

# **East Bay Municipal Utility District Employees' Retirement System**

**Actuarial Valuation and Review of Pension Plan  
as of June 30, 2018**



This report has been prepared at the request of the Retirement Board to assist in administering the Fund. This valuation report may not otherwise be copied or reproduced in any form without the consent of the Retirement Board and may only be provided to other parties in its entirety, unless expressly authorized by Segal. The measurements shown in this actuarial valuation may not be applicable for other purposes.

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*January 10, 2019*

*Ms. Sophia Skoda  
Director of Finance  
East Bay Municipal Utility District  
375 Eleventh Street  
Oakland, CA 94607-4240*

*Dear Sophia:*

*We are pleased to submit this Actuarial Valuation and Review as of June 30, 2018 for only the pension plan. The Review of Contribution Rates and Funding Status for the health insurance benefit (HIB) plan is provided in a separate report. This report summarizes the actuarial data used in the valuation, establishes the funding requirements for fiscal 2019/2020 and analyzes the preceding year's experience.*

*This report was prepared in accordance with generally accepted actuarial principles and practices, at the request of the Board to assist in administering the Plan. The census and financial information on which our calculations were based were prepared by East Bay Municipal Utility District Employees' Retirement System (EBMUDERS). That assistance is gratefully acknowledged.*


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

*The actuarial calculations were completed under my supervision. I am a member of the American Academy of Actuaries and I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of our knowledge, the information supplied in this actuarial valuation is complete and accurate. Further, in our opinion, the assumptions as approved by the Board are reasonably related to the experience of and the expectations for the Plan.*

*We look forward to reviewing this report at your next meeting and to answering any questions.*

*Sincerely,*

*Segal Consulting, a Member of the Segal Group, Inc.*

By:   
*Andy Yeung, ASA, MAAA, FCA, EA*  
*Vice President and Actuary*

*JRC/hy*

## SECTION 1

### VALUATION SUMMARY

Purpose .....	i
Significant Issues in Valuation Year.....	ii
Summary of Key Valuation Results.....	vi
Important Information about Actuarial Valuations .....	viii

## SECTION 2

### VALUATION RESULTS

A. Participant Data.....	1
B. Financial Information.....	4
C. Actuarial Experience.....	7
D. Employer and Member Contributions .....	12
E. Funded Ratio.....	18
F. Volatility Ratios .....	20

## SECTION 3

### SUPPLEMENTAL INFORMATION

EXHIBIT A Table of Plan Coverage.....	21
EXHIBIT B Participants in Active Service as of June 30, 2018.....	24
EXHIBIT C Reconciliation of Participant Data.....	26
EXHIBIT D Summary Statement of Income and Expenses on an Actuarial Value Basis for All Pension Plan and HIB Plan Assets .....	27
EXHIBIT E Summary Statement of Assets for Pension and HIB Plans .....	28
EXHIBIT F Development of the Fund Through June 30, 2018 for All Pension Plan and HIB Plan Assets .....	29
EXHIBIT G Actuarial Balance Sheet .....	30
EXHIBIT H Development of Unfunded Actuarial Accrued Liability for Year Ended June 30, 2018.....	31
EXHIBIT I Table of Amortization Bases...	32
EXHIBIT J Projection of UAAL Balances and Payments.....	33
EXHIBIT K Section 415 Limitations .....	35
EXHIBIT L Definitions of Pension Terms..	36

## SECTION 4

### REPORTING INFORMATION

EXHIBIT I Summary of Actuarial Valuation Results .....	38
EXHIBIT II Actuarial Assumptions and Actuarial Cost Method .....	40
EXHIBIT III Summary of Plan Provisions ....	48

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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### Purpose

This report has been prepared by Segal Consulting (“Segal”) to present a valuation of the East Bay Municipal Utility District Employees' Retirement System (EBMUDERS) as of June 30, 2018. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits. The contribution requirements presented in this report are based on:

- The benefit provisions of the pension plan, as administered by the Board;
- The characteristics of covered active participants, inactive vested participants, and retired participants and beneficiaries as of June 30, 2018, provided by EBMUDERS;
- The assets of the plan as of June 30, 2018, provided by EBMUDERS;
- Economic assumptions regarding future salary increases and investment earnings adopted by the Board for the June 30, 2018 valuation; and
- Other actuarial assumptions, regarding employee terminations, retirement, death, etc., adopted by the Board for the June 30, 2018 valuation.

One of the general goals of an actuarial valuation is to establish contributions which fully fund the System's liabilities, and which, as a percentage of payroll, remain as level as possible for each generation of active members. Annual actuarial valuations measure the progress toward this goal, as well as test the adequacy of the contribution rates.

In preparing this valuation, we have employed generally accepted actuarial methods and assumptions to evaluate the System's assets, liabilities and future contribution requirements. Our calculations are based upon member data and financial information provided to us by the System's staff. This information has not been audited by us, but it has been reviewed and found to be consistent, both internally and with prior year's information.

*Ref: Pg. 32*

The contribution requirements are determined as a percentage of payroll. The System's employer rates provide for both normal cost and a payment or credit to amortize any unfunded or overfunded actuarial accrued liabilities. In the valuation, new unfunded actuarial accrued liabilities (UAAL) established on or after July 1, 2011 as a result of actuarial gains or losses and change in actuarial assumptions/methods has been amortized over separate declining 20-year and 25-year periods, respectively. The balance of the UAAL established prior to July 1, 2011 continues to be amortized in layers over the current respective remaining fixed periods. Based on the total UAAL contribution rate recommended in the June 30, 2018 valuation, the equivalent single amortization period is about 18 years. The rates calculated in this report may be adopted by the Board for the fiscal year that extends from July 1, 2019 through June 30, 2020.

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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### Significant Issues in Valuation Year

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

- Ref: Pgs. 16, 40, and 45* > The results of this valuation reflect changes in the actuarial assumptions adopted by the Board on September 20, 2018. These new assumptions (7.00% investment return, 2.75% inflation, the introduction of an assumption to anticipate election of an optional form of benefit at retirement, etc.) are described in Section 4, Exhibit II of this report. These assumption changes resulted in an increase in the combined (1955/1980 Plan and 2013 Tier) employer contribution rate of 0.71% of payroll.
- Ref: Pgs. 19 and 31* > The funded ratio measured on a valuation value of assets basis increased from 74.9% at June 30, 2017 to 75.6% at June 30, 2018. The funded ratio if measured on a market value of assets basis increased from 76.4% to 77.3%. The UAAL increased from \$518.8 million as of June 30, 2017 to \$542.6 million as of June 30, 2018. The increase in the UAAL is primarily due to (a) reflection of salary increases for actives upon the completion of negotiation between the District and the bargaining parties<sup>1</sup>, (b) changes in actuarial assumptions, and (c) other actuarial losses, offset somewhat by (d) the higher than expected return on the valuation value of assets (after smoothing) and (e) the normal one-year lag in implementing the contribution rates in the June 30, 2017 valuation. A reconciliation of the System's UAAL is provided in Section 3, Exhibit H. A schedule of the current UAAL amortization amounts is provided in Section 3, Exhibit I. Note that a graphical presentation of the UAAL amortization bases and payments has been provided as a new Exhibit J in Section 3.
- Ref: Pgs. 33 and 34* > The employer contribution rates that Segal recommended for the 2018/2019 Fiscal Year ("recommended rates") were provided in the June 30, 2017 valuation report. However, the Board decided to carry over unchanged for the 2018/2019 Fiscal Year ("adopted rates") the higher total (Retirement Plan plus HIB Plan) employer contribution rates previously adopted by the Board for the 2017/2018 Fiscal Year, as determined in the June 30, 2016 valuation. That action was based on the concern that the reduction in the employer contribution rates as developed in the June 30, 2017 valuation may be temporary as a review of the economic actuarial assumptions was scheduled as part of the June 30, 2018 valuation and the employer contribution rates might increase if the Board were to adopt more conservative assumptions as a result of that review (similar to actions taken at other retirement systems in California). Therefore, maintaining the 2017/2018

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<sup>1</sup> We noted in the June 30, 2017 valuation report that there was a reduction in the UAAL in that valuation because there had been no general salary increases other than individual merit and promotion increases since April 2016 because contract negotiation was not complete as of June 30, 2017.

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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employer contribution rates for 2018/2019 would have the indirect impact of stabilizing the contribution rates should an increase in the contribution rates materialize for 2019/2020.

While the Board decided to carry over the higher total employer contribution rates as determined in the June 30, 2016 valuation, both the employer and the member Normal Cost rates for the 2018/2019 Fiscal Year were nonetheless those calculated in the June 30, 2017 valuation in order to reflect the latest demographic information available for determining those rates. After adjusting for the Normal Cost rates, there was a higher amount left toward paying off the UAAL relative to the UAAL rates originally calculated in our June 30, 2017 Retirement Plan valuation.

*Ref: Pg. 16*

- The adopted and recommended aggregate employer rates from the June 30, 2017 valuation are 36.08% and 34.84%, respectively. The aggregate employer rate calculated in this valuation has increased from the recommended rate of 34.84% of payroll to 34.86% of payroll. The increase in the employer rate was primarily due to (a) an increase in the normal cost rate due to demographic changes (includes refinement in the method used in the allocation of liability between normal cost and actuarial accrued liability), (b) reflection of salary increases for actives upon the completion of negotiations between the District and the bargaining parties<sup>2</sup>, (c) changes in actuarial assumptions, and (d) other actuarial losses, offset somewhat by (e) the higher than expected return on the valuation value of assets (after smoothing), (f) higher than expected growth in total payroll, and (g) the normal one-year lag in implementing the contribution rates in the June 30, 2017 valuation.

*Ref: Pg. 17*

- The aggregate member rate calculated in this valuation has remained unchanged at 8.68% of payroll. A reconciliation of the System's aggregate member rate is provided in Section 2, Subsection D (see Chart 15).

*Ref: Pg. 5*

- As indicated in Section 2, Subsection B (see Chart 7) of this report, the total net unrecognized investment gain as of June 30, 2018 is \$38.9 million for the assets for the pension and HIB plans (note that in the previous valuation, this amount was a net deferred gain of \$32.0 million). This net investment gain will be recognized in the determination of the actuarial value of assets for funding purposes in the next few years. This implies that earning the assumed rate of investment return of 7.00% per year (net of expenses) on a market value basis will produce investment gains on the actuarial value of assets after June 30, 2018.

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<sup>2</sup> See discussion in footnote 1.

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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The net deferred gain of \$38.9 million represents 2.2% of the market value of assets as of June 30, 2018. Unless offset by future investment losses or other unfavorable experience, the recognition of the net \$38.9 million market gain is expected to have an impact on the System's future funded percentage and contribution rate requirements. This potential impact may be illustrated as follows:

- If the pension plan portion of the net deferred gain was recognized immediately and entirely in the valuation value of assets, the funded percentage would increase from 75.6% to 77.3%.

For comparison purposes, if the pension plan portion of the net deferred gain was recognized immediately and entirely in the valuation value of assets in the June 30, 2017 valuation, the funded percentage would have increased from 74.9% to 76.4%.

- If the pension plan portion of the net deferred gain was recognized immediately and entirely in the valuation value of assets, the aggregate employer rate (payable at the end of each pay period) would decrease from 34.86% to about 33.5% of payroll.

For comparison purposes, if the pension plan portion of the net deferred gain was recognized immediately and entirely in the valuation value of assets in the June 30, 2017 valuation, the aggregate employer rate (payable at the end of each pay period) would have decreased from 35.18% of payroll to about 34.0% of payroll.

- The actuarial valuation report as of June 30, 2018 is based on financial information as of that date. Changes in the value of assets subsequent to that date are not reflected. Declines in asset values will increase the actuarial cost of the plan, while increases will decrease the actuarial cost of the plan.

### Impact of Future Experience on Contribution Rates

Future contribution requirements may differ from those determined in the valuation because of:

- Differences between actual experience and anticipated experience;
- Changes in actuarial assumptions or methods;
- Changes in statutory provisions; and
- Difference between the contribution rates determined by the valuation and those adopted by the Board.

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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### New Actuarial Standard of Practice on Risk Adjustment

The Actuarial Standards Board approved a new Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment. ASOP 51 will be effective with EBMUDERS' June 30, 2019 actuarial valuation. ASOP 51 requires actuaries to identify risks that "may reasonably be anticipated to significantly affect the plan's future financial condition". Investment risk, asset/liability mismatch risk, interest rate risk, longevity and other demographic risks and contribution risk are also cited as examples in ASOP 51. The standard does not require the actuary to evaluate the likelihood of contributing entities to make contributions when due, nor does it require the actuary to assess the likelihood or consequences of future changes in applicable law.

The actuary's assessment can be qualitative or quantitative (e.g., based on numerical demonstrations). The actuary may use non-numerical methods for assessing risks that might take the form of commentary about potential adverse experience and the likely effect on future results. While the standard does not require that every valuation include a quantitative risk assessment, the actuary may recommend that a more detailed risk assessment be performed. When making that decision, the actuary will take into account such factors as the Plan's design, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions.

We will discuss with EBMUDERS what would be most appropriate to include in EBMUDERS' risk report for the June 30, 2019 valuation.

**SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System**

**Summary of Key Valuation Results**

	<b>June 30, 2018</b>		<b>June 30, 2017 (Adopted Rates)<sup>(1)</sup></b>	
<b>Employer Contribution Rates:</b>				
<i>(payable at the end of each pay period)</i>	<u>Total Rate</u>	<u>Estimated Annual Amount<sup>(2)</sup></u>	<u>Total Rate</u>	<u>Estimated Annual Amount<sup>(2)</sup></u>
1955/1980 Plan	36.72%	\$54,434,300	37.86%	\$56,124,253
2013 Tier	29.79%	16,311,026	31.24%	17,104,950
Combined	34.86%	70,745,326	36.08%	73,229,203
<b>Average Member Contribution Rates:</b>				
<i>(payable at the end of each pay period)</i>	<u>Total Rate</u>	<u>Estimated Annual Amount<sup>(2)</sup></u>	<u>Total Rate</u>	<u>Estimated Annual Amount<sup>(2)</sup></u>
1955/1980 Plan	8.66% <sup>(2)</sup>	\$12,837,719	8.66% <sup>(3)</sup>	\$12,837,719
2013 Tier	8.75%	4,790,919	8.75%	4,790,919
Combined	8.68%	17,628,638	8.68%	17,628,638
<b>Funded Status:</b>				
Actuarial accrued liability (AAL)		\$2,220,977,433		\$2,068,014,945
Valuation value of pension plan assets <sup>(4)</sup> (VVA)		1,678,417,000		1,549,213,319
Market value of pension plan assets <sup>(4)</sup> (MVA)		1,716,478,000		1,580,556,000
Actuarial value of pension plan and HIB plan assets		1,714,363,843		1,580,665,009
Market value of pension plan and HIB plan assets		1,753,240,000		1,612,644,000
Funded ratio on VVA basis		75.6%		74.9%
Funded ratio on pension plan MVA basis		77.3%		76.4%
Unfunded actuarial accrued liability (UAAL) on VVA basis		\$542,560,433		\$518,801,626
Unfunded actuarial accrued liability (UAAL) on pension plan MVA basis		504,499,433		487,458,945

<sup>(1)</sup> The recommended employer contribution rates from the June 30, 2017 valuation were 36.66% for the 1955/1980 Plan, 29.91% for the 2013 Tier, and 34.84% for the two plans combined.

<sup>(2)</sup> Estimated based on June 30, 2018 projected payroll of \$202,994,918.

<sup>(3)</sup> The rate of 8.66% payable during fiscal years 2018/2019 and 2019/2020 is calculated by taking the total employee rate payable beginning April 18, 2016 (i.e., 8.75%), less the HIB employee contribution rate of 0.09%.

<sup>(4)</sup> Net of HIB plan assets.

**SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System**

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**Summary of Key Valuation Results (continued)**

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	<b>June 30, 2018</b>	<b>June 30, 2017</b>
<b>Demographic Data:</b>		
Number of retired participants and beneficiaries	1,779	1,713
Number of vested participants	284	267
Number of active participants	1,828	1,802
Projected total payroll	\$202,994,918	\$184,858,798
Projected average payroll	111,048	102,585
<b>Key Economic Assumptions:</b>		
Interest rate	7.00%	7.25%
Inflation rate	2.75%	3.00%
Across the board salary increase	0.50%	0.50%
Cost of living adjustments	2.75%	3.00%

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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### Important Information about Actuarial Valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare an actuarial valuation, Segal relies on a number of input items. These include:

- **Plan of benefits** Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
- **Participant data** An actuarial valuation for a plan is based on data provided to the actuary by the System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
- **Assets** This valuation is based on the market value of assets as of the valuation date, as provided by the System. The System uses an “actuarial value of assets” that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
- **Actuarial assumptions** In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, termination, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan’s assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, that does not mean that the previous assumptions were unreasonable.

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

## SECTION 1: Valuation Summary for the East Bay Municipal Utility District Employees' Retirement System

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- The valuation is prepared at the request of the Board to assist the sponsors of the Fund in preparing items related to the pension plan in their financial reports. Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.
- If the System is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The Board should look to their other advisors for expertise in these areas.

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

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**A. PARTICIPANT DATA**

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

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

More detailed information for this valuation year and the preceding valuation can be found in Section 3, Exhibits A, B, and C.

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

**CHART 1**

**Participant Population: 2009 – 2018**

<b>Year Ended June 30</b>	<b>Active Participants</b>	<b>Vested Terminated Participants</b>	<b>Retired Participants and Beneficiaries</b>	<b>Ratio of Non-Actives to Actives</b>
2009	1,792	230	1,230	0.81
2010	1,756	222	1,270	0.85
2011	1,702	226	1,325	0.91
2012	1,703	224	1,361	0.93
2013	1,666	232	1,440	1.00
2014	1,715	237	1,497	1.01
2015	1,762	239	1,563	1.02
2016	1,789	248	1,630	1.05
2017	1,802	267	1,713	1.10
2018	1,828	284	1,779	1.13

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**Active Participants**

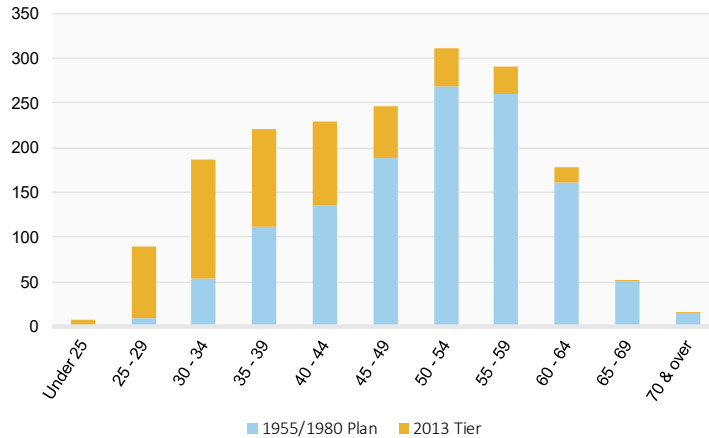
Plan costs are affected by the age, years of service and payroll of active participants. In this year's valuation, there were 1,828 active participants with an average age of 47.8, average service of 12.4 years and average payroll of \$111,048. The 1,802 active participants in the prior valuation had an average age of 48.0, average service of 12.8 years and average payroll of \$102,585.

**Inactive Participants**

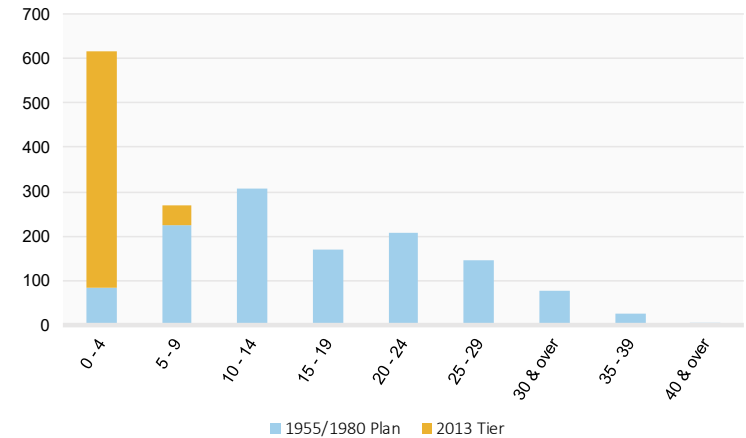
In this year's valuation, there were 284 participants with a vested right to a deferred or immediate vested benefit compared to 267 in the prior valuation.

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

**CHART 2**  
**Distribution of Active Participants by Age as of June 30, 2018**



**CHART 3**  
**Distribution of Active Participants by Years of Service as of June 30, 2018**



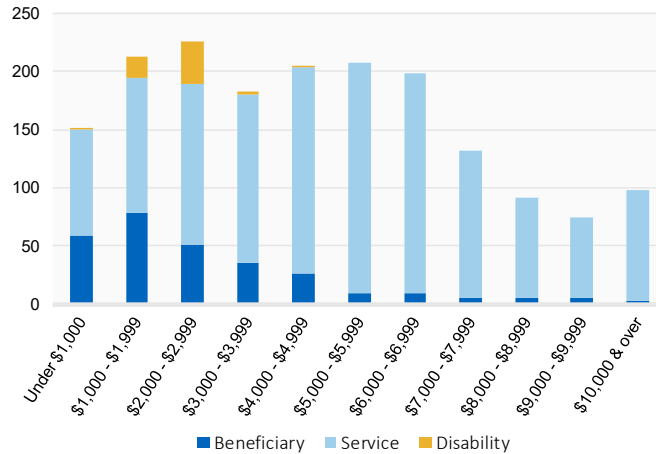
**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**Retired Participants and Beneficiaries**

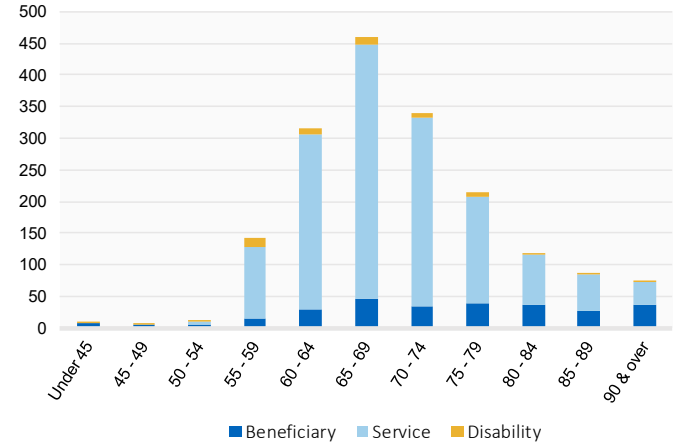
As of June 30, 2018, 1,489 retired participants and 290 beneficiaries were receiving total monthly benefits of \$8,612,030. For comparison, in the previous valuation, there were 1,428 retired participants and 285 beneficiaries receiving monthly benefits of \$7,963,078.

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

**CHART 4**  
**Distribution of Retired Participants and Beneficiaries by Type and by Monthly Amount as of June 30, 2018**



**CHART 5**  
**Distribution of Retired Participants and Beneficiaries by Type and by Age as of June 30, 2018**



**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

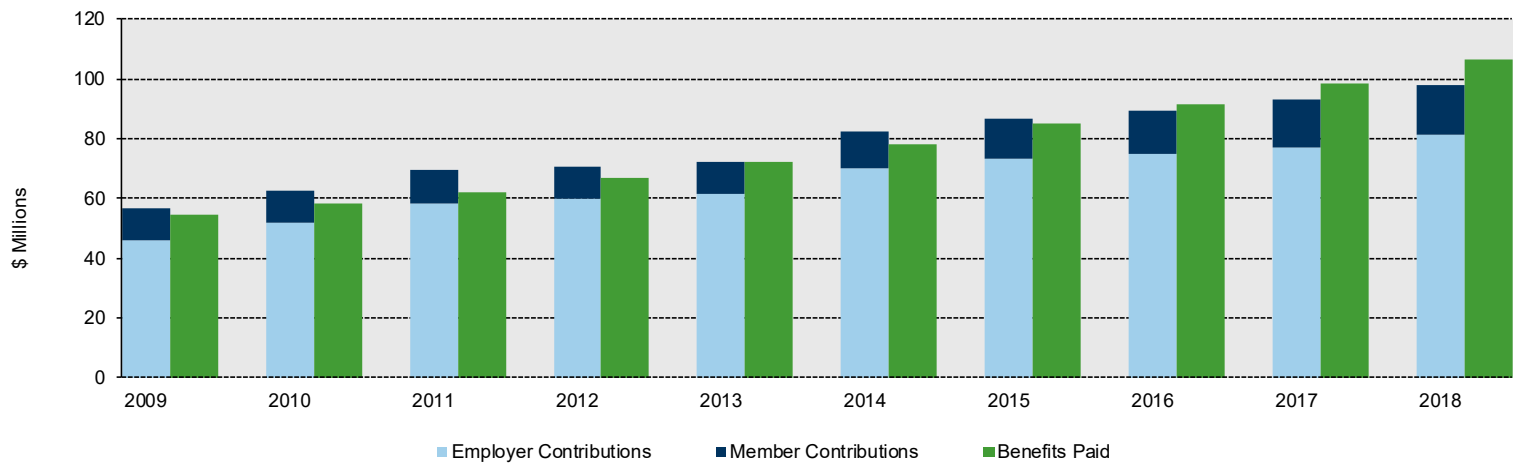
**B. FINANCIAL INFORMATION**

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

Pension plan assets change as a result of the net impact of these income and expense components. Additional financial information, including a summary of these transactions for the valuation year, is presented in Section 3, Exhibits D, E and F.

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

**CHART 6**  
**Comparison of Contributions with Benefits for Years Ended June 30, 2009 – 2018**  
**(for Pension and HIB benefits)**



## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

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

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

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

### CHART 7

#### Determination of Actuarial Value of Assets for Year Ended June 30, 2018 (for Pension and HIB plans)

1. Market value of assets:					
(a) Pension plan					\$1,716,478,000
(b) HIB plan					<u>36,762,000</u>
(c) Total					\$1,753,240,000
2. Calculation of deferred return:	Actual Market	Expected Market	Investment	Deferred	Deferred
	<u>Return (net)</u>	<u>Return (net)</u>	<u>Gain / (Loss)</u>	<u>Factor</u>	<u>Return</u>
(a) Year ended June 30, 2014	\$218,575,000	\$87,289,839	\$131,285,161	0%	\$0
(b) Year ended June 30, 2015	58,937,000	101,068,500	(42,131,500)	20%	(8,426,300)
(c) Year ended June 30, 2016	12,894,000	105,466,650	(92,572,650)	40%	(37,029,060)
(d) Year ended June 30, 2017	200,254,000	102,606,314	97,647,686	60%	58,588,611
(e) Year ended June 30, 2018	148,798,000	116,619,368	32,178,632	80%	<u>25,742,906</u>
(f) Total unrecognized return*					\$38,876,157
3. Preliminary actuarial value: (1c) - (2f)					\$1,714,363,843
4. Adjustment to be within 30% corridor of market value					0
5. Final actuarial value of assets for pension and HIB plans: (3) + (4)					\$1,714,363,843
6. Actuarial value as a percentage of market value: (5) ÷ (1c)					97.8%
7. Valuation value of pension plan assets: (1a) ÷ (1c) x (5)					\$1,678,417,000

\* The amount of deferred return that will be recognized in each subsequent valuation is as follows (amounts may not total exactly due to rounding):

6/30/2019	\$(975,567)
6/30/2020	7,450,733
6/30/2021	25,965,263
6/30/2022	<u>6,435,726</u>
Total	\$38,876,157

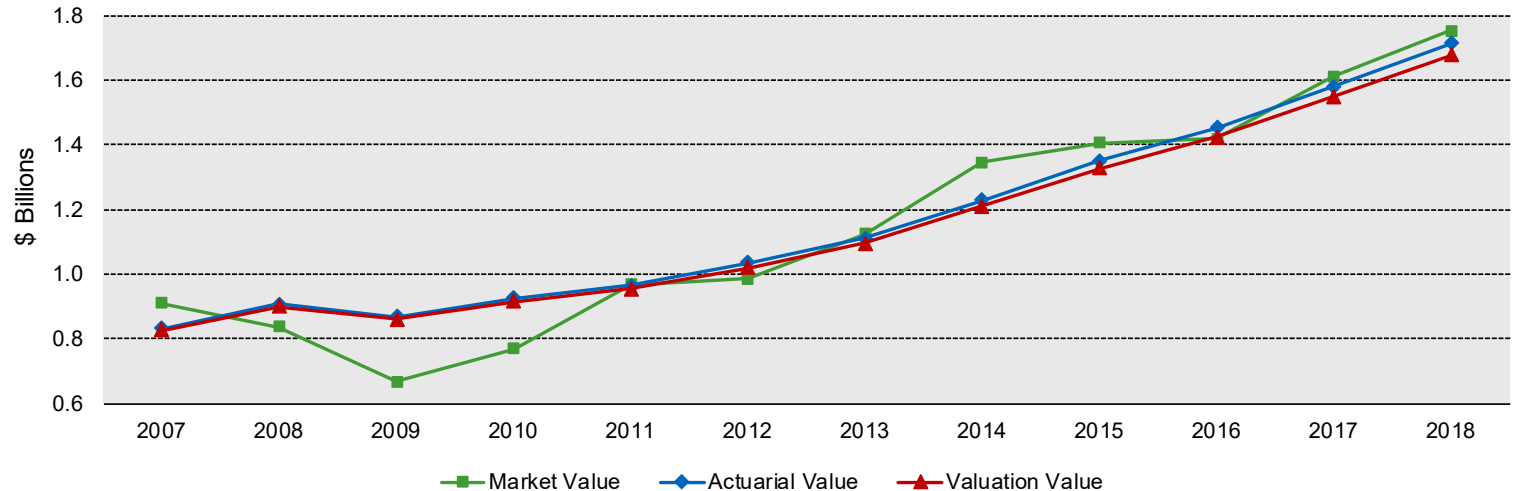
**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

The market value, actuarial value, and valuation value of assets are representations of EBMUDERS' financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The valuation value of assets is the actuarial value, excluding HIB assets. The valuation value

of assets is significant because EBMUDERS' liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

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

**CHART 8**  
**Market Value, Actuarial Value, and Valuation Value of Assets as of June 30, 2007 – 2018\***



\* Market Value and Actuarial Value of Assets are for pension and HIB benefits. Valuation Value of Assets are for pension benefits only.

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

### C. ACTUARIAL EXPERIENCE

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

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

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

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

The total loss is \$14,053,082, a \$27,228,527 gain from investments and a \$41,281,609 loss from all other sources. The net experience variation from individual sources other than investments was 1.86% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is provided on the following pages.

*This chart provides a summary of the actuarial experience during the past year.*

### CHART 9 Actuarial Experience for Year Ended June 30, 2018

1. Net gain from investments <sup>(1)</sup>	\$27,228,527
2. Net loss from other experience <sup>(2)</sup>	(48,581,253)
3. Net gain from one-year lag in implementing the contribution rate calculated in the June 30, 2017 valuation until fiscal year 2018/2019 <sup>(3)</sup>	<u>7,299,644</u>
4. Net experience loss: (1) + (2) + (3)	\$(14,053,082)

<sup>(1)</sup> Details in Chart 10.

<sup>(2)</sup> Details in Section 3, Exhibit H.

<sup>(3)</sup> Includes the contribution gain due to higher than expected salaries.

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**Investment Rate of Return**

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on EBMUDERS' investment policy. For valuation purposes, the assumed rate of return on the valuation value of assets is 7.25% (for the June 30, 2017 valuation). The actual rate of return on a valuation value basis (after smoothing) for the 2017/2018 plan year was 9.01%

Since the actual return for the year was greater than the assumed return, EBMUD experienced an actuarial gain during the year ended June 30, 2018 with regard to its investments.

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

**CHART 10**

**Investment Experience for Year Ended June 30, 2018 – Valuation Value, Actuarial Value, and Market Value of Assets**

	<b>Valuation Value (includes pension plan assets only)</b>	<b>Actuarial Value (includes pension and HIB plan assets)</b>	<b>Market Value (includes pension and HIB plan assets)</b>
1. Actual return	\$139,184,681	\$141,900,834	\$148,798,000
2. Average value of assets	\$1,544,222,819	\$1,576,564,009	\$1,608,543,000
3. Actual rate of return: (1) ÷ (2)	9.01%	9.00%	9.25%
4. Assumed rate of return	7.25%	7.25%	7.25%
5. Expected return: (2) x (4)	\$111,956,154	\$114,300,891	\$116,619,368
6. Actuarial gain/(loss): (1) – (5)	<u>\$27,228,527</u>	<u>\$27,599,943</u>	<u>\$32,178,632</u>

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

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

**CHART 11**

**Investment Return – Valuation Value, Actuarial Value, and Market Value: 2009 – 2018\***

Year Ended June 30	Valuation Value Investment Return		Actuarial Value Investment Return		Market Value Investment Return	
	Amount	Percent	Amount	Percent	Amount	Percent
2009	\$(40,442,084)	(4.49)%	\$(40,593,156)	(4.47)%	\$(171,905,000)	(20.47)%
2010	51,167,488	5.93%	51,966,871	5.96%	95,737,000	14.27%
2011	33,223,487	3.62%	33,642,654	3.62%	191,970,000	24.85%
2012	64,558,352	6.75%	65,488,807	6.76%	15,202,000	1.57%
2013	75,506,213	7.40%	76,545,489	7.39%	137,318,000	13.91%
2014	112,077,589	10.22%	113,600,558	10.19%	218,575,000	19.41%
2015	117,145,293	9.68%	118,952,917	9.67%	58,937,000	4.37%
2016	102,598,231	7.74%	104,468,421	7.74%	12,894,000	0.92%
2017	131,217,766	9.23%	133,617,292	9.22%	200,254,000	14.15%
2018	139,184,681	9.01%	141,900,834	9.00%	148,798,000	9.25%
Five-Year Average Return		9.17%		9.16%		9.42%
Ten-Year Average Return		6.43%		6.42%		7.49%

\* Market Value and Actuarial Value of Assets are for the pension plan and the HIB plan. Valuation Value of Assets are for the pension plan only.

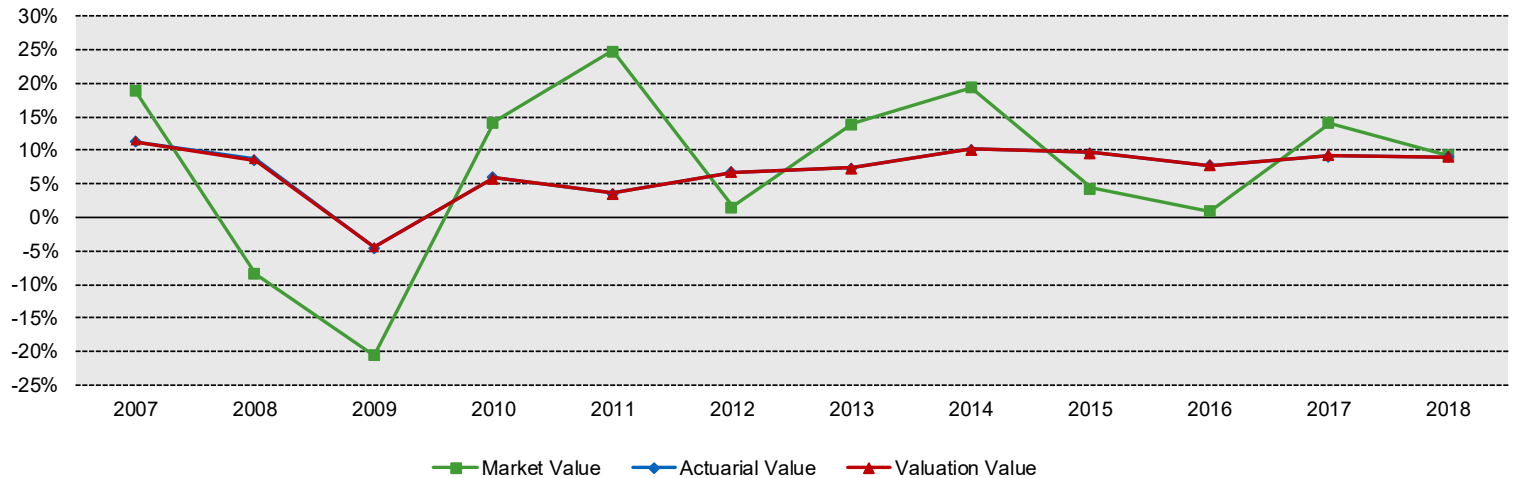
**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

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

*This chart illustrates how this leveling effect has actually worked over the years 2007 - 2018.*

**CHART 12**

**Market Value, Actuarial Value, and Valuation Value of Assets: Rates of Return for Years Ended June 30, 2017 – 2018\***



\* Market Value and Actuarial Value of Assets are for pension and HIB benefits. Valuation Value of Assets are for pension benefits only.

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

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### Other Experience

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

- the extent of turnover among the participants,
- retirement experience (earlier or later than expected),
- mortality (more or fewer deaths than expected),

- the number of disability retirements, and
- salary increases different than assumed.

The net loss from this other experience for the year ended June 30, 2018 amounted to \$41,281,609, which is 1.86% of the actuarial accrued liability.

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

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**D. EMPLOYER AND MEMBER CONTRIBUTIONS**

Employer contributions consist of two components:

*Normal Cost*

The annual contribution rate that, if paid annually from a member's first year of membership through the year of retirement, would accumulate to the amount necessary to fully fund the member's retirement-related benefits. Accumulation includes annual crediting of interest at the assumed investment earnings rate. The contribution rate is expressed as a level percentage of the member's compensation.

*Contribution to the Unfunded Actuarial Accrued Liability (UAAL)*

The annual contribution rate that, if paid annually over the UAAL amortization period, would accumulate to the amount necessary to fully fund the UAAL. Accumulation includes annual crediting of interest at the assumed investment earning rate. The contribution (or rate credit in the case of a negative UAAL) is calculated to remain as a level percentage of future active member payroll (including payroll for new members as they enter the System) assuming a constant number of active members. In order to remain as a level percentage of payroll, amortization payments (credits) are scheduled to increase at the annual rate of 3.25% (i.e., 2.75% inflation plus 0.50% across-the-board salary increase).

Plan changes, assumption changes, and experience gains/losses prior to July 1, 2011 are amortized over separate decreasing 30-year amortization periods. On or after July 1, 2011, plan changes are amortized over separate decreasing 15-year periods; assumption or method changes are amortized over separate decreasing 25-year periods; and experience gains/losses are amortized over separate decreasing 20-year periods.

The recommended employer contribution rates are provided on Chart 13.

Member contributions:

*1955/1980 Plan Members*

Employee contribution rates for 1955/1980 Plan members are prescribed in the Ordinance. Effective April 17, 2006, the rate of member retirement contributions is 6.83%, and 6.74% of that rate is allocated to pay pension benefits. The rest, or 0.09%, is used to pay HIB benefits. The Board of Directors may adjust the employee rates solely pursuant to the terms of a negotiated collective bargaining agreement or memorandum of understanding with employee bargaining units.

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

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Based on bargaining unit contract negotiations in 2013, members are contracted to pay the following employee rates (as a percentage of pay) beginning April 22, 2013:

<u>Effective Date</u>	<u>Member Rate</u>		
	<u>(a) Total</u>	<u>(b) HIB Plan</u>	<u>(c) = (a) – (b) Pension Plan</u>
April 17, 2006*	6.83%*	0.09%	6.74%
April 22, 2013	7.33%	0.09%	7.24%
April 21, 2014	7.83%	0.09%	7.74%
April 20, 2015	8.33%	0.09%	8.24%
April 18, 2016	8.75%	0.09%	8.66%

\* Pursuant to the Ordinance.

*2013 Tier Members*

Pursuant to Section 7522.30(a) of the Government Code, 2013 Tier members are required to contribute at least 50% of the Normal Cost rate. In addition, there are certain additional requirements that would have to be met such as requiring the employee rates be rounded to the nearest one quarter of one percent and requiring the new employees to pay the contribution rate of “similarly situated employees”, if it is greater. (reference: Section 7522.30(c)). We further understand that different rules may have to be applied for collectively bargained employees, non-represented, managerial or other supervisory employees. (reference: Section 7522.30(e)). In preparing the Normal Cost rates in this report, we have assumed that exactly 50% of the Normal Cost would be paid by the new members and we have taken into account in this valuation only the requirements of Section 7522.30(c), but not requirements of Section 7522.30(e). We have also compared the total Normal Cost rates between the current valuation and the initial CalPEPRA valuation so that a rate increase (or decrease) of less than 1% of payroll would result in no change to the member’s rate (reference: Section 7522.30(d)). In particular, the total Normal Cost rate of 17.56% was determined in the first CalPEPRA valuation and this rate has been used through the June 30, 2017 valuation to determine the 50% of the Normal Cost paid by the employees because the change in the total Normal Cost has been less than 1% of payroll over that time.

Accumulation for all members includes crediting of interest at the assumed investment earnings rate. The member contribution rates are provided on Chart 13.

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

### CHART 13

#### Recommended Contribution Rates (% of payroll; payable at the end of each pay period)

	June 30, 2018 Valuation		June 30, 2017 Valuation (Adopted Rates)	
	Rate	Estimated Annual Amount <sup>(1)</sup>	Rate	Estimated Annual Amount <sup>(1)</sup>
<b>1955/1980 Plan</b>				
Total Normal Cost	24.63%	\$36,511,896	24.22%	\$35,904,105
Expected Employee Contributions	<u>-8.66%</u> <sup>(2)</sup>	<u>-12,837,719</u>	<u>-8.66%</u> <sup>(2)</sup>	<u>-12,837,719</u>
Employer Normal Cost	15.97%	\$23,674,177	15.56%	\$23,066,386
UAAL	<u>20.75%</u>	<u>30,760,123</u>	<u>22.30%</u> <sup>(3)</sup>	<u>33,057,867</u>
Total Employer Contribution	36.72%	\$54,434,300	37.86%	\$56,124,253
<b>2013 Tier</b>				
Total Normal Cost	17.79%	\$9,740,623	17.56% <sup>(4)</sup>	\$9,614,690
Expected Employee Contributions	<u>-8.75%</u>	<u>-4,790,919</u>	<u>-8.75%</u>	<u>-4,790,919</u>
Employer Normal Cost	9.04%	\$4,949,704	8.81%	\$4,823,771
UAAL	<u>20.75%</u>	<u>11,361,322</u>	<u>22.43%</u> <sup>(3)</sup>	<u>12,281,179</u>
Total Employer Contribution	29.79%	\$16,311,026	31.24%	\$17,104,950
<b>Combined</b>				
Total Normal Cost	22.79%	\$46,252,519	22.42%	\$45,518,795
Expected Employee Contributions	<u>-8.68%</u>	<u>-17,628,638</u>	<u>-8.68%</u>	<u>-17,628,638</u>
Employer Normal Cost	14.11%	\$28,623,881	13.74%	\$27,890,157
UAAL	<u>20.75%</u>	<u>42,121,445</u>	<u>22.34%</u>	<u>45,339,046</u>
Total Employer Contribution	34.86%	\$70,745,326	36.08%	\$73,229,203

<sup>(1)</sup> Amounts are based on the following June 30, 2018 projected annual payroll:

1955/1980 Plan	\$148,241,558
2013 Tier	<u>54,753,360</u>
Combined	\$202,994,918

<sup>(2)</sup> The rate of 8.66% payable during fiscal years 2018/2019 and 2019/2020 is calculated by taking the total employee rate payable beginning April 18, 2016 (i.e., 8.75%), less the HIB employee contribution rate of 0.09%.

<sup>(3)</sup> The adopted UAAL rates for the June 30, 2017 valuation for the 1955/1980 Plan and the 2013 Tier are not the same since the Board decided to carry over unchanged the higher total (i.e. Pension Plan plus HIB Plan) employer contribution rates from the June 30, 2016 valuations for the June 30, 2017 valuations. Since the actuarially determined rates in the 2017 valuation for the HIB Plan were actually higher than the 2016 valuation rates, the adopted HIB Plan rates for the 2017 valuation were the actuarially determined rates from that valuation. The adopted Pension Plan rates for the 2017 valuation were then the difference between the total adopted rates and the HIB Plan rates. For the Pension Plan, the employer normal cost rates for the 2017 valuation remain the same as those rates actuarially determined for that valuation in order to reflect the most recent demographic information, and the UAAL rates represent the difference between the total rates and the normal cost rates, which produces said variance in the UAAL rates.

<sup>(4)</sup> 17.56% has been calculated using membership data and actuarial assumptions as of June 30, 2017. It is a pure coincidence that this rate is the same as the rate we calculated in the first CalPEPRA valuation.

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**CHART 13**

**Recommended Contribution Rates (% of payroll; payable at the end of each pay period)**

	June 30, 2018 Valuation		June 30, 2017 Valuation (Recommended Rates)	
	Rate	Estimated Annual Amount <sup>(1)</sup>	Rate	Estimated Annual Amount <sup>(1)</sup>
<b>1955/1980 Plan</b>				
Total Normal Cost	24.63%	\$36,511,896	24.22%	\$35,904,105
Expected Employee Contributions	<u>-8.66%</u> <sup>(2)</sup>	<u>-12,837,719</u>	<u>-8.66%</u> <sup>(2)</sup>	<u>-12,837,719</u>
Employer Normal Cost	15.97%	\$23,674,177	15.56%	\$23,066,386
UAAL	<u>20.75%</u>	<u>30,760,123</u>	<u>21.10%</u>	<u>31,278,969</u>
Total Employer Contribution	36.72%	\$54,434,300	36.66%	\$54,345,355
<b>2013 Tier</b>				
Total Normal Cost	17.79%	\$9,740,623	17.56% <sup>(3)</sup>	\$9,614,690
Expected Employee Contributions	<u>-8.75%</u>	<u>-4,790,919</u>	<u>-8.75%</u>	<u>-4,790,919</u>
Employer Normal Cost	9.04%	\$4,949,704	8.81%	\$4,823,771
UAAL	<u>20.75%</u>	<u>11,361,322</u>	<u>21.10%</u>	<u>11,552,959</u>
Total Employer Contribution	29.79%	\$16,311,026	29.91%	\$16,376,730
<b>Combined</b>				
Total Normal Cost	22.79%	\$46,252,519	22.42%	\$45,518,795
Expected Employee Contributions	<u>-8.68%</u>	<u>-17,628,638</u>	<u>-8.68%</u>	<u>-17,628,638</u>
Employer Normal Cost	14.11%	\$28,623,881	13.74%	\$27,890,157
UAAL	<u>20.75%</u>	<u>42,121,445</u>	<u>21.10%</u>	<u>42,831,928</u>
Total Employer Contribution	34.86%	\$70,745,326	34.84%	\$70,722,085

<sup>(1)</sup> Amounts are based on the following June 30, 2018 projected annual payroll:

1955/1980 Plan	\$148,241,558
2013 Tier	<u>54,753,360</u>
Combined	\$202,994,918

<sup>(2)</sup> The rate of 8.66% payable during fiscal years 2018/2019 and 2019/2020 is calculated by taking the total employee rate payable beginning April 18, 2016 (i.e., 8.75%), less the HIB employee contribution rate of 0.09%.

<sup>(3)</sup> 17.56% has been calculated using membership data and actuarial assumptions as of June 30, 2017. It is a pure coincidence that this rate is the same as the rate we calculated in the first CalPEPRA valuation.

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

The employer contribution rates as of June 30, 2018 are based on all of the data described in the previous sections, the actuarial assumptions described in Section 4, and the Plan provisions adopted at the time of preparation of the Actuarial Valuation. They include all changes affecting future costs, adopted benefit changes, actuarial gains and losses, and changes in the actuarial assumptions.

### Reconciliation of Recommended Employer Contribution

The chart below details the changes in the recommended employer contribution from the prior valuation to the current year's valuation.

*The chart reconciles the employer contribution from the prior valuation to the amount determined in this valuation.*

#### CHART 14

#### Reconciliation of Recommended Employer Contribution Rate from June 30, 2017 to June 30, 2018

	Contribution Rate	Estimated Amount <sup>(1)</sup>
Adopted Contribution Rate as of June 30, 2017	36.08%	\$73,229,203
Recommended Contribution Rate as of June 30, 2017	34.84%	\$70,722,085
Effect of actuarial experience during fiscal 2017/2018		
1. Effect of increase in employer normal cost due to demographic changes <sup>(2)</sup>	0.06%	\$121,797
2. Effect of investment gain (after smoothing)	(0.95)%	(1,928,452)
3. Effect of reflecting salary increases for actives upon completion of negotiations between the District and the bargaining parties	1.38%	2,801,330
4. Effect of higher than expected growth in total payroll	(1.24)%	(2,517,137)
5. Effect of one-year lag in implementing contribution rates	(0.26)%	(527,787)
6. Effect of other demographic experience losses on actuarial accrued liability <sup>(2)</sup>	0.32%	632,226
7. Effect of changes in actuarial assumptions	0.71%	1,441,264
Subtotal	0.02%	\$23,241
Recommended Contribution Rate as of June 30, 2018	34.86%	\$70,745,326

<sup>(1)</sup> Based on June 30, 2018 projected annual payroll of \$202,994,918.

<sup>(2)</sup> Includes refinement in the method used in the allocation of liability between normal cost and actuarial accrued liability.

**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

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The member contribution rates as of June 30, 2018 are based on all of the data described in the previous sections, the actuarial assumptions described in Section 4, and the Plan provisions adopted at the time of preparation of the Actuarial Valuation. They include all changes affecting future costs, adopted benefit changes, actuarial gains and losses, and changes in the actuarial assumptions.

**Reconciliation of Recommended Employee Contribution**

The chart below details the changes in the recommended member contribution rate from the prior valuation to the current year's valuation.

*The chart reconciles the employee contribution from the prior valuation to the amount determined in this valuation.*

**CHART 15**

**Reconciliation of Recommended Employee Contribution Rate from June 30, 2017 to June 30, 2018**

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	Contribution Rate	Estimated Amount*
Average Contribution Rate as of June 30, 2017	8.68%	\$17,628,638
1. Effect of change in member demographics	0.00%	0
Average Contribution Rate as of June 30, 2018	8.68%	\$17,628,638

\* Based on June 30, 2018 projected annual payroll of \$202,994,918.

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

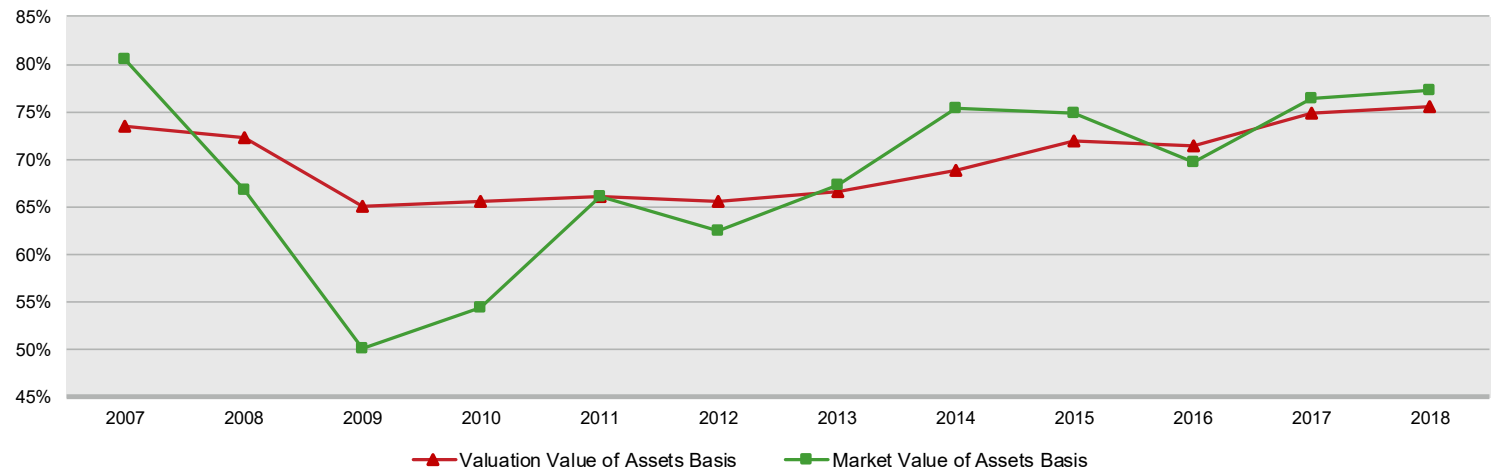
### E. FUNDED RATIO

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

The funded status measures shown in this valuation are appropriate for assessing the need for or amount of future contributions. However, they are not necessarily appropriate for assessing the sufficiency of Plan assets to cover the estimated cost of setting the Plan's benefit obligations. As the chart below shows, the measures are different depending on whether the valuation value or market value of assets is used.

#### CHART 16

Funded Ratio for Plan Years Ending June 30, 2007 - 2018



**SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System**

**CHART 17**

**Schedule of Funding Progress  
(Dollar Amounts in Thousands)**

<b>Actuarial Valuation Date</b>	<b>Valuation Value of Assets (a)</b>	<b>Actuarial Accrued Liability (AAL) (b)</b>	<b>Unfunded/ (Overfunded) AAL (UAAL) (b) - (a)</b>	<b>Funded Ratio (a) / (b)</b>	<b>Covered Payroll (c)</b>	<b>UAAL as a Percentage of Covered Payroll [(b) - (a)] / (c)</b>
06/30/2009	\$862,021	\$1,323,555	\$461,534	65.1%	\$161,893	285.1%
06/30/2010	915,845	1,396,003	480,158	65.6%	164,085	292.6%
06/30/2011	954,719	1,446,039	491,320	66.0%	159,505	308.0%
06/30/2012	1,021,546	1,556,696	535,150	65.6%	158,847	336.9%
06/30/2013	1,095,847	1,646,534	550,687	66.6%	159,246	345.8%
06/30/2014	1,210,321	1,756,706	546,385	68.9%	167,196	326.8%
06/30/2015	1,327,113	1,845,912	518,799	71.9%	174,899	296.6%
06/30/2016	1,425,785	1,995,863	570,078	71.4%	183,971	309.9%
06/30/2017	1,549,213	2,068,015	518,802	74.9%	184,859	280.6%
06/30/2018	1,678,417	2,220,977	542,560	75.6%	202,995	267.3%

## SECTION 2: Valuation Results for the East Bay Municipal Utility District Employees' Retirement System

### F. VOLATILITY RATIOS

Retirement plans are subject to volatility in the level of required contributions. This volatility tends to increase as retirement plans become more mature.

The Asset Volatility Ratio (AVR), which is equal to the market value of assets divided by total payroll, provides an indication of the potential contribution volatility for any given level of investment volatility. A higher AVR indicates that the plan is subject to a greater level of contribution volatility. This is a current measure since it is based on the current level of assets.

For EBMUD, the current AVR is about 8.5. This means that a 1% asset gain/(loss) (relative to the assumed investment return) translates to about 8.5% of one-year's payroll. Since EBMUD amortizes actuarial gains and losses over a 20-year period, there would be a 0.6% of payroll decrease/(increase) in the required contribution for each 1% asset gain/(loss).

The Liability Volatility Ratio (LVR), which is equal to the Actuarial Accrued Liability divided by payroll, provides an indication of the longer-term potential for contribution volatility for any given level of investment volatility. This is because, over an extended period of time, the plan's assets should track the plan's liabilities. For example, if a plan is 50% funded on a market value basis, the liability volatility ratio would be double the asset volatility ratio and the plan sponsor should expect contribution volatility to increase over time as the plan becomes better funded.

The LVR also indicates how volatile contributions will be in response to changes in the Actuarial Accrued Liability due to actual experience or to changes in actuarial assumptions.

For EBMUD, the current LVR is about 10.9. This is about 28% higher than the AVR. Therefore, we would expect that contribution volatility will increase over the long-term.

*This chart shows how the asset and liability volatility ratios have varied over time.*

**CHART 18**  
**Volatility Ratios for Years Ended June 30, 2009 – 2018**

Year Ended June 30	Asset Volatility Ratio	Liability Volatility Ratio
2009	4.1	8.2
2010	4.6	8.5
2011	6.0	9.1
2012	6.1	9.8
2013	7.0	10.3
2014	7.9	10.5
2015	7.9	10.6
2016	7.6	10.8
2017	8.6	11.2
2018	8.5	10.9

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

*This exhibit summarizes the participant data used for the current and prior valuations.*

**EXHIBIT A**

**Table of Plan Coverage**

**i. All**

<b>Category</b>	<b>Year Ended June 30</b>		<b>Change From Prior Year</b>
	<b>2018</b>	<b>2017</b>	
<b>Active participants in valuation:</b>			
Number	1,828	1,802	1.4%
Average age	47.8	48.0	-0.2
Average service	12.4	12.8	-0.4
Projected total payroll	\$202,994,918	\$184,858,798	9.8%
Projected average payroll	\$111,048	\$102,585	8.2%
Account balances	\$190,870,938	\$180,582,819	5.7%
Total active vested participants	1,211	1,215	-0.3%
<b>Vested terminated participants:</b>			
Number	284	267	6.4%
Average age	49.1	49.0	0.1
<b>Retired participants:</b>			
Number in pay status	1,428	1,370	4.2%
Average age	69.7	69.5	0.2
Average monthly benefit	\$5,363	\$5,175	3.6%
<b>Disabled participants:</b>			
Number in pay status	61	58	5.2%
Average age	65.0	64.5	0.5
Average monthly benefit	\$2,210	\$2,209	0.0%
<b>Beneficiaries:</b>			
Number in pay status	290	285	1.8%
Average age	73.6	74.0	-0.4
Average monthly benefit	\$2,825	\$2,615	8.0%

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT A**

**Table of Plan Coverage**

**ii. 1955/1980 Plan**

<b>Category</b>	<b>Year Ended June 30</b>		<b>Change From Prior Year</b>
	<b>2018</b>	<b>2017</b>	
<b>Active participants in valuation:</b>			
Number	1,252	1,334	-6.1%
Average age	51.5	51.2	0.3
Average service	16.9	16.6	0.3
Projected total payroll	\$148,241,558	\$144,384,277	2.7%
Projected average payroll	\$118,404	\$108,234	9.4%
Account balances	\$179,078,975	\$173,283,945	3.3%
Total active vested participants	1,167	1,215	-4.0%
<b>Vested terminated participants:</b>			
Number	225	226	-0.4%
Average age	50.9	50.5	0.4
<b>Retired participants:</b>			
Number in pay status	1,428	1,370	4.2%
Average age	69.7	69.5	0.2
Average monthly benefit	\$5,363	\$5,175	3.6%
<b>Disabled participants:</b>			
Number in pay status	61	58	5.2%
Average age	65.0	64.5	0.5
Average monthly benefit	\$2,210	\$2,209	0.0%
<b>Beneficiaries:</b>			
Number in pay status	290	285	1.8%
Average age	73.6	74.0	-0.4
Average monthly benefit	\$2,825	\$2,615	8.0%

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT A**

**Table of Plan Coverage**

**iii. 2013 Tier**

<b>Category</b>	<b>Year Ended June 30</b>		<b>Change From Prior Year</b>
	<b>2018</b>	<b>2017</b>	
<b>Active participants in valuation:</b>			
Number	576	468	23.1%
Average age	39.7	39.0	0.7
Average service	2.6	2.2	0.4
Projected total payroll	\$54,753,360	\$40,474,521	35.3%
Projected average payroll	\$95,058	\$86,484	9.9%
Account balances	\$11,791,963	\$7,298,874	61.6%
Total active vested participants	44	0	N/A
<b>Vested terminated participants:</b>			
Number	59	41	43.9%
Average age	42.3	40.9	1.4
<b>Retired participants:</b>			
Number in pay status	N/A	N/A	N/A
Average age	N/A	N/A	N/A
Average monthly benefit	N/A	N/A	N/A
<b>Disabled participants:</b>			
Number in pay status	N/A	N/A	N/A
Average age	N/A	N/A	N/A
Average monthly benefit	N/A	N/A	N/A
<b>Beneficiaries:</b>			
Number in pay status	N/A	N/A	N/A
Average age	N/A	N/A	N/A
Average monthly benefit	N/A	N/A	N/A

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT B**

**Participants in Active Service as of June 30, 2018  
By Age, Years of Service, and Average Projected Payroll**

**i. 1955/1980 Plan**

Age	Years of Service									
	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & over
Under 25	--	--	--	--	--	--	--	--	--	--
25 - 29	10	1	9	--	--	--	--	--	--	--
30 - 34	53	18	32	3	--	--	--	--	--	--
35 - 39	111	19	43	46	3	--	--	--	--	--
40 - 44	136	15	41	48	28	4	--	--	--	--
45 - 49	188	15	31	51	44	36	10	1	--	--
50 - 54	268	13	23	68	34	67	43	20	--	--
55 - 59	260	3	26	52	32	58	54	29	5	1
60 - 64	162	--	17	27	23	25	30	20	18	2
65 - 69	50	1	4	9	5	13	8	4	3	3
70 & over	14	--	--	3	2	4	2	3	--	--
Total	1,252	85	226	307	171	207	147	77	26	6
	\$118,404	\$113,072	\$115,014	\$117,010	\$114,422	\$121,165	\$122,995	\$128,407	\$127,724	\$129,942

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT B**

**Participants in Active Service as of June 30, 2018  
By Age, Years of Service, and Average Projected Payroll**

**ii. 2013 Tier**

Age	Years of Service									
	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & over
Under 25	7	7	--	--	--	--	--	--	--	--
	\$87,171	\$87,171	--	--	--	--	--	--	--	--
25 - 29	79	75	4	--	--	--	--	--	--	--
	94,019	93,525	\$103,294	--	--	--	--	--	--	--
30 - 34	133	128	5	--	--	--	--	--	--	--
	90,614	90,455	94,687	--	--	--	--	--	--	--
35 - 39	110	102	8	--	--	--	--	--	--	--
	96,251	96,069	98,574	--	--	--	--	--	--	--
40 - 44	94	91	3	--	--	--	--	--	--	--
	99,385	99,316	101,497	--	--	--	--	--	--	--
45 - 49	59	50	9	--	--	--	--	--	--	--
	99,790	99,431	101,786	--	--	--	--	--	--	--
50 - 54	44	36	8	--	--	--	--	--	--	--
	93,436	91,064	104,108	--	--	--	--	--	--	--
55 - 59	30	24	6	--	--	--	--	--	--	--
	95,234	93,491	102,207	--	--	--	--	--	--	--
60 - 64	17	16	1	--	--	--	--	--	--	--
	91,788	90,414	113,775	--	--	--	--	--	--	--
65 - 69	2	2	--	--	--	--	--	--	--	--
	98,273	98,273	--	--	--	--	--	--	--	--
70 & over	1	1	--	--	--	--	--	--	--	--
	121,388	121,388	--	--	--	--	--	--	--	--
Total	576	532	44	--	--	--	--	--	--	--
	\$95,058	\$94,545	\$101,265	--	--	--	--	--	--	--

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT C**

**Reconciliation of Participant Data**

	<b>Active Participants</b>	<b>Vested Participants</b>	<b>Disabled</b>	<b>Retired Participants</b>	<b>Beneficiaries</b>	<b>Total</b>
Number as of June 30, 2017	1,802	267	58	1,370	285	3,782
New participants	141	0	0	0	0	141
Terminations – with vested rights	-25	25	0	0	0	0
Refund of contributions	-8	-8	0	0	0	-16
Retirements	-82	-9	0	91	0	0
New disabilities	-2	-1	3	0	0	0
Return to work	2	-2	0	0	0	0
Died with or without beneficiary	0	0	0	-33	5 <sup>(1)</sup>	-28
Data adjustments	<u>0</u>	<u>12<sup>(2)</sup></u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>12</u>
Number as of June 30, 2018	1,828	284	61	1,428	290	3,891

<sup>(1)</sup> This is the net increase in the number of beneficiaries after subtracting the number of beneficiaries who died during the year.

<sup>(2)</sup> All 12 members were hired and terminated employment during fiscal year 2017/2018.

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT D**

**Summary Statement of Income and Expenses on an Actuarial Value Basis for All Pension Plan and HIB Plan Assets**

	Year Ended June 30, 2018	Year Ended June 30, 2017
<b>Contribution income:</b>		
Employer contributions	\$81,096,000	\$76,860,000
Employee contributions	<u>17,079,000</u>	<u>16,018,000</u>
Net contribution income	\$98,175,000	\$92,878,000
<b>Investment income:</b>		
Interest, dividends and other income	\$31,365,000	\$28,865,000
Recognition of capital appreciation	117,590,834	111,575,292
Less investment and administrative fees	<u>(7,055,000)</u>	<u>(6,823,000)</u>
Net investment income	<u>\$141,900,834</u>	<u>\$133,617,292</u>
<b>Total income available for benefits</b>	<b>\$240,075,834</b>	<b>\$226,495,292</b>
<b>Less benefit payments:</b>		
Benefits paid	\$(105,984,000)	\$(98,152,000)
Refund of contributions	<u>(393,000)</u>	<u>(465,000)</u>
Net benefit payments	\$(106,377,000)	\$(98,617,000)
<b>Change in amount available for future benefits</b>	<b>\$133,698,834</b>	<b>\$127,878,292</b>

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT E**

**Summary Statement of Assets for Pension and HIB Plans**

	Year Ended June 30, 2018	Year Ended June 30, 2017
<b>Cash equivalents</b>	\$41,196,000	\$48,988,000
<b>Accounts receivable:</b>		
Brokers, securities sold	\$2,424,000	\$4,449,000
Employer and employee contributions	1,648,000	1,263,000
Interest and dividends	<u>2,673,000</u>	<u>2,341,000</u>
Total accounts receivable	\$6,745,000	\$8,053,000
<b>Investments:</b>		
Equities	\$1,197,060,000	\$1,227,836,000
Fixed income investments	431,709,000	251,860,000
Real estate	89,629,000	84,282,000
Securities lending collateral	47,104,000	108,858,000
Other assets	<u>536,000</u>	<u>518,000</u>
Total investments at market value	<u>\$1,766,038,000</u>	<u>\$1,673,354,000</u>
<b>Total assets</b>	<u>\$1,813,979,000</u>	<u>\$1,730,395,000</u>
<b>Less accounts payable:</b>		
Accounts payable and accrued expenses	\$(2,167,000)	\$(2,061,000)
Payables to brokers, securities purchased	(11,468,000)	(6,832,000)
Securities lending collateral	<u>(47,104,000)</u>	<u>(108,858,000)</u>
Total accounts payable	\$(60,739,000)	\$(117,751,000)
<b>Net assets at market value</b>	<u>\$1,753,240,000</u>	<u>\$1,612,644,000</u>
<b>Net assets at actuarial value</b>	<u>\$1,714,363,843</u>	<u>\$1,580,665,009</u>
<b>Net assets at valuation value (pension plan only)</b>	<u>\$1,678,417,000</u>	<u>\$1,549,213,319</u>

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT F**

**Development of the Fund Through June 30, 2018 for All Pension Plan and HIB Plan Assets**

<b>Year Ended June 30</b>	<b>Employer Contributions</b>	<b>Employee Contributions</b>	<b>Net Actuarial Value Investment Return*</b>	<b>Benefit Payments</b>	<b>Actuarial Value of Assets at End of Year</b>
2009	\$45,803,000	\$10,740,000	\$(40,593,156)	\$54,502,000	\$869,375,000
2010	51,756,000	10,918,000	51,966,871	58,109,000	925,906,871
2011	58,481,000	10,850,000	33,642,654	62,114,000	966,766,525
2012	59,651,000	10,723,000	65,488,807	66,843,000	1,035,786,332
2013	61,567,000	10,566,000	76,545,489	72,095,000	1,112,369,821
2014	70,117,000	12,133,000	113,600,558	78,265,000	1,229,955,379
2015	73,141,000	13,427,000	118,952,917	85,184,000	1,350,292,296
2016	74,672,000	14,925,000	104,468,421	91,571,000	1,452,786,717
2017	76,860,000	16,018,000	133,617,292	98,617,000	1,580,665,009
2018	81,096,000	17,079,000	141,900,834	106,377,000	1,714,363,843

\* Net of investment fees and administrative expenses.

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT G**

**Actuarial Balance Sheet**

An overview of the Plan's funding is given by an Actuarial Balance Sheet. In this approach, we first determine the amount and timing of all future payments that will be made by the Plan for current participants. We then discount these payments at the valuation interest rate to the date of the valuation, thereby determining their present value. We refer to this present value as the "liability" of the Plan.

Second, we determine how this liability will be met. These actuarial "assets" include the net amount of assets already accumulated by the Plan, the present value of future member contributions, the present value of future employer normal cost contributions, and the present value of future employer amortization payments.

**Actuarial Balance Sheet**

**Assets**

	<u>June 30, 2018</u>	<u>June 30, 2017</u>
1. Total valuation assets	\$1,678,417,000	\$1,549,213,319
2. Present value of future contribution by members	148,485,510 <sup>(1)</sup>	138,093,251
3. Present value of future employer contributions for:		
(a) entry age normal cost	213,798,965	187,172,177
(b) unfunded actuarial accrued liability	<u>542,560,433</u>	<u>518,801,626</u>
4. Total current and future assets	\$2,583,261,908	\$2,393,280,373

**Liabilities**

	<u>June 30, 2018</u>	<u>June 30, 2017</u>
5. Present value of benefits for retirees and beneficiaries	\$1,362,091,541	\$1,259,012,986
6. Present value of benefits for terminated vested members	44,915,354	43,660,442
7. Present value of benefits for active members	<u>1,176,255,013</u>	<u>1,090,606,945</u>
8. Total liabilities	\$2,583,261,908	\$2,393,280,373

<sup>(1)</sup> For actuarial balance sheet display purposes only, we aligned the timing of this item with the other items in this table by discounting the present value of future member contributions to the beginning of the fiscal year. This has no impact on the normal cost contribution rates developed in this report.

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT H**

**Development of Unfunded Actuarial Accrued Liability for Year Ended June 30, 2018**

1. Unfunded actuarial accrued liability at beginning of year		\$518,801,626
2. Normal cost at beginning of year		40,636,371
3. Expected employer and member contributions at beginning of year		(78,297,708)
4. Interest		<u>34,882,671</u>
5. Expected unfunded actuarial accrued liability		\$516,022,960
6. Changes due to:		
(a) Gain from investments (after smoothing)	\$(27,228,527)	
(b) Reflection of salary increases for actives upon the completion of negotiations between the District and the bargaining parties <sup>(1)</sup>	39,577,265	
(c) Gain due to one-year lag in implementing contribution rates in June 30, 2017 valuation (with interest to end of year)	(7,299,644)	
(d) Loss from all other sources	9,003,988	
(e) Changes in actuarial assumptions	<u>12,484,391</u>	
(f) Total changes		<u>\$26,537,473</u>
7. Unfunded actuarial accrued liability at end of year		\$542,560,433

Note: The "net loss from other experience" of \$48,581,253 from Section 2, Chart 9 is equal to the sum of items 6(b) and 6(d).

<sup>(1)</sup> We noted in the June 30, 2017 valuation report that there was a reduction in the UAAL in that valuation because there had been no general salary increases other than individual merit and promotional increases since April 2016 because contract negotiation was not complete as of June 30, 2017.

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT I**

**Table of Amortization Bases**

Type	Date Established	Initial Years	Initial Amount	Outstanding Balance	Years Remaining	Annual Payment*
Experience Gain	6/30/2000	30	\$(10,871,830)	\$(11,628,338)	12	\$(1,170,209)
Change in Assumptions	6/30/2000	30	8,629,891	9,230,397	12	928,894
Plan Amendments	6/30/2000	30	13,607,265	14,554,117	12	1,464,643
3.5% Retiree COLA Assumption	6/30/2000	30	27,057,441	28,940,215	12	2,912,377
Experience Loss	6/30/2001	30	2,292,281	2,507,822	13	236,839
Experience Loss	6/30/2002	30	26,232,251	29,184,874	14	2,601,700
Plan Amendments	6/30/2002	30	5,111,914	5,687,294	14	506,997
Experience Loss	6/30/2003	30	43,692,270	49,187,610	15	4,159,813
Plan Amendments	6/30/2003	30	67,138,578	75,582,843	15	6,392,067
Experience Loss	6/30/2004	30	32,731,232	37,124,829	16	2,991,509
New Assumption / Domestic Partners	6/30/2004	30	(9,812,646)	(11,129,824)	16	(896,838)
Experience Loss	6/30/2005	30	26,910,233	30,635,663	17	2,361,106
Remove Limit Pension Base	6/30/2005	30	27,315,928	30,956,186	17	2,385,808
Experience Loss	6/30/2006	30	14,160,133	16,126,351	18	1,192,742
Experience Gain	6/30/2007	30	(3,098,126)	(3,519,170)	19	(250,536)
Experience Gain	6/30/2008	30	(7,800,585)	(8,814,388)	20	(605,622)
Change in Assumptions	6/30/2008	30	51,413,374	58,095,329	20	3,991,635
Experience Loss	6/30/2009	30	114,894,458	128,841,808	21	8,564,225
Experience Loss	6/30/2010	30	3,039,098	3,374,931	22	217,500
Change in Assumptions	6/30/2010	30	8,098,499	8,993,416	22	579,587
Experience Loss	6/30/2011	30	4,428,038	4,863,661	23	304,490
Experience Gain	6/30/2012	20	(15,668,764)	(14,967,435)	14	(1,334,279)
Change in Assumptions	6/30/2012	25	53,400,521	55,197,134	19	3,929,586
Experience Loss	6/30/2013	20	10,858,322	10,529,171	15	890,456
Experience Gain	6/30/2014	20	(26,406,581)	(25,880,871)	16	(2,085,474)
Change in Assumptions	6/30/2014	25	18,421,049	18,915,568	21	1,257,334
Experience Gain	6/30/2015	20	(28,955,525)	(28,642,944)	17	(2,207,526)
Experience Gain	6/30/2016	20	(1,408,751)	(1,401,798)	18	(103,680)
Change in Assumptions	6/30/2016	25	52,595,760	53,444,380	23	3,345,895
Experience Gain	6/30/2017	20	(50,022,788)	(49,965,871)	19	(3,557,163)
Experience Loss	6/30/2018	20	14,053,082	14,053,082	20	965,564
Change in Assumptions	6/30/2018	25	12,484,391	<u>12,484,391</u>	25	<u>741,438</u>
<b>Total</b>				<b>\$542,560,433</b>		<b>\$40,710,878</b>

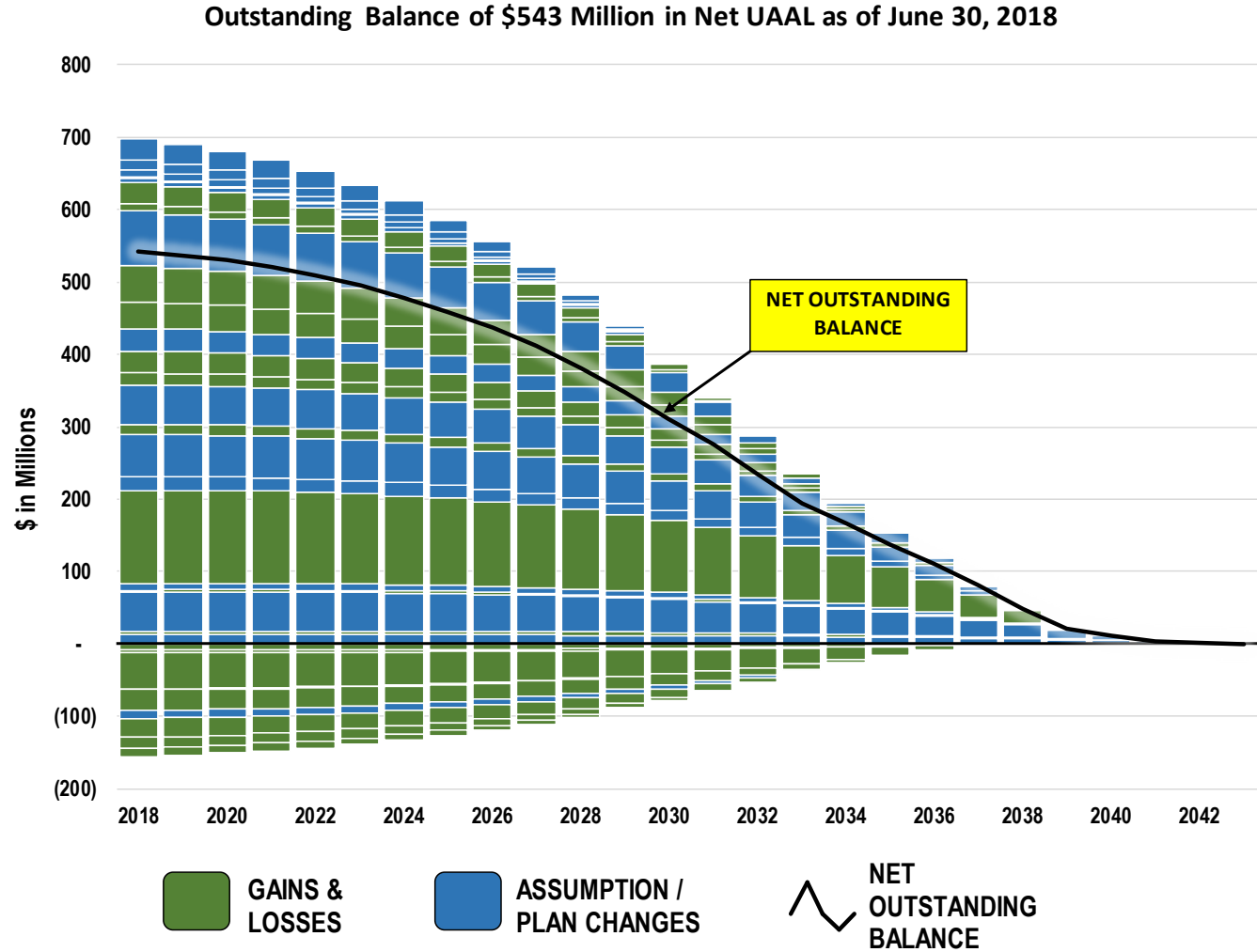
\* Beginning of year payment, reflecting level percentage of payroll.

Note: The equivalent single amortization period is about 18 years.

**SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT J**

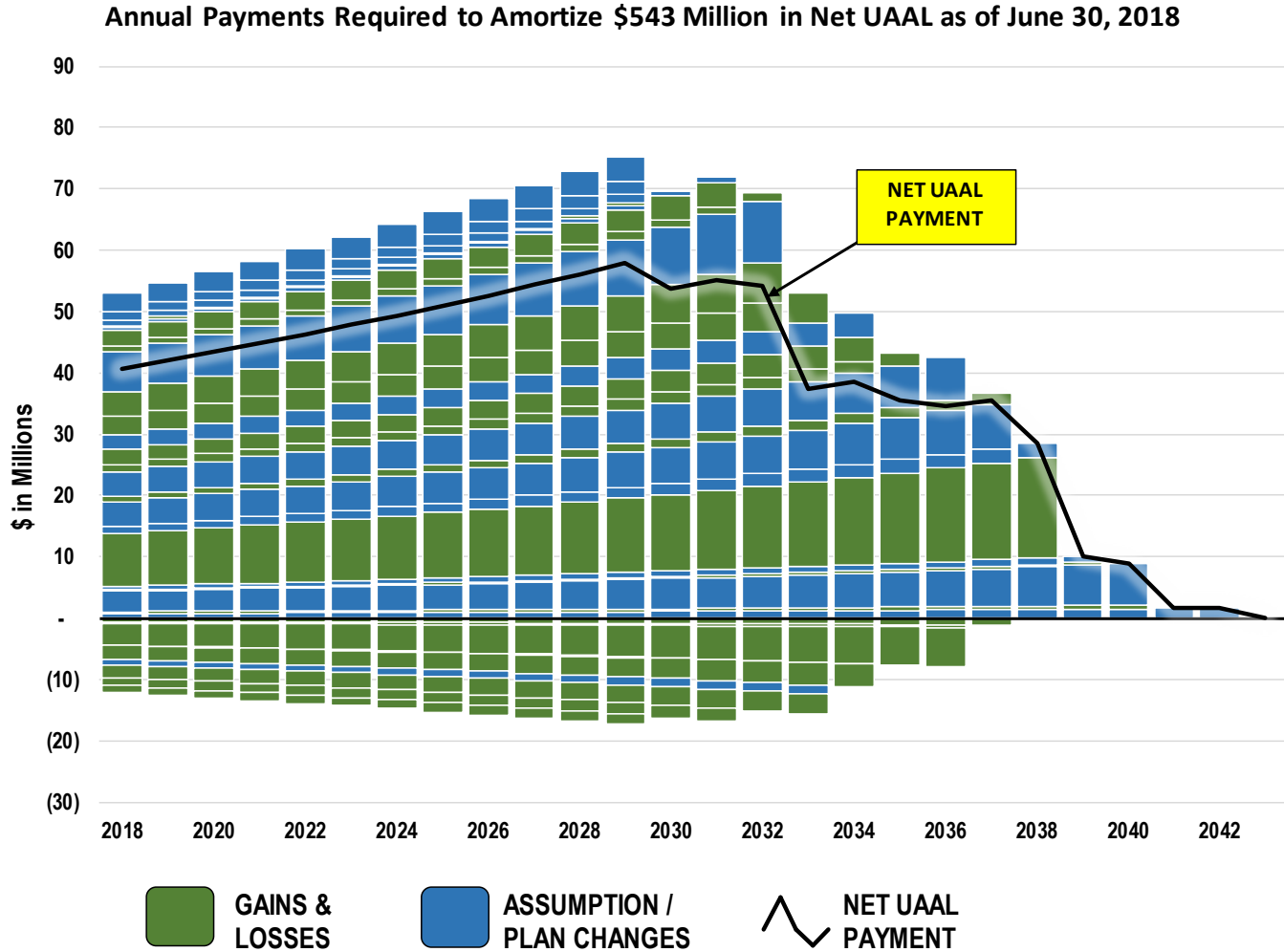
**Projection of UAAL Balances and Payments (1 of 2)**



SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System

EXHIBIT J

Projection of UAAL Balances and Payments (2 of 2)



### SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System

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#### EXHIBIT K

#### Section 415 Limitations

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Section 415 of the Internal Revenue Code (IRC) specifies the maximum benefits that may be paid to an individual from a defined benefit plan and the maximum amounts that may be allocated each year to an individual's account in a defined contribution plan.

A qualified pension plan may not pay benefits in excess of the Section 415 limits. The ultimate penalty for non-compliance is disqualification: active participants could be taxed on their vested benefits and the IRS may seek to tax the income earned on the plan's assets.

In particular, Section 415(b) of the IRC limits the maximum annual benefit payable at the Normal Retirement Age to a dollar limit of \$160,000 indexed for inflation. That limit is \$220,000 for 2018 and \$225,000 for 2019. Normal Retirement Age for these purposes is age 62. These are the limits in simplified terms. They must be adjusted based on each participant's circumstances, for such things as age at retirement, form of benefits chosen and after tax contributions.

Benefits for members in the non-CalPEPRA plan in excess of the limits may be paid through a qualified governmental excess plan that meets the requirements of Section 415(m).

Legal Counsel's review and interpretation of the law and regulations should be sought on any questions in this regard.

Contribution rates determined in this valuation have not been reduced for the Section 415 limitations. Actual limitations will result in actuarial gains as they occur.

## SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System

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### EXHIBIT L

#### Definitions of Pension Terms

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

#### **Assumptions or Actuarial**

##### **Assumptions:**

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

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

##### **Normal Cost:**

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

##### **Actuarial Accrued Liability**

##### **For Actives:**

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

##### **Actuarial Accrued Liability**

##### **For Pensioners:**

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

##### **Unfunded Actuarial Accrued**

##### **Liability:**

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

##### **Amortization of the Unfunded**

##### **Actuarial Accrued Liability:**

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

### SECTION 3: Supplemental Information for the East Bay Municipal Utility District Employees' Retirement System

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**Investment Return:**

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

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

**EXHIBIT I**

**Summary of Actuarial Valuation Results**

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

1. Retired participants as of the valuation date (including 290 beneficiaries in pay status)	1,779
2. Participants inactive during year ended June 30, 2018 with vested rights	284
3. Participants active during the year ended June 30, 2018	1,828
Fully vested	1,211
Not vested	617

The actuarial factors as of the valuation date are as follows:

1. Normal cost, beginning of year	\$44,711,240
2. Present value of future benefits	2,583,261,908
3. Present value of future normal costs	362,284,475
4. Actuarial accrued liability	
Retired participants and beneficiaries	\$1,362,091,541
Inactive participants with vested rights	44,915,354
Active participants	<u>813,970,538</u>
Subtotal	\$2,220,977,433
5. Valuation value of assets (\$1,753,240,000 at market value for pension and HIB plans, as reported by the auditor, and \$1,714,363,843 at actuarial value for pension and HIB plans)	\$1,678,417,000 <sup>(1)</sup>
6. Unfunded actuarial accrued liability	\$542,560,433

<sup>(1)</sup> Net of HIB assets.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**EXHIBIT I (continued)**

**Summary of Actuarial Valuation Results**

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The determination of the recommended contribution at the end of each pay period is as follows:

	<u>1955/1980 Plan</u>	<u>2013 Tier</u>	<u>Combined</u>
1. Total normal cost	\$36,511,896	\$9,740,623	\$46,252,519
2. Expected employee contributions	<u>-12,837,719</u>	<u>-4,790,919</u>	<u>-17,628,638</u>
3. Employer normal cost: (1) + (2)	\$23,674,177	\$4,949,704	\$28,623,881
4. Payment on unfunded actuarial accrued liability	<u>30,760,123</u>	<u>11,361,322</u>	<u>42,121,445</u>
5. Total recommended contribution: (3) + (4)	\$54,434,300	\$16,311,026	\$70,745,326
6. Projected payroll	\$148,241,558	\$54,753,360	\$202,994,918
7. Total recommended contribution as a percentage of projected payroll: (5) ÷ (6)	36.72%	29.79%	34.86%

*Note: The contribution amounts shown above are based on the recommended employer and employee contribution rates payable at the end of each pay period, multiplied by the projected payroll.*

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**EXHIBIT II**

**Actuarial Assumptions and Actuarial Cost Method**

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**Rationale for Assumptions:** The information and analysis used in selecting each assumption that has a significant effect on this actuarial valuation is shown in the July 1, 2012 through June 30, 2016 Actuarial Experience Study report dated November 10, 2016 and the Review of Economic Actuarial Assumptions report dated September 12, 2018. Unless otherwise noted, all actuarial assumptions and methods shown below apply to both tiers. These assumptions were adopted by the Board.

**Economic Assumptions:**

**Net Investment Return:** 7.00%, net of investment and administrative expenses.

**Interest Credited to Employee Accounts:** 7.00%

**Inflation:** 2.75%\*

**Across the Board Salary Increases:** 0.50%

**Cost of Living Increases:** 2.75% per annum.

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\* The maximum amount of compensation earnable for all 1955/1980 Plan members who began membership in EBMUDERS on or after January 1, 1996 and pensionable compensation for all 2013 Tier members that can be taken into account is also assumed to increase by 2.75% per year.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Salary Increases:**

**Annual Rate of Compensation Increase**

Inflation: 2.75% per year; plus across the board salary increases of 0.50% per year; plus the following merit and promotional increases based on years of service:

<b>Years of Service</b>	<b>Merit and Promotional Increases</b>
0	6.00%
1	5.00%
2	4.00%
3	3.00%
4	2.00%
5	1.00%
6	0.80%
7+	0.50%

**Demographic Assumptions:**

**Mortality Rates:**

*Pre-retirement*

Males

Headcount-Weighted RP-2014 Employee Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward two years for males

Females

Headcount-Weighted RP-2014 Employee Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward one year for females

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Mortality Rates: (continued)**

*After Service Retirement and  
All Beneficiaries*

Males	Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward two years for males
Females	Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward one year for females

*After Disability Retirement:*

Males	Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward nine years for males
Females	Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional improvement scale MP-2015, set forward nine years for females

The above mortality tables contain a margin slightly less than 20% for males and females combined, based on actual to expected deaths, as a provision to reflect future mortality improvement, based on a review of mortality experience as of the measurement date.

**Disability Rates:**

Age	Rate (%)		Age	Rate (%)	
	Male	Female		Male	Female
25	0.000	0.000	50	0.200	0.380
30	0.006	0.030	55	0.200	0.460
35	0.016	0.068	60	0.230	0.560
40	0.068	0.212	65	0.310	0.660
45	0.160	0.330			

*Note: Disability rates applicable after eight years of service.*

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Termination Rates:**

Service	Rate (%)	
	Ordinary Withdrawal*	
	Male	Female
0	2.25	3.00
1	1.00	2.50
2	0.75	2.25
3	0.50	2.00
4	0.25	1.25

Age	Rate (%)			
	Ordinary Withdrawal**		Vested Termination	
	Male	Female	Male	Female
25	0.230	0.640	6.40	7.00
30	0.205	0.540	5.40	6.40
35	0.180	0.440	3.50	4.80
40	0.155	0.340	2.20	3.40
45	0.130	0.240	1.70	2.40
50	0.105	0.140	0.96	1.40
55	0.080	0.085	0.48	0.70
60	0.055	0.060	0.34	0.50

\* *Applicable for members with less than five years of service.*

\*\* *Applicable after five years of service.*

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

**Retirement Rates:**

Age	Rate (%)			
	1955/1980 Plan		2013 Tier	
	Male	Female	Male	Female
52	0.00	0.00	2.00	1.00
53	0.00	0.00	2.00	1.00
54*	6.00	6.00	3.00	2.00
55	7.00	7.00	5.00	4.00
56	7.00	8.00	6.00	5.00
57	9.00	8.00	6.00	5.00
58	10.00	9.00	6.00	5.00
59	10.00	12.00	8.00	7.00
60	13.00	13.00	8.00	7.00
61	13.00	19.00	10.00	11.00
62	25.00	19.00	19.00	15.00
63	20.00	17.00	16.00	12.00
64	15.00	17.00	8.00	12.00
65	25.00	17.00	26.00	17.00
66	25.00	30.00	25.00	20.00
67	20.00	30.00	35.00	25.00
68	25.00	30.00	35.00	35.00
69	40.00	30.00	40.00	35.00
70	100.00	100.00	100.00	100.00

\* The rate for 1955/1980 Plan members age 54 with 30 or more years of service (i.e., eligible for unreduced benefits) is 50% for males and females.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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<b>Retirement Age for Inactive Vested Participants:</b>	59										
<b>Reciprocity:</b>	30% of members who terminate with a vested benefit are assumed to enter a reciprocal system. For reciprocals, we assume 3.75% compensation increases per annum.										
<b>Unknown Data for Participants:</b>	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.										
<b>Percent Married/Domestic Partnership:</b>	Spouses/domestic partners of active and inactive members are assumed to be the opposite sex of the member. The percent married/domestic partnership at retirement is assumed to be 80% for male members and 50% for female members.										
<b>Age of Spouse/Domestic Partner:</b>	Female (or male) spouses/domestic partners are 3 years younger (or older) than the members.										
<b>Optional Forms of Benefit:</b>	At retirement, members with spouses or domestic partners are assumed to elect the following optional forms of benefit (single members are assumed to elect the Unmodified option):										
	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Option Elected</u></th> <th style="text-align: right;"><u>Election Percentage</u></th> </tr> </thead> <tbody> <tr> <td>Unmodified or Option 1</td> <td style="text-align: right;">50%</td> </tr> <tr> <td>Option 2 (100% continuance)</td> <td style="text-align: right;">10%</td> </tr> <tr> <td>Option 3 (50% continuance)</td> <td style="text-align: right;">20%</td> </tr> <tr> <td>Option 4 (25% continuance)</td> <td style="text-align: right;">20%</td> </tr> </tbody> </table>	<u>Option Elected</u>	<u>Election Percentage</u>	Unmodified or Option 1	50%	Option 2 (100% continuance)	10%	Option 3 (50% continuance)	20%	Option 4 (25% continuance)	20%
<u>Option Elected</u>	<u>Election Percentage</u>										
Unmodified or Option 1	50%										
Option 2 (100% continuance)	10%										
Option 3 (50% continuance)	20%										
Option 4 (25% continuance)	20%										
<b>Future Benefit Accruals:</b>	1.0 year of service per year of employment plus 0.036 years of additional service to anticipate conversion of unused sick leave for each year of employment. As directed by EBMUD, this assumption has been applied to active members in the 1955/1980 Plan and the 2013 Tier.										
<b>Actuarial Value of Assets:</b>	Market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a five-year period, further adjusted, if necessary, to be within 30% of the market value.										

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Actuarial Cost Method:** Entry Age Cost Method. Entry Age is the age at the member's hire date. Actuarial Accrued Liability is calculated on an individual basis and is based on costs allocated as a level percentage of compensation. The Normal Cost is calculated on an individual basis where the Entry Age Normal Cost is calculated as the sum of the individual Normal Costs.

The UAAL from plan changes, assumption changes, and experience gains/losses prior to July 1, 2011 are amortized over separate decreasing 30-year amortization periods. On or after July 1, 2011, any new UAAL resulting from plan changes are amortized over separate decreasing 15-year periods; assumption or method changes are amortized over separate decreasing 25-year periods; and experience gains/losses are amortized over separate decreasing 20-year periods.

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**Changes in Actuarial Assumptions:** Based on the June 30, 2018 Review of Economic Actuarial Assumptions, the following assumptions were changed. Previously, these assumptions were as follows:

**Net Investment Return:** 7.25%, net of investment and administrative expenses.

**Interest Credited to Employee Accounts:** 7.25%

**Inflation:** 3.00%\*

**Cost of Living Increases:** 3.00% per annum.

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\* The maximum amount of pensionable compensation that can be taken into account for all 2013 Tier members is also assumed to increase by 3.00% per year.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Changes in Actuarial Assumptions (continued):**

**Salary Increases:**

<b>Annual Rate of Compensation Increase</b>	
Inflation: 3.00% per year; plus across the board salary increases of 0.50% per year; plus the following merit and promotional increases based on years of service:	
<b>Years of Service</b>	<b>Merit and Promotional Increases</b>
0	6.00%
1	5.00%
2	4.00%
3	3.00%
4	2.00%
5	1.00%
6	0.80%
7+	0.50%

**Reciprocity:** 30% of members who terminate with a vested benefit are assumed to enter a reciprocal system. For reciprocals, we assume 4.00% compensation increases per annum.

**Optional Forms of Benefit:** At retirement, all members are assumed to elect the following optional forms of benefit:

<b>Option Elected</b>	<b>Election Percentage</b>
Unmodified or Option 1	100%
Option 2 (100% continuance)	0%
Option 3 (50% continuance)	0%
Option 4 (25% continuance)	0%

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**EXHIBIT III**

**Summary of Plan Provisions**

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This exhibit summarizes the major provisions of the EBMUD included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

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<b>Plan Year:</b>	July 1 through June 30
<b>Census Date:</b>	June 30

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**Membership Eligibility:**

<i>1955/1980 Plan</i>	All employees who first become members before January 1, 2013.
<i>2013 Tier</i>	All employees who first become members on or after January 1, 2013.

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**Final Compensation for Benefit Determination:**

<i>1955/1980 Plan</i>	Highest two consecutive years of compensation earnable (FAS2).
<i>2013 Tier</i>	Highest thirty-six consecutive months of pensionable compensation (FAS3).

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**Compensation Limit:**

<i>1955/1980 Plan</i>	IRC Section 401(a)(17) compensation limit applies to all employees who began membership in EBMUDERS on or after January 1, 1996.*
<i>2013 Tier</i>	\$121,388 for 2018

*\* Included for the first time in the June 30, 2018 valuation based on discussions with the Retirement Office staff in January 2018 and it did not impact the employer contribution rates.*

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**Normal or Unreduced Retirement Eligibility:**

*Age and Service Requirement*

<i>1955/1980 Plan</i>	Age 65; Age 62 with 5 years of service; Age 59 with 20 years of service; Age 54 with 30 years of service; Other combinations of age and service between ages 54 and 59.
<i>2013 Tier</i>	Age 67 with 5 years of service (for unreduced benefit).

## SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System

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### Early Retirement Eligibility:

#### *Age and Service Requirement*

<i>1955/1980 Plan</i>	Age 54 with 5 years of service.
<i>2013 Tier</i>	Age 52 with 5 years of service.

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### Benefit Formula:

#### *1955/1980 Plan:*

<i>1955 Formula</i>	2.42% (2.82% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service including all service extension credit.
<i>1955/80 Formula</i>	2.42% (2.82% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service up to August 1, 1980 including all service extension credit, plus 2.20% (2.60% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service after August 1, 1980. Applies to members who elected to convert to the 1980 Formula in 1980.
<i>1955/90 Formula</i>	2.42% (2.82% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service up to January 1, 2000 including all service extension credit, plus 2.20% (2.60% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service after January 1, 2000. Applies to members who elected to convert to the 1980 Formula in 1989.
<i>1980 Formula</i>	2.20% (2.60% if member is credited with District Service on or after January 1, 2004) times Final Compensation per year of service including all service extension credit. Applies to all members hired on or after January 1, 1980.
<i>Service Extension Credit</i>	2.42% (2.82% if member is credited with District Service on or after January 1, 2004) for members with any service under the 1955 Formula or 2.20% (2.60% if member is credited with District Service on or after January 1, 2004) for members with service only under the 1980 Formula times Final Compensation per year of Service Extension Credit. Service extension credit is the number of unused sick leave days credited to a member at the time of retirement converted on a 260-day basis. The number of such days is then doubled for the benefit calculation and for service retirements to meet the early retirement provision of the Ordinance.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Benefit Formula: (continued)**

1955/1980 Plan:

*Benefit Adjustments*

Reduced by 3% per year under the age of eligibility for an unreduced benefit, based on service at retirement, for retirements before age 63 (before age 62 commencing November 1, 2000). Effective July 1, 1999, Service Extension Credit is included in the years of service calculation of service for determining eligibility for unreduced retirement.

2013 Tier:

<b>Retirement Age</b>	<b>Benefit Formula</b>
52	1.00% x FAS3 x Years of Service
55	1.30% x FAS3 x Years of Service
60	1.80% x FAS3 x Years of Service
62	2.00% x FAS3 x Years of Service
65	2.30% x FAS3 x Years of Service
67 or later	2.50% x FAS3 x Years of Service

**Disability:**

*Eligibility*

Eight years of service (not available for Directors).

*Benefit*

Greater of:

1.5% times Final Compensation per year of service.

One-third of Final Compensation.

**Vesting:**

*Requirements*

Five years of service, must leave contributions on deposit, reciprocal service counts for vesting purposes.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Pre-Retirement Death Benefit:**

<i>Eligibility</i>	Eligible for retirement.
<i>Benefit</i>	50% of the unmodified service retirement benefit to eligible surviving spouse/surviving domestic partner plus the lump sum payment of accumulated retirement contributions.
	OR
<i>Eligibility</i>	None.
<i>Benefit</i>	Lump sum payment of accumulated retirement contributions.

**Post-Retirement Death Benefit:**

50% of the unmodified service retirement benefit to surviving spouse or registered domestic partner (tied to the implementation of the AB 205 legislation).

**Member Contributions:**

*1955/1980 Plan* Effective April 17, 2006, retirement system members contribute at a rate of 6.83% of pay, as prescribed in the Ordinance. Based on bargaining unit contract negotiations in 2013, members are contracted to pay the following employee rates (as a percentage of pay) beginning April 22, 2013:

<u>Effective Date</u>	<u>Member Rate</u>		
	<u>(a) Total</u>	<u>(b) HIB Plan</u>	<u>(c) = (a) – (b) Pension Plan</u>
April 17, 2006*	6.83%*	0.09%	6.74%
April 22, 2013	7.33%	0.09%	7.24%
April 21, 2014	7.83%	0.09%	7.74%
April 20, 2015	8.33%	0.09%	8.24%
April 18, 2016	8.75%	0.09%	8.66%

\* Pursuant to the Ordinance.

**SECTION 4: Reporting Information for the East Bay Municipal Utility District Employees' Retirement System**

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**Member Contributions: (continued)**

*2013 Tier*

Initial member contribution rate is set at 50% of the total 2013 Tier Normal Cost rate, rounded to the nearest quarter of 1%. Once established, the member contribution rate will be adjusted annually to reflect the change in the 2013 Tier Normal Cost rate, but only if the change is more than 1% of payroll.

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**Cost of Living:**

Payable July 1 of each year, the basic minimum COLA benefit is the lesser of 3% and the actual change in the cost of living index.

Excess of the actual change of cost of living index over 3% is accumulated in individual retiree COLA banks.

Withdrawals from the bank are made in years when the index increases less than 3%.

Increases of up to 5% are granted in years when the Retirement Board determines that the System is more than 85% funded on a Projected Benefit Obligation basis. In those years when the System is more than 85% funded and the cost of living index exceeds 5%, any excess cost of living over 5% is accumulated in the COLA bank.

Effective October 1, 2000, in those years when the system is more than 85% funded on a Projected Benefit Obligation basis and the cost of living is less than 4%, withdrawals from the bank are made to allow cost of living increases up to 4%.

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**Changes in Plan Provisions:**

None during July 1, 2017 to June 30, 2018.

**NOTE:**

*The summary of major plan provisions is designed to outline principal plan benefits as interpreted for purposes of the actuarial valuation. If the System should find the plan summary not in accordance with the actual provisions, the System should alert the actuary so that both can be sure the proper provisions are valued.*

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