuarial Accrued Liability.

- Valuation Date: The point from which all future plan experience is projected and as of which all present values are calculated.