MARCH 9, 2016

Report to the Retirement Board of the

Massachusetts Bay Transportation Authority Retirement Fund

CRITICAL THINKING
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SCOPE OF SERVICE

FTI Consulting, Inc. ("FTI") is a global advisory firm that helps companies and their stakeholders protect and enhance enterprise value in an increasingly complex economic, legal, and regulatory environment. We employ more than 4,400 professionals around the globe. FTI professionals work closely with clients to address complex business challenges in areas such as investigations, litigation, mergers and acquisitions, regulatory issues, reputation management, strategic communications and restructuring. Our professionals are some of the most experienced leaders in their fields including: Certified Public Accountants, forensic accountants, certified actuaries, corporate investigation specialists, intellectual property specialists, Nobel Laureate economists, banking and securities professionals, e-discovery professionals, corporate, financial and crisis communications specialists, Chartered Financial Analysts, industry experts and Certified Turnaround Professionals.

FTI was retained by the Retirement Board (the "Board") of the Massachusetts Bay Transportation Authority Retirement Fund (the "MBTARF") to assess certain aspects of the assets, liabilities and investment returns included in the MBTARF's Annual Reports for the calendar years 2011, 2012 and 2013. Unless otherwise noted, the scope of FTI's procedures and observations are limited to these periods. The FTI team included forensic accountants, certified valuation experts and accredited pension plan actuaries.

The results of our work performed to date and the relevant observations are memorialized in this report (the "Report"). In the individual sections of the Report, we set forth the documents reviewed, the procedures performed and our results and observations for each area of inquiry.

The information contained herein has been prepared based upon financial and other data obtained by FTI from the MBTARF and other sources. FTI's work was limited to the specific scope of procedures requested by the Board and the sufficiency of these procedures is solely the responsibility of the Board. Consequently, we make no representation regarding the sufficiency of the procedures described in this Report either for purposes for which this Report has been requested or for any other purpose.

With respect to any financial information, our work did not constitute an examination, review or compilation in accordance with standards established by the American Institute of Certified Public Accountants (“AICPA”).

BACKGROUND

The MBTARF was established on January 1, 1948, under an agreement and declaration of trust (restated on October 28, 1980) (the "Trust Agreement") by and among the predecessor to the Massachusetts Bay Transportation Authority (the "Authority"), Local 589, Amalgamated Transit Union, Boston Carmen's Union and AFL CIO (collectively, the "Union"). The MBTARF is a single employer plan and was established as a contributory defined benefit retirement plan in accordance with an agreement between the Authority and the Union (the "Pension Agreement"); effective July 1, 1970 (restated thereafter) and adopted by the Authority and the Union for the purpose of receiving contributions and providing pension benefits for its members and qualified beneficiaries. The MBTARF covers all employees of the Authority except Massachusetts Bay Transportation Authority police, who are covered separately, and certain executives who elect coverage under an alternate plan. The MBTARF receives contributions from both the Authority and the MBTARF members, and pays earned retirement benefits to the members.

The structure and activities of the MBTARF are governed by the Trust Agreement. The Trust Agreement establishes the Board as the highest authority within the MBTARF. The primary responsibility of the Board is to establish the MBTARF's investment objectives and to invest the MBTARF's assets pursuant to those objectives. Among other things, the Board is also responsible for the selection of a custodian to buy, sell or hold the assets of the MBTARF as directed and the selection of an investment consultant, individual investment managers and an actuary.

In addition to the Board, the MBTARF has approximately ten employees (the "Staff"), including the Executive Director, who are responsible for day-to-day operations. Among other things, the Staff monitors the daily investment activity reported by the custodian; monitors the performance of the individual investment managers; calculates and pays member benefits; and is responsible for the MBTARF's financial reporting. The Staff also work directly with the MBTARF's actuary, investment consultant and other third-party advisors.

EXECUTIVE SUMMARY

We have compared the investment balances included in the MBTARF's Annual Reports as of December 31, 2010, 2011, 2012 and 2013 to the amounts reported by the MBTARF's custodian, State Street Bank ("SSB" or the "Custodian"). We have also compared the price of individual assets reported by SSB to other pricing or valuation sources. We did not identify any significant differences between the amounts reported by the MBTARF and the supporting documentation provided by third parties.

We have compared the MBTARF's investment returns for 2011, 2012 and 2013 as computed by the Custodian to the returns reported in the MBTARF's 2011, 2012 and 2013 Annual Reports noting no significant differences.

Based on our review of the 2011, 2012, 2013 and 2014 actuarial valuations prepared by the MBTARF's actuary, Buck Consultants, LLC ("Buck"), it appears that the process of setting actuarial assumptions and methods conform to Actuarial Standards of Practice and that Buck's recommended assumptions were appropriately adopted by the Board. Further, in our opinion, the mortality rates, projected investment returns and asset smoothing technique used for the 2011, 2012, 2013 and 2014 actuarial valuations were reasonable and appropriately applied. It should also be noted that each of these actuarial assumptions were proposed and recommended by the MBTARF's third-party actuary, Buck.

FUND ASSETS AND INVESTMENT RETURNS

Background

Investment Assets as reported in the MBTARF Annual Report

December 31,	2013	2012	2011	2010
Cash	$40,155,245	$34,170,631	$22,940,812	$16,580,022
Fixed income	329,768,379	310,157,549	318,091,620	315,858,857
Equity	768,014,489	606,766,824	600,584,567	681,455,034
Real estate and alternative investments	466,293,395	481,108,545	440,074,495	470,704,749
TOTAL	$1,604,231,508	$1,432,203,549	$1,381,691,494	$1,484,598,662

Investment Returns as reported in the MBTARF Annual Report

	2013	2012	2011[1]
Total Fund	17.08%	14.93%	1.06%
Domestic Large Cap Equity	32.08	20.10	
Domestic Small Cap Equity	42.25	18.83	
Global Equity and Emerging Markets	29.17	30.41	
International Equity	24.83	20.98	
Fixed Income	0.84	11.81	
Real Estate	14.32	11.55	
Hedge Fund	(4.75)	(1.94)	
Private Equity	14.69	4.91	
Diversified Beta	2.73	3.66	

[1] The MBTARF did not report investment returns for individual asset classes for 2011.

The MBTARF's investments are comprised of cash and cash equivalents, equity (domestic and foreign), and fixed income securities (domestic and foreign) ("Traditional Investments") and real estate, private equity and hedge funds ("Alternative Investments.")

The MBTARF reports the value of its investments at fair value. As stated in the MBTARF's 2013 Annual Report, exchange traded investments are valued at the closing price on the last business day of the reporting period while securities traded over-the-counter (such as fixed income securities) are usually valued at the average of the closing bid and asked prices.

Alternative Investments are valued based on estimates provided by the investment manager and supported by audited financial statements.

The safeguarding and valuation of the MBTARF's Traditional Investments is performed primarily by the Custodian. The Alternative Investments are not held by the Custodian but are accounted for in the Custodian's records. (As discussed below, the Custodian receives investment reports directly from the managers of the Alternative Investments.) The Custodian is also responsible for cash movement directed by the Staff, delivery of monthly reports showing key information such as returns ("Flash Reports") and compliance dashboard and recordkeeping of all Investment Manager (defined below) transactions. SSB also functions as the investment subsidiary ledger for the MBTARF and tracks the performance of the investments and provides performance reports on a monthly and annual basis.

On a monthly basis, SSB sends an Excel spreadsheet of all activity, which captures all trades, cash activity and monthly portfolio pricing to the MBTARF. The Staff reviews the information for accuracy and agrees the amounts to the general ledger within MAS 90 – the accounting software used by the MBTARF. The portfolio balance from SSB is recorded as of each reporting period end.

In addition, also on a monthly basis, SSB's analytical team provides the MBTARF with Flash Reports which include detailed information and monthly and year-to-date performance on each Investment Manager, and total investments and activity over the month. The Flash Report is reviewed by the Staff for accuracy and is reconciled to the monthly Traditional Investment Manager's performance reports. The Flash Reports are provided to the Board on a monthly basis and also used to prepare monthly and quarterly financial reports for the Board as well as the MBTARF Annual Reports.

The securities held by SSB are priced by SSB using independent pricing services. The value of each Alternative Investment is provided by the respective fund administrator for each of the Alternative Investments in the form of a capital account statement. As an independent check on the value of each of its Alternative Investments, the Staff compares the capital account statement to the audited financial statements of the Alternative Investment. The Investment Managers also send capital account statements directly to SSB and the MBTARF's investment consultant, The Marco Consulting Group, Inc. ("Marco.")

The MBTARF outsources a number of investment-related activities to independent investment managers to select the underlying securities in the funds. The investment managers include managers of Traditional and Alternative Investments (the "Investment Managers.") The Investment Managers' primary responsibilities include portfolio management, execution of investment transactions, preparation of reports used by SSB, and preparation of reports used by the MBTARF.

The Board retains Marco as its investment consultant to perform due diligence on Investment Managers prior to selection by the Board, and to monitor the performance of the MBTARF and the individual Investment Managers relative to the objectives and benchmarks set forth in the MBTARF's Investment Policy Statement. Marco presents quarterly and annual investment results to the Board.

FTI's Procedures

The procedures performed on the MBTARF's reported investment assets and investment returns included the following:

For 2010 (year-end balances), 2011, 2012 and 2013:

1. Walk-through, with the Staff, the process for recording investment balances and transactions.

2. Trace and agree investment balances included in the financial statements to trial balances and underlying support.

    a. Obtain MBTARF's schedule of assets held at year-end ("Schedule of Assets") for each year. Use Schedule of Assets to reconcile asset totals to trial balance and financial statements.
    b. Reconcile amounts provided in Schedule of Assets for investments held at SSB to SSB year-end holdings report for the MBTARF.
    c. Trace and agree third-party capital account statements and audited financials (for each Alternative Investment) to Schedule of Assets.

3. Compare the value of investments provided by SSB with values provided by Bloomberg for those investments covered by Bloomberg.

a. Determine securities covered by Bloomberg.
b. Compare prices from SSB to Bloomberg.
c. Investigate differences.
d. For securities not covered by Bloomberg, inquire of SSB for pricing source and review sources.

4. Confirmation of Alternative Investments (including carrying values).

   a. Trace audit confirmations and compare to fair value amounts provided in Schedule of Assets. Reconcile any differences.
   b. Compute sample coverage and judgmentally select additional Investment Managers for confirmation.

5. Confirmation of publicly traded securities held by SSB.

   a. Review MBTARF's agreements with SSB to ascertain services performed by SSB.
   b. Review relevant reports on the controls of SSB as a service organization (also known as Service Organization Control (SOC) 1 reports) and the independent auditor reports on the controls and processes to ascertain reliance on SSB as custodian.
   c. Confirmation of year-end balances and realized gains and unrealized gains from SSB reports and discuss with SSB representatives.

6. Trace annual returns in annual financial statements for 2011, 2012 and 2013 and Management Discussion and Analysis section of the Annual Report (2013 only) to support:

   a. Alternative investments – trace to returns provided by SSB for 2012 and 2013.
   b. SSB held investments – trace to returns provided in Flash Reports obtained from SSB for 2012 and 2013.
   c. Marco independently computes returns from statements it receives directly from the Investment Managers and reconciles this information back to SSB return calculations. The Staff does not utilize Marco's calculations for financial reporting, but uses them as a quality control check on the investment returns provided by SSB and reported by the MBTARF. We compared the annual returns calculated by Marco to those reported by the MBTARF.

Documents and other sources of information reviewed:

The list below is a summary of key sources of data used by FTI and is not intended to be all-inclusive.

- Audited Financial Statements for years ended December 31, 2010, 2011, 2012 and 2013

- MBTARF trial balance as of December 31, 2010, 2011, 2012 and 2013
- Schedule of Assets as of December 31, 2010, 2011, 2012 and 2013
- Capital account statements as of December 31, 2011, 2012 and 2013 from Investment Managers
- Audited financials for individual investments at December 31, 2011, 2012 and 2013 from Investment Managers
- Other financial schedules used by the MBTARF in its financial reporting process
- Confirmations of selected investment balances, distributions, contributions and returns received by the MBTARF's independent auditor
- Custodian Contract between The Board of the Massachusetts Bay Transportation Authority Retirement Fund and State Street Bank and Trust Company dated August 27, 2004
- The Marco Consulting Group Performance Report – MBTA Retirement Fund, December 31, 2011, December 31, 2012 and December 31, 2013
- Most recent SSB SOC1 reports
- SSB data obtained through State Street Portal (defined below)

In addition to continuous interaction with members of the Staff, FTI interviewed Michael Mulhern, Executive Director; John Barry, Deputy Executive Director; Catherine McGahan, Manager of Financial Services and representatives from Marco. We also had access to members of SSB.

Results and Observations

Walk-through with Staff the process for recording investment balances and transactions.

After a review of documents and other background materials, FTI had discussions with the Staff on January 7, 2016 and January 21, 2016 to walk through the accounting process, identify documents used by the MBTARF in the financial reporting process, and navigate the My State Street site (SSB's online client information-delivery portal) ("State Street Portal"). Refer to discussion above for details regarding the accounting and investment processes.

Total Investment Assets

December 31,	2013	2012	2011
Total Investments per Annual Report	$1,604,231,508	$1,432,203,549	$1,381,691,494

Trace investment-carrying balances in audited financials to trial balances and Schedule of Assets.

We noted agreement within $5 when we compared total investment assets as reported in the MBTARF Annual Reports to the amounts included in the trial balance and Schedule of Assets for each respective period.

Assets held by Custodian

December 31,	2013	2012	2011
Cash	$40,155,245	$34,170,631	$22,940,812
Fixed Income	159,066,617	179,085,995	199,811,966
Equity	688,735,485	538,553,406	535,692,328
Total	$887,957,347	$751,810,032	$758,445,106

Reconcile the MBTARF Schedule of Assets of securities held at SSB as custodian to other documents from SSB

For assets held at the Custodian, we compared the Schedule of Assets to SSB data obtained through the State Street Portal. No differences were identified with the exception of $16,786 in the December 31, 2013 Cash and Cash Equivalents balance (or 0.04% of total cash and cash equivalents).

Compare investment values provided by SSB with Bloomberg

For those equity and fixed income investments covered by Bloomberg (in excess of 98% of the domestic equity investments and 72% of domestic fixed income investments for each year end for 2011, 2012 and 2013), FTI compared the Bloomberg price with the price maintained by SSB. FTI found only minute differences between the two price sources, that, in aggregate, is less than 0.05% of the total portfolio value as of each year end for 2011, 2012 and 2013 (the Bloomberg prices are higher, in aggregate, than the SSB prices included in the MBTARF Annual Reports.) The variances were expected and due to differences in the sources of information and proprietary models and methodologies used by the different pricing services.

The values of the investments provided by SSB and included in the MBTARF's Annual Reports are consistent with the values provided by Bloomberg. For those investments not covered by Bloomberg, we had discussions with SSB to obtain its pricing sources for these investments. The pricing sources selected and employed by SSB are reputable vendors and widely used throughout the financial services industry.

Alternative and Other Investments not held by SSB

December 31,	**2013**	**2012**	**2011**
Hedge Funds	$128,335,366	$137,105,800	$101,946,554
Real Estate Funds	145,081,633	148,411,974	135,352,034
Alternative Investments	192,876,396	195,590,771	202,775,907
Other Fund Managers	249,980,766	199,284,973	183,171,893
Total	$716,274,161	$680,393,518	$623,246,388

Trace and agree third-party capital account statements and audited financial statements (for each Alternative Investment) to Schedule of Assets

We agreed third-party capital account statements and audited financial statements to the Schedule of Assets at December 31, 2011, 2012 and 2013. All amounts agreed with the exception of $54,887 (or less than .01% of total Alternative Investments) in 2011, $26,965 (or less than .006% of total Alternative Investments) in 2012, and $580,146 (or 0.12% of total Alternative Investments) in 2013.[1] These differences are primarily due to i.) instances where the capital account statements were not received by the MBTARF in a timely manner and an estimate of fair value was recorded in the annual report; and ii.) the use of differing foreign currency exchange rates. No other differences between the supporting documentation and the Schedule of Assets were identified.

[1] The differences exclude the impact of writing down the Fletcher investment which is discussed later in this report.

Confirmation of Alternative Investments (including carrying values)

FTI obtained investment confirmations received by the MBTARF's independent auditor from various Investment Managers. In addition to the audit confirmations, FTI selected and independently confirmed additional investments directly with the Investment Managers. FTI's selection focused on larger investment balances and covered a cross section of asset classes. FTI compared the balances from all of the confirmations to the respective fair values in the Schedule of Assets. The table below summarizes the investments confirmed by year.

	2013	2012	2011
Confirmations obtained and provided by auditor			
Number	22	21	6
Amount	$376,958,774	$164,270,963	$60,237,763
Additional Confirmations obtained by FTI			
Number	17	17	14
Amount	$146,346,077	$181,465,681	$126,879,316
Total Confirmations obtained			
Number	39	38	20
Amount	$523,304,850	$345,736,644	$187,117,079
% of Alternative Investments Confirmed	73%	51%	30%

We identified no differences when comparing the amounts in the confirmations obtained to the investment balances in the Schedule of Assets.

Investment Returns

	2013	2012	2011[1]
Total Fund	17.08%	14.93%	1.06%
Domestic Large Cap Equity	32.08	20.10	
Domestic Small Cap Equity	42.25	18.83	
Global Equity and Emerging Markets	29.17	30.41	
International Equity	24.83	20.98	
Fixed Income	0.84	11.81	
Real Estate	14.32	11.55	
Hedge Fund	(4.75)	(1.94)	
Private Equity	14.69	4.91	
Diversified Beta	2.73	3.66	

[1] The MBTARF did not report investment returns for individual asset classes for 2011.

Trace annual returns from the MBTARF Annual Reports to SSB Flash Reports and other sources

FTI reviewed the MBTARF's agreements with SSB to ascertain services to be performed. FTI also reviewed SSB SOC1 reports noting that SSB was provided an unqualified (clean) opinion from its independent auditor (a big four accounting firm.)

FTI obtained Flash Reports as of December 31, 2011, 2012 and 2013 directly from SSB via the State Street Portal. FTI compared these returns to those reported in the MBTARF's Annual Reports for each respective year. FTI also received a snapshot of the Flash Report for 2013 dated July 11, 2014 that the MBTARF relied on for the returns included in its 2013 Annual Report. FTI found no difference in total investment returns, however FTI identified three insignificant differences in the returns for individual asset classes as described below:

a. International equity return for 2013 in the Annual Report was overstated by 1.48 percentage points (23.35% in the Flash Report versus 24.83% as presented in the Annual Report.)

b. The return on domestic large cap equities for 2013 in the Annual Report is presented as 32.08%. Per the Flash Report, the return was 32.008%, which rounds to 32.01%.
c. The MBTARF policy is to report the returns gross, however the return for the Sands Global Growth in 2012 was incorrectly reported as net. As a result the Global Equity and Emerging Markets return for 2012 was understated (the gross return is 31.06% whereas the net return is 30.41%.)

The three differences noted are limited to the reported returns for the specific asset classes and have no impact on the total investment returns included in the MBTARF Annual Reports, nor do they affect the reported investment values.

Reconcile annual returns from SSB Flash Reports to Marco Report

FTI also compared the SSB annual returns to the annual returns by fund manager as re-calculated by Marco for the period ended December 31, 2013. The variance between SSB's calculated 2013 annual returns and the annual return calculated by Marco was less than 0.6% and typically had a difference of 0.3% or less.[2]

Weston and Fletcher Investments

During the period covered by our review, two specific investments came under additional scrutiny by the MBTARF due to concerns regarding the respective asset managers, Weston Capital Partners and Fletcher Asset Management. We reviewed the MBTARF's accounting for these investments. Our procedures included interviews of certain of the Staff, including executive management, and a review of relevant correspondence, including email communications, memos and legal documents.

Fletcher Asset Management

The MBTARF made a $10 million investment with Fletcher in August 2004, which was redeemed at a profit beginning in the fall of 2007. The MBTARF subsequently made a second investment with Fletcher of $25 million in June 2007 (the "Fletcher Investment").

[2] The Marco analyses are limited in nature, do not include all of the detailed investment transaction history maintained by SSB and are not intended to be the authoritative source of the investment performance.

Both of these investments were made prior to the period covered by our Report, however the Staff recorded impairments to the carrying values of the Fletcher Investment (the Fletcher Fixed Income (hedge fund) and the Fletcher Note (fixed income)) for the years ended December 31, 2011, 2012 and 2013. The MBTARF wrote down these assets by 40%, 33% and 100% of the balances as of December 31, 2011, 2012 and 2013, respectively.

The write down at December 31, 2011 was supported by a memo, which provides a chronology of the MBTARF's relationship with Fletcher, including the other investment with this manager, and the events that led to the MBTARF's decision to value its investment at less than the amount reported in its capital account statement. For 2012 the MBTARF wrote down an additional 33% of the investment balance. After Fletcher filed for bankruptcy in 2013, the MBTARF wrote off the remaining investment balance as of December 31, 2013. We also reviewed the Richard J. Davis Trustee Report and Disclosure Statement In re: Fletcher International, Inc. dated January 24, 2014. Nothing came to our attention that suggests the accounting for the Fletcher Investment did not comply with generally accepted accounting principles.

Weston Capital Partners

In 2008, the MBTARF invested $10 million in Partners II, a fund managed by Weston Capital Partners. In 2012 the MBTARF learned of an impermissible loan Partners II made to another Weston related entity and other issues. In November of 2012 the MBTARF through its counsel demanded a winding up of the Partner's II funds. By August 2014, the MBTARF received the full amount of its investment plus a profit and no adjustment to the investment balance was recorded. Nothing came to our attention that suggests the accounting for the Weston investment did not comply with generally accepted accounting principles.

Summary

We have compared the investment balances included in the MBTARF's Annual Reports as of December 31, 2010, 2011, 2012 and 2013 to the amounts reported by the MBTARF's custodian, SSB. We have also compared the price of individual assets reported by SSB to other pricing or valuation sources. We did not identify any significant differences between the amounts reported by the MBTARF and the supporting documentation provided by third parties.

We have compared the MBTARF's investment returns for 2011, 2012 and 2013 as computed by the Custodian to the returns reported in the MBTARF's 2011, 2012 and 2013 Annual Reports noting no significant differences.

ACTUARIAL ASSUMPTIONS

Background

Retirement fund liabilities and contribution requirements are determined by pension actuaries. Funds such as the MBTARF typically do not employ in-house actuarial staff, but retain outside pension actuarial firms to prepare annual actuarial valuations and consult on specific issues as needed. The Board retained Buck as the actuary for the MBTARF.

Buck is a human resources consulting firm with approximately 1,500 employees in nearly 200 global locations. Buck provides actuarial consulting to defined benefit plan sponsors of all types, including private, not-for-profit and public entities.

Buck's main responsibility as the MBTARF's actuary is to provide an annual actuarial valuation with information regarding the funded status and contribution requirements for the MBTARF. They also provide separate valuation reports with disclosures in accordance with the Governmental Accounting Standard Board ("GASB"). The results presented in these reports are used in the MBTARF's and the Authority's financial reports. With a few exceptions, the same assumptions and methods are used in both the funding and GASB reports. One exception is that, for GASB disclosures, the actual market value of assets is required. Valuations for funding purposes typically adjust the asset values by spreading investment gains and losses over a five-year period, thereby reducing the volatility in funding requirements.

In order to calculate the total estimated obligation of a pension plan, the actuary uses data for both the active and retired members as well as the attributes of the fund's assets.

The member data used by Buck is provided by the Authority, via the MBTARF, and the asset data is provided by the MBTARF. Assumptions used in the valuations are recommended by Buck and approved by the Board. There are two types of actuarial assumptions – demographic and economic.

Demographic assumptions estimate member behaviour and eligibility for benefits and are based on existing member data. The member data includes individual information such as date of hire, date of birth and salary history for each active worker and date of birth, benefit amount, beneficiary information and form of payment for each member currently receiving benefits. Assumptions used by the actuary are applied to the current member data to project future expected benefit payments. Demographic assumptions include termination rates (when workers leave employment before retirement), retirement rates, mortality rates and other factors that affect when and how much in benefits will be paid from the fund.

Economic assumptions include inflation, the investment return on assets and salary increases for active members. The determination of appropriate inflation and investment return assumptions have a correlation to past results, but are more dependent on the current macro-economic environment and a fund’s asset allocation. The salary increase assumption is also based on past history (especially any merit and seniority component) but is closely linked to the inflation assumption.

Actuarial assumptions are based on prior experience, but must also be the actuary’s best estimate of future experience. The MBTARF actuarial assumptions were reviewed annually by Buck and approved by the Board. The annual review takes into consideration any major changes that have occurred at the fund level (shifts in employment or changes in plan provisions) or at the more broad economic level (recessions or shifts in inflation).

Annual reviews of actuarial assumptions are based on very general observations. More detailed analysis is required on a periodic basis to provide points of reference that enable the actuary to determine trends in member and economic experience. To aid in this research, actuaries perform experience studies that look at actual experience for the fund over a set period (typically the prior five-year period).

In a typical experience study, the actuary compares expected results versus actual results for each decrement (i.e. change in status of members including termination of employment, retirement, disability and death). For example, based on the termination of employment assumption, 100 workers might have been expected to quit working before retirement. If only 50 quit, then the actuary may likely recommend that the termination assumption be lowered. Experience is broken down not only by decrement, but by age within each decrement. The demographic decrement with the greatest impact on pension planning is post-retirement mortality. The longer members live, the more benefits that are paid out, which means a higher liability.

It is important to remember that the assumptions do not ultimately affect the amount of benefits paid. Assumptions are used merely to estimate future benefits to be paid and the present value of those future benefits.

The economic assumption with the greatest impact on funding and disclosure is the expected rate of return on investments. The source for benefit payments is the current assets on hand plus future contributions and investment returns. The greater the investment income, the less contributions are required. In calculating pension plan liabilities, the expected rate of return of assets is also used as the discount rate to develop the present value of plan benefits.

The investment income assumption is determined based in part on history, but a greater weight is given to the current asset allocation of the funds and current economic indicators. Current economic indicators are used to create a capital market analysis. In a capital market analysis, each asset class is projected under multiple scenarios and a confidence range is determined for the investment return assumption.

<u>FTI's Procedures</u>

The procedures performed on the MBTARF's actuarial assumptions included the following:

1. Review actuarial reports, including funding report, GASB 67 and GASB 68 reports.
2. Review data files and compare totals with data summaries in the valuation reports.
3. Review sample lives exhibit from MBTARF actuary.
4. Compare economic assumptions to industry norms and standards.
5. Where available, compare demographic assumptions to industry norms and standards.
6. Review most recent experience study and compare current actuarial assumptions to recommendations presented.
7. Discuss with actuary the process of setting actuarial assumptions and methods.

Documents and other sources of information reviewed:

The list below is a summary of key sources of data provided by the Buck and/or the MBTARF and is not intended to be all-inclusive.

- 2011 Actuarial Valuation
- 2012 Actuarial Valuation
- 2013 Actuarial Valuation
- 2014 Actuarial Valuation
- 2015 Actuarial Valuation
- 2010 Experience Study
- 2015 Experience Study
- 2014 GASB 67 Report
- 2014 GASB 68 Report
- Data from the Authority to Buck for the 2014 valuation
- Sample lives from Buck
- 2014 MBTARF Annual Report (including the Pension Agreement section)
- April 25, 2013 letter from Buck regarding investment return assumption
- Plan Document for MBTARF Employees Plan
- 2009 Actuarial Valuation for MBTARF Employees Plan
- Determination Letter for MBTARF Employees Plan
- July 8, 2015 letter from Buck to James Long

In addition to the documents reviewed, we also interviewed certain of the Staff and Buck's lead actuary for the MBTARF.

Results and Observations

The results of the annual actuarial valuations are used for the actuarial section of the annual financial statements. The three main components of the actuarial valuation (as discussed in the Background section above) are the plan provisions, member data and actuarial assumptions. Therefore, our review focused on those three elements.

Plan Provisions and Member Data

- Every actuarial valuation must properly disclose the plan provisions used in the determination of liabilities and contribution amounts. Each year, the Annual Reports included a section containing the current Pension Agreement. The plan provisions in the Pension Agreement only change as the Authority and the Union, together, approve amendments. The most recent change to the plan provisions affecting benefits was made for members with hire dates on or after December 6, 2012. This change increased the eligibility requirement for early retirement (for an unreduced benefit) to age 55 with 25 years of service (early retirement remains at any age with 23 years of service for all other employees). The plan provisions in each of the actuarial valuation reports from 2011-2013 accurately reflect the Pension Agreement in the applicable MBTARF Annual Reports.

- In order to review the valuation data process, we compared the active worker, retiree and beneficiary data provided by MBTARF to Buck for the December 31, 2014 actuarial valuation and determined that the appropriate data was being used in the valuation. An audit of the data was not performed, but we compared the totals of number of members, salaries and benefits and noted only a few insignificant differences.

- We requested and received sample life data from Buck for three participants. Samples were received for one active worker, one retired member and one terminated participant. A replication of total liabilities was not within the scope of our review however, we matched the liabilities on an individual level for the three sample lives to a reasonable level (within 5%, which is consistent with the Actuarial Standards of Practice). For the active participant, the liability was determined by calculating an estimated benefit at each retirement age, applying probabilities for retirement, then present-valuing back to the valuation date (December 31, 2014). For the retiree, the monthly benefit currently payable was multiplied by an appropriate annuity factor. The liability for the terminated participant was simply the accumulated employee contributions.

- Benefit calculations are prepared by the Staff when each member retires. The results of those calculations are used to not only pay the member his or her monthly benefit, but to provide Buck with accurate information to use in its actuarial valuation. We requested and received from the MBTARF benefit calculations for five members who recently retired. All five members in the sample retired October 1, 2015. Benefits were determined by multiplying an average of the three highest years of salary times 2.46% times years of benefit service. For all five samples, we were able to match the calculated results. We were also able to match the 2014 salaries used in the benefit calculations with the salaries used for each participant in Buck's 2014 valuation.

- In reviewing the five sample benefit calculations, we noted that actual salary for the final year was higher than in prior years for three of the five samples (by 8%, 8% and 13%). This was due to the inclusion of unused sick and vacation pay in the average salary calculation (in accordance with the pension plan provisions which include these amounts). The estimated salary assumptions used in the 2011-2014 actuarial valuations do not implicitly reflect the addition of these lump sum payments. We recommend that these lump sum payments be considered by Buck when performing the next actuarial valuation.

Actuarial Assumptions

- Buck set forth the process of how the Board sets assumptions. The results of the experience study are presented to the Board with recommendations for assumption changes, where warranted. Recommended changes were made to the assumptions used in the valuations following the 2010 experience study. Recommended changes resulting from the 2015 experience study are expected to be implemented into the 2016 valuation. Although most changes in assumptions happen as a result of experience studies, assumptions are reviewed, and approved by the Board, annually. When asset allocations, plan provisions and/or member demographics change, the assumptions that project expected experience are revised as warranted.

- Buck confirmed to FTI that all assumptions proposed by Buck were approved by the Board.

- The expected investment return assumption was determined using a capital market study that provided stochastic modelling of expected future investment returns based on the MBTARF's asset allocation. This method is customary in the industry. The change to increase the investment return assumption from 7.5% to 8% was made in response to a change in the MBTARF's asset allocation and was based on an analysis prepared by Buck. The 8% return assumption was first used in the December 31, 2011 actuarial valuation and is the basis for the liabilities presented in the MBTARF's financial statements for 2012 and 2013.

- Mortality tables contain probabilities of death at each age. The choice of a mortality table is based on the death rates of a plan's members, and is updated as the mortality experience of the members changes. The mortality table used (in the 2011, 2012 and 2013 actuarial valuations) for active and retired members was UP 1994 Mortality Table for Males projected 10 years from the valuation date using Scale AA. Beneficiary mortality was based on the Female version of this table. Projected mortality rates using Scale AA assume greater life expectancy by lowering the mortality rate, by an age-specific factor times the number of projection years (in this case, 10 years). The projected UP 1994 tables were first used in the 2011 valuation and the change to use them was based on the number of actual deaths from 2006 to 2010, as presented in the 2010 experience study for the MBTARF.

- Public pension funds typically use an actuarial value of assets ("AVA") for contribution and funded status purposes. Use of an AVA allows the volatility of market returns to be smoothed over a certain time period (typically 5 years). Prior to December 31, 2013, the MBTARF used a five-year moving average for the asset smoothing method. Due to its simplified nature, this method never allowed the actuarial value of assets to converge to the actual market value and was not typical of asset smoothing methods used in the industry. As a result, starting with the December 31, 2013 valuation, a change was made that spread asset gains and losses over 5 years, which more closely conformed to industry norms. As is the case when changing asset smoothing methods, in the first year (2013), the actuarial value of assets was equal to its actual market value and 2014 is the first year with gains or losses that will be spread over time under the new method. The MBTARF only changed the actuarial asset valuation method once in the period 2011 through 2013.

- After reviewing the actuarial valuation and experience study reports, and interviewing the actuary from Buck and certain members of the Staff, it appears that Buck's process of setting actuarial assumptions and methods conforms to the Actuarial Standards of Practice and that Buck's recommended assumptions were appropriately adopted by the Board.

Other

- For many public pension plans, an actuarial audit is prepared every 5 to 10 years. An actuarial audit is intended as a quality control measure to assess the plan's actuarial valuations. The actuarial audit is prepared by an actuarial firm independent of the plan actuary and typically entails a full replication of the most recent actuarial valuation; and in many cases, the most recent experience study. Due to possible differences in software and internal firm processes, results do not necessarily need to match exactly, but are deemed reasonable if within a reasonable corridor. According to Buck, the MBTARF has not retained a firm to prepare an actuarial audit in at least the last 11 years. We recommend that a full valuation replication actuarial audit be prepared in the near future.
- The Actuarial Code of Professional Conduct requires an actuary to disclose any potential conflicts, Buck disclosed no such conflicts and confirmed to FTI that no aspect of Buck's relationship with the MBTARF might impair or appear to impair the objectivity of its work.

Summary

Based on our review of the 2011, 2012, 2013 and 2014 actuarial valuations prepared by the MBTARF's actuary, Buck, it appears that the process of setting actuarial assumptions and methods conform to Actuarial Standards of Practice and that Buck's recommended assumptions were appropriately adopted by the Board. Further, in our opinion, the mortality rates, projected investment returns and asset smoothing technique used for the 2011, 2012, 2013 and 2014 actuarial valuations were reasonable and appropriately applied. It should also be noted that each of these actuarial assumptions were proposed and recommended by Buck.

ALLEGATIONS

In June 2015 certain individuals including Harry Markopolos, released a power-point presentation in which, among other things, they alleged that the MBTARF's reported investment returns appeared to be overstated and the pension liabilities appeared to be understated. Specifically they claimed:

1. *"Reported investment returns appeared overstated by up to $123 million*
2. *Pension portfolio assets appeared overstated by $139.5 million*
    - A. *Liberal asset smoothing assumptions used - $96 million*
    - B. *Bonds discrepancy (book versus market value) $43.5 million*
3. *Pension liabilities appeared understated by up to $211 million*
    - A. *Use of outdated mortality table - $105 million*
    - B. *Liberal increase in expected return assumption $106 million*
4. *Size of pension underfunded ratio appeared understated by 5 to 6 percent*
5. *Excessive staffing fees paid out ($4 million annually) and in violation with the governing trust"*

The Markopolos presentation does not include any calculations or analyses that support the amounts referred to above. According to an article in the Boston Globe dated June 27, 2015, Markopolos and his team prepared a 103-page report supporting their claims. The MBTARF requested the report but received no response. FTI also requested from Markopolos and the individuals named in the power point a copy of the report as well as an opportunity to discuss their claims; to date none have responded to our requests.

FTI traced and agreed the MBTARF's reported investment balances as of December 31, 2010, 2011, 2012 and 2013 and the reported investment returns for the years 2011, 2012 and 2013 with SSB and other third-party sources. With the exception of a few insignificant differences, as noted elsewhere in this Report, FTI did not identify any errors with the MBTARF's reported amounts.

Despite the claim of Markopolos and the others, the mortality table used by the MBTARF was properly updated to reflect the actual experience of its members. The allegation made regarding the actuary's use of an outdated mortality table was made with an incomplete description of the mortality table (i.e., the projection details were not considered). In our opinion, the mortality table, the asset return assumptions and the asset smoothing technique employed by the MBTARF were reasonable and appropriately applied in accordance with the applicable actuarial standards.

The Funded Ratio is simply the MBTARF's assets divided by the estimated benefits to be paid to plan members ("Actuarially Accrued Liability"). As noted throughout this Report, we have not identified any evidence to suggest that the reported MBTARF assets were misstated. Further, the actuarial valuations (and the resulting Actuarially Accrued Liability) appear to have been prepared in accordance with the applicable standards. As a result, the reported Funded Ratio included in the 2013 Annual Report appears to be properly stated.

Regarding "staffing fees", the Trust Agreement, which is the governing document for the MBTARF, stipulates that the MBTARF is responsible for "reasonable compensation for employees and agents, office expenses and for services of counsel rendered to the Board and reasonable expenses incident thereto," as well as compensation for a custodian. We observed that the Staff annually submitted a detailed budget of administrative expenses to the Board for approval, and periodically provided the Board with a comparison of actual expenses to the budget.

The average annual administrative expense for the three years ended December 31, 2013 was approximately $3.7 million or 0.21% of plan assets as of December 31, 2013. There are no standard requirements for how public pension funds report administrative fees. To provide a frame of reference, we reviewed the expenses in detail from seven plans that are somewhat similar to the MBTARF in size and/or location[3]. As a percentage of assets, the administrative expenses for the seven sample funds ranged from 0.09% to 0.24%.

[3] The Boston College Public Pension Database provides financial information, including administrative expenses, of many large public pension plans. However, due to the differing level of services and/or subsidies provided to plans by their sponsors, a meaningful comparison of expenses between plans is not readily available.

We did not observe any indication that the MBTARF's administrative expenses differ significantly from similar plans.

John Sullivan
Senior Managing Director
F T I Consulting
200 State Street
Boston, MA 02109