# The Water and Power Employees' Retirement Plan of the City of Los Angeles

## Actuarial Valuation and Review as of July 1, 2019

Segal Consulting

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September 17, 2019

Board of Administration
The Water and Power Employees' Retirement Plan of the City of Los Angeles
111 North Hope Street, Room 357
Los Angeles, CA 90012

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of July 1, 2019. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and establishes the funding requirements for fiscal year 2019-2020.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist in administering the Retirement Plan. The census information and financial information on which our calculations were based was prepared by the Retirement Office. That assistance is gratefully acknowledged.

The actuarial calculations were directed under the supervision of John Monroe, ASA, MAAA, Enrolled Actuary. We are members of the American Academy of Actuaries and we 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.

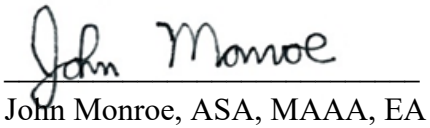
We look forward to reviewing this report at your next meeting and to answering any questions.

Sincerely,

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

By: 

Paul Angelo, FSA, MAAA, EA, FCA
Senior Vice President and Actuary



John Monroe, ASA, MAAA, EA
Vice President and Actuary

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**The Water and Power Employees' Retirement Plan of the City of Los Angeles Actuarial Valuation and Review as of July 1, 2019**

# Section 1: Actuarial Valuation Summary

## Purpose and Basis

This report was prepared by Segal Consulting ("Segal") to present a valuation of The Water and Power Employees' Retirement Plan of the City of Los Angeles ("the Plan") as of July 1, 2019. The valuation was performed to determine whether the assets and contribution rates are sufficient to provide the prescribed benefits. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of current Plan assets to cover the estimated cost of settling the Plan's accrued benefit obligations.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

The 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 members, inactive vested members, and retired members and beneficiaries as of March 31, 2019, provided by the Retirement Office;
- The assets of the Plan as of June 30, 2019, provided by the Retirement Office;
- Economic assumptions regarding future salary increases and investment earnings adopted by the Retirement Board for the July 1, 2019 valuation;
- Other actuarial assumptions regarding employee terminations, retirement, death, etc. adopted by the Retirement Board for the July 1, 2019 valuation; and
- The funding policy adopted by the Retirement Board.

In preparing this valuation, we have employed generally accepted actuarial methods and assumptions to evaluate the Plan's assets, liabilities and future contribution requirements. Our calculations are based upon member data and financial information provided to us by the Retirement Office. 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.

The contribution requirements are determined as a percentage of payroll. The employer rates provide for both Normal Cost and a contribution to amortize any unfunded or overfunded actuarial accrued liabilities. In this valuation, we have applied the funding policy adopted by the Board on May 18, 2000. Details of the funding policy are provided in *Section 4, Exhibit I on page 65*.

A schedule of current amortization balances and payments may be found in *Section 3, Exhibit G on page 52*. A graphical projection of the Unfunded Actuarial Accrued Liability (UAAL) amortization balances and payments has been included in *Section 3, Exhibit H on page 53.*

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.

## Significant Issues

*Ref: Pgs. 28, 66*

1. The results of this valuation reflect changes in the actuarial assumptions as recommended by Segal and adopted by the Board for the July 1, 2019 valuation. These changes were documented in our Actuarial Experience Study and are also outlined in Section 4, Exhibit I of this report. These assumption changes resulted in an increase in the aggregate required contribution rate (all tiers combined) of 0.88% of compensation. Of the various assumption changes, the most significant cost impact is from the change to the merit and promotion salary increase assumption.

*Ref: Pgs. 26, 52*

2. The Actuarial Accrued Liability exceeds the Actuarial Value of Assets, resulting in an Unfunded Actuarial Accrued Liability (UAAL) of $1.07 billion, which is a decrease from $1.18 billion in the previous valuation. The Board's funding policy determines the Department's required contribution as the normal cost increased or offset by a UAAL amortization charge or credit. Under this funding policy, the Plan's UAAL is amortized over various 15-year periods, each beginning with the year that each portion or base of the UAAL was first identified and amortized.

*Ref: Pgs. 27-31*

3. The aggregate required contribution rate decreased from 40.15% to 37.97% of pay for the 2019-2020 plan year; those contributions are estimated to be $433.6 million. This decrease is primarily due to an increase in total payroll reducing the UAAL contribution rate and the 2004 UAAL layer becoming fully amortized, offset to some degree by the changes in actuarial assumptions. Under the Plan's funding policy, the required contribution rate continues to be larger than the mandatory 110% matching of the employee contribution for Tier 1.

*Ref: Pgs. 21-23, 26, 28*

4. The market value of assets earned a return of 6.5% for the July 1, 2018 to June 30, 2019 plan year. The Actuarial Value of Assets earned a return of 6.8% for the July 1, 2018 to June 30, 2019 plan year due to the deferral of most of the current year investment loss and the recognition of prior investment gains and losses. This resulted in an actuarial loss of $56.8 million when measured against the assumed rate of return of 7.25% for 2018-2019. This actuarial investment loss increased the aggregate required contribution by 0.54% of compensation.

*Ref: Pgs. 26, 28*

5. The salaries for continuing actives increased on average by 5.9% from the amounts in effect on March 31, 2018 to the amounts in effect on March 31, 2019. Since this increase is more than the average assumed rate of approximately 5.4%, the plan experienced an actuarial loss from individual salary experience. This loss amounted to $31.9 million for the current year, which increased the aggregate required contribution by 0.30% of compensation. There was also a gain from cost-of-living adjustments (COLAs) for retirees and beneficiaries less than assumed which amounted to $12.8 million, decreasing the aggregate required contribution rate by 0.12% of compensation.

*Ref: Pgs. 18, 19*

6. The total unrecognized return (i.e., the difference between the market value of assets and the "smoothed" actuarial value of assets) changed by $26 million during the plan year, from a $144 million unrecognized gain in 2018 to a $118 million unrecognized gain in 2019 (as indicated in *Section 2, Subsection B* of this report). This deferred investment gain will be recognized in the determination of the Actuarial Value of Assets for funding purposes over the next four years. This means that, if the Plan earns the assumed rate of investment return of 7.00% per year (net of expenses) on a **market value** basis, then the deferred gains will be recognized over the next four years as shown in the footnote in the Determination of Actuarial Value of Assets chart in *Subsection B*.

7. The unrecognized investment gains of $118 million represent about 0.9% of the Market Value of Assets. Unless offset by future investment losses or other unfavorable experience, the future recognition of the $118 million in past market gains is expected to have an impact on the Plan's future funded ratio and the aggregate required contributions. This potential impact may be illustrated as follows:

   a. If the deferred gains were recognized immediately in the Actuarial Value of Assets, the funded percentage would increase from 92.2% to 93.1%.

      For comparison purposes, if all the deferred gains in the July 1, 2018 valuation had been recognized immediately in the July 1, 2018 valuation, the funded percentage would have increased from 91.1% to 92.2%.

   b. If the deferred gains were recognized immediately in the Actuarial Value of Assets, the aggregate required contribution rate would decrease from 38.0% of covered payroll to 36.9% of covered payroll.

      For comparison purposes, if all the deferred gains in the July 1, 2018 valuation had been recognized immediately in the July 1, 2018 valuation, the aggregate employer contribution rate would have decreased from 40.2% of covered payroll to 38.7% of covered payroll.

*Ref: Pg. 35*

8. This year, the balance in the General Reserve increased slightly from $2.389 billion as of June 30, 2018 to $2.406 billion as of June 30, 2019. This reserve tracks changes in the book value of assets and any gains and losses are recorded directly to the General Reserve. Consistent with prior valuations, this year we have been instructed to include all but $129.9 million of the end of year General Reserve as valuation assets. The $129.9 million amount is 1% of the end of year market value of assets.

9. The actuarial valuation report as of July 1, 2019 is based on financial information as of that date. Changes in the value of assets subsequent to that date, to the extent that they exist, 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.

*Ref: Pg. 39*

10. The Actuarial Standards Board approved a new Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment. ASOP 51 is effective with WPERP's July 1, 2019 actuarial valuation. ASOP 51 requires actuaries to identify and assess risks that "may reasonably be anticipated to significantly affect the plan's future financial condition". Examples of key risks listed that are particularly relevant to WPERP are asset/liability mismatch risk, investment risk, and longevity risk. The standard also requires an actuary to consider if there is any ongoing contribution risk to the plan, however it does not require the actuary to evaluate the particular ability or willingness 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 initial assessment can be strictly a qualitative discussion about potential adverse experience and the possible effect on future results, but it may also include quantitative numerical demonstrations where informative. The actuary is also encouraged to consider a recommendation as to whether a more detailed assessment or risk report would be significantly beneficial for the intended user in order to examine particular financial risks. When making that recommendation, the actuary will take into account such factors as the plan's design, risk profile, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions.

    Since the actuarial valuation results are dependent on a fixed set of assumptions and data as of a specific date, there is risk that emerging results may differ, perhaps significantly, as actual experience is fluid and will not exactly track current assumptions. This potential divergence may have a significant impact on the future financial condition of the plan. We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the Plan's future financial condition, but have included a brief discussion of some key risks that may affect the Plan in *Section 2, Subsection L*. A more detailed assessment of the risks would provide the Board with a better understanding of the inherent risks and is recommended. This assessment would further discuss and highlight information and risks particular to WPERP such as detailed historical experience and key events, growing plan maturity, heightened contribution sensitivity to asset and liability changes, and projected sensitivity to potential future investment returns.

## Summary of Key Valuation Results

| | | July 1, 2019 | | July 1, 2018 | |
|---|---|---|---|---|---|
| | | Total Rate | Estimated Annual Dollar Amount | Total Rate | Estimated Annual Dollar Amount |
| **Required Contribution for plan year beginning July 1:[1]** | • Tier 1 & Tier 2 Combined (aggregate) | 37.97% | $433,555,219 | 40.15% | $430,997,257 |
| | • Tier 1 | 41.03% | 330,062,360 | 42.73% | 348,393,606 |
| | • Tier 2 | 30.66% | 103,492,859 | 31.99% | 82,603,651 |

| | | July 1, 2019 | July 1, 2018 |
|---|---|---|---|
| **Actuarial Accrued Liability as of July 1:** | • Retired members and beneficiaries | $7,738,487,474 | $7,324,080,162 |
| | • Inactive vested members[2] | 224,906,012 | 220,277,427 |
| | • Active members | 5,848,562,997 | 5,643,185,141 |
| | • Total Actuarial Accrued Liability | 13,811,956,483 | 13,187,542,730 |
| | • Total Normal Cost (beginning of year) for plan year beginning July 1 | 263,472,814 | 243,262,953 |
| **Assets as of July 1:** | • Market Value of Assets (MVA) | $12,987,087,001 | $12,277,085,263 |
| | • Actuarial Value of Assets (AVA) | 12,739,144,966 | 12,009,999,030 |
| | • Actuarial Value of Assets as a percentage of Market Value of Assets | 98.1% | 97.8% |
| **Funded status as of July 1:** | • Unfunded Actuarial Accrued Liability on Market Value of Assets basis | $824,869,482 | $910,457,467 |
| | • Funded percentage on MVA basis | 94.03% | 93.10% |
| | • Unfunded Actuarial Accrued Liability on Actuarial Value of Assets basis | $1,072,811,517 | $1,177,543,700 |
| | • Funded percentage on AVA basis | 92.23% | 91.07% |
| **Key assumptions as of July 1:** | • Net investment return | 7.00% | 7.25% |
| | • Price Inflation | 2.75% | 3.00% |

[1] Required contributions are assumed to be paid at the middle of every year.

[2] Includes terminated members due a refund of member contributions and members receiving Permanent Total Disability (PTD) benefits.

## Summary of Key Valuation Results (continued)

| | | July 1, 2019 | July 1, 2018 | Change From Prior Year |
|---|---|---|---|---|
| **Demographic data as of July 1:** | **Active Members:** | | | |
| | • Number of members | 10,362 | 10,114 | 2.5% |
| | • Average age | 47.2 | 47.5 | -0.3 |
| | • Average service | 14.6 | 15.1 | -0.5 |
| | • Total projected compensation | $1,141,875,615 | $1,073,554,607 | 6.4% |
| | • Average projected compensation | 110,198 | $106,145 | 3.8% |
| | **Retired Members and Beneficiaries:** | | | |
| | • Number of members: | | | |
| | – Retired members | 7,355 | 7,199 | 2.2% |
| | – Beneficiaries | 1,960 | 1,966 | -0.3% |
| | – Total | 9,315 | 9,165 | 1.6% |
| | • Average age | 74.5 | 74.6 | -0.1 |
| | • Average monthly benefit | $5,483 | $5,251 | 4.4% |
| | **Inactive Vested Members:** | | | |
| | • Number of members[1] | 1,663 | 1,728 | -3.8% |
| | • Average Age | 51.7 | 53.4 | -1.7 |
| | **Total Members:** | 21,340 | 21,007 | 1.6% |

[1] Includes terminated members due a refund of member contributions and members receiving PTD benefits.

## Important Information About Actuarial Valuations

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

In order to prepare a valuation, Segal 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 Retirement Office. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data. |
| **Assets** | The valuation is based on the Market Value of Assets as of the valuation date, as provided by the Retirement Office. The Plan 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:

- The actuarial valuation is prepared at the request of the WPERP. 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. 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; and
  - Changes in plan provisions.
- If the WPERP 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 WPERP 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 WPERP, it is not a fiduciary in its capacity as actuaries and consultants with respect to the WPERP.

# Section 2: Actuarial Valuation Results

## A. Member Data

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

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

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

### MEMBER POPULATION: 2010 – 2019

| Year Ended June 30 | Active Members | Inactive Vested Members[1] | Retired Members and Beneficiaries[2] | Total Non-Actives | Ratio of Non-Actives to Actives | Ratio of Retired Members and Beneficiaries to Actives |
|---|---|---|---|---|---|---|
| 2010 | 9,295 | 1,739 | 8,468 | 10,207 | 1.10 | 0.91 |
| 2011 | 9,203 | 1,694 | 8,496 | 10,190 | 1.11 | 0.92 |
| 2012 | 8,962 | 1,648 | 8,510 | 10,158 | 1.13 | 0.95 |
| 2013 | 8,913 | 1,555 | 8,642 | 10,197 | 1.14 | 0.97 |
| 2014 | 8,960 | 1,484 | 8,739 | 10,223 | 1.14 | 0.98 |
| 2015 | 9,205 | 1,528 | 8,843 | 10,371 | 1.13 | 0.96 |
| 2016 | 9,348 | 1,612 | 9,265 | 10,877 | 1.16 | 0.99 |
| 2017 | 9,806 | 1,648 | 9,272 | 10,920 | 1.11 | 0.95 |
| 2018 | 10,114 | 1,728 | 9,165 | 10,893 | 1.08 | 0.91 |
| 2019 | 10,362 | 1,663 | 9,315 | 10,978 | 1.06 | 0.90 |

(1) Includes terminated members due a refund of member contributions and members receiving PTD benefits.

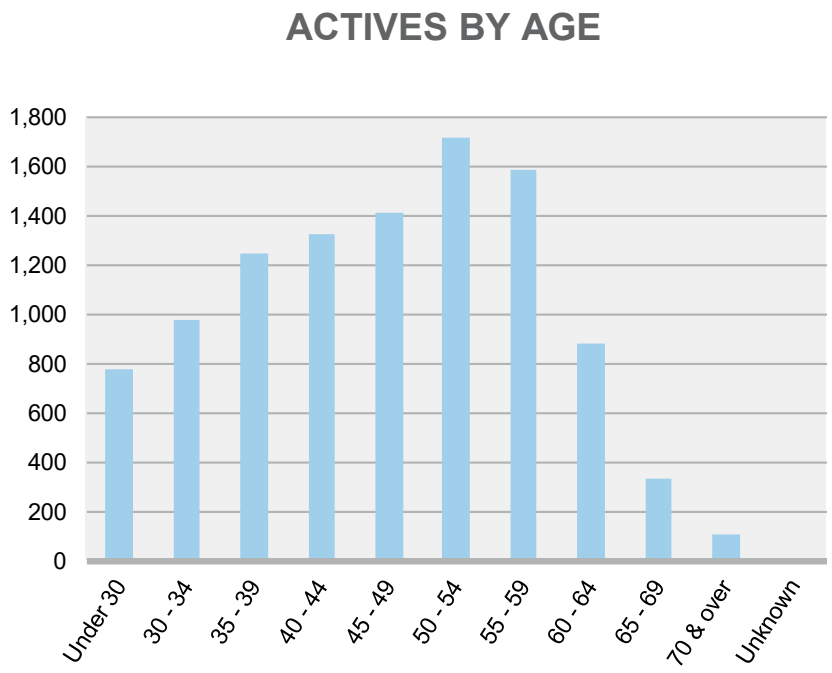
(2) Starting in the 2018 valuation, assignee records for Options B and C were combined with the benefit for the corresponding retired members. Before 2018, these assignee records were separate from the corresponding retired member records.

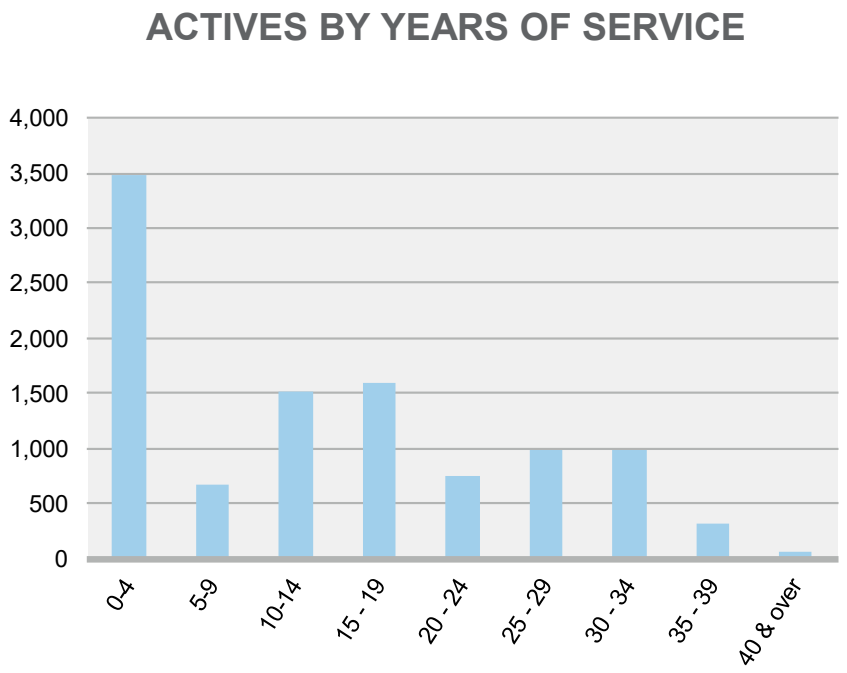
## Active Members

Plan costs are affected by the age, years of service and compensation of active members. In this year's valuation, there were 10,362 active members with an average age of 47.2, average years of service of 14.6 years and average compensation of $110,198. The 10,114 active members in the prior valuation had an average age of 47.5, average service of 15.1 years and average compensation of $106,145.

Among the active members, there were none with unknown age information.

**Distribution of Active Participants as of July 1, 2019**




## Inactive Members

In this year's valuation, there were 1,663 members with a vested right to a deferred or immediate vested benefit or entitled to a return of their employee contributions, versus 1,728 in the prior valuation.

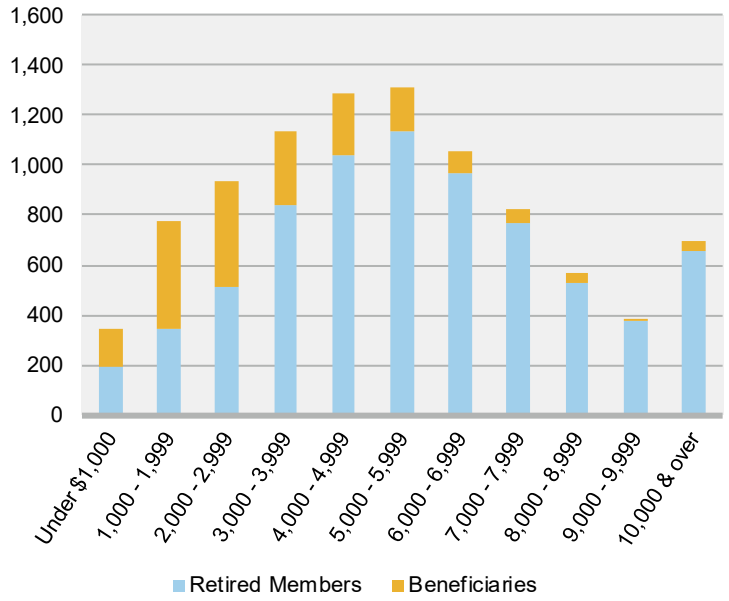
## Retired Members and Beneficiaries

As of July 1, 2019, 7,355 retired members and 1,960 beneficiaries were receiving total monthly benefits of $51,072,965. For comparison, in the previous valuation, there were 7,199 retired members and 1,966 beneficiaries receiving monthly benefits of $48,126,356.

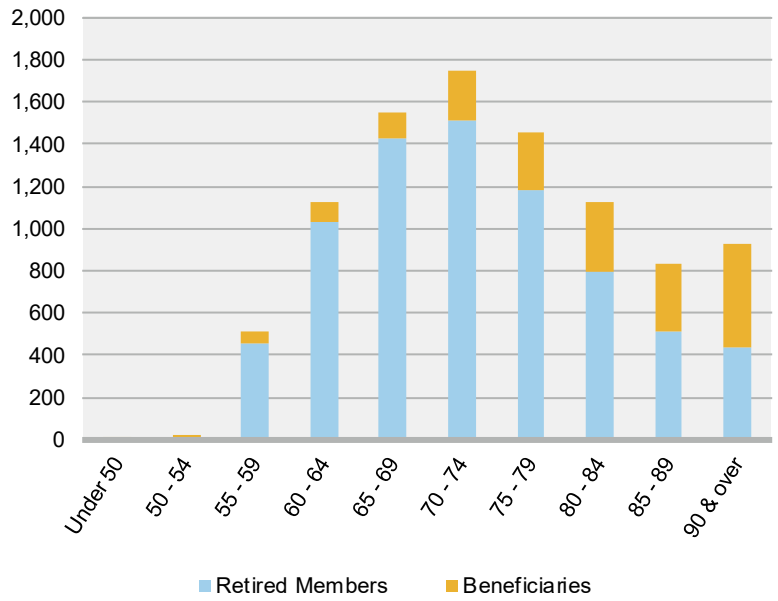
As of July 1, 2019, the average monthly benefit for retired members and beneficiaries is $5,483, compared to $5,251 in the previous valuation. The average age for retired members and beneficiaries is 74.5 in the current valuation, compared with 74.6 in the prior valuation.

### Distribution of Retired Members and Beneficiaries as of July 1, 2019

**RETIRED MEMBERS AND BENEFICIARIES BY TYPE AND MONTHLY AMOUNT**




**RETIRED MEMBERS AND BENEFICIARIES BY TYPE AND AGE**



## Historical Plan Population

The chart below demonstrates the progression of the active population over the last ten years. The chart also shows the changes among the retired population over the same time period.

### MEMBER STATISTICS: 2010 – 2019

| Year Ended June 30 | Active Participants | | | Retired Members and Beneficiaries | | |
|---|---|---|---|---|---|---|
| | Count | Average Age | Average Service | Count | Average Age | Average Monthly Amount |
| 2010 | 9,295 | 48.0 | 17.6 | 8,468 | 75.0 | $3,824 |
| 2011 | 9,203 | 48.4 | 17.7 | 8,496 | 75.0 | 4,036 |
| 2012 | 8,962 | 48.9 | 18.2 | 8,510 | 75.0 | 4,184 |
| 2013 | 8,913 | 49.3 | 18.4 | 8,642 | 74.9 | 4,339 |
| 2014 | 8,960 | 49.3 | 18.3 | 8,739 | 74.8 | 4,526 |
| 2015 | 9,205 | 48.9 | 17.6 | 8,843 | 74.7 | 4,679 |
| 2016 | 9,348 | 48.0 | 16.3 | 9,265 | 74.4 | 4,861 |
| 2017 | 9,806 | 47.9 | 15.7 | 9,272 | 74.5 | 4,972 |
| 2018 | 10,114 | 47.5 | 15.1 | 9,165 | 74.6 | 5,251 |
| 2019 | 10,362 | 47.2 | 14.6 | 9,315 | 74.5 | 5,483 |

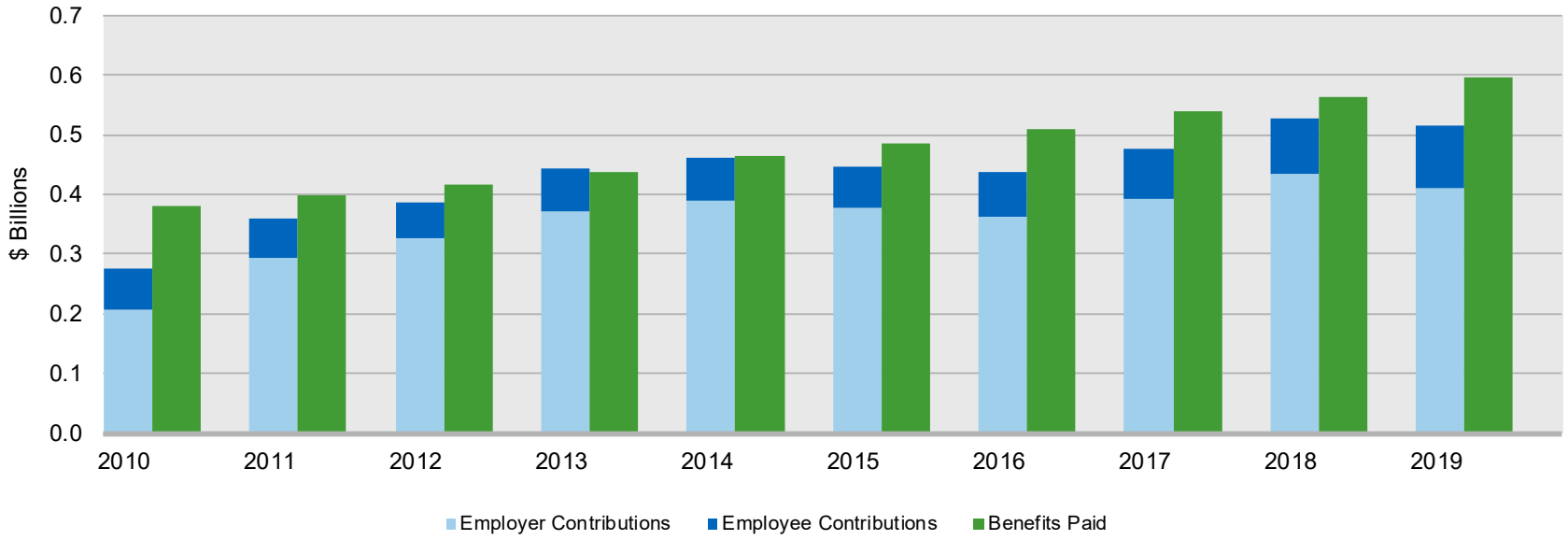
## B. Financial Information

Retirement plan funding anticipates that, over the long term, both contributions and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components. Additional financial information, including a summary of transactions for the valuation year, is presented in *Section 3, Exhibits D, E, and F*.

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 valuation 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.

Please note that as instructed by Plan staff, we have included all but $129.9 million (1% of the end of year market value of assets) in the General Reserve as valuation assets.

**COMPARISON OF CONTRIBUTIONS WITH BENEFITS**
**FOR YEARS ENDED JUNE 30, 2010 – 2019**



# DETERMINATION OF ACTUARIAL VALUE OF ASSETS

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Market Value of Assets as of June 30, 2019 | | | | | $12,987,087,001 |
| **2** | Calculation of unrecognized return | **Total Actual Market Return (net)** | **Expected Market Return (net)** | **Investment[1] Gain (Loss)** | **Deferred Factor** | **Deferred Return[2]** |
| a) | Year ended June 30, 2015 | $416,474,352 | $726,771,065 | -$310,296,713 | 0.0 | $0 |
| b) | Year ended June 30, 2016 | 82,810,914 | 753,804,054 | -670,993,140 | 0.2 | -134,198,628 |
| c) | Year ended June 30, 2017 | 1,281,254,293 | 729,713,941 | 551,540,352 | 0.4 | 220,616,141 |
| d) | Year ended June 30, 2018 | 998,777,227 | 818,967,517 | 179,809,710 | 0.6 | 107,885,826 |
| e) | Year ended June 30, 2019 | 791,832,113 | 887,122,330 | -95,290,217 | 0.8 | -76,232,174 |
| f) | Total unrecognized return[3] | | | | | $118,071,165 |
| **3** | Gross Actuarial Value of Assets **1 – 2f** | | | | | 12,869,015,836 |
| **4** | Portion of General Reserve not included as valuation asset | | | | | 129,870,870 |
| **5** | Net Actuarial Value of Assets as of June 30, 2019 **3 - 4** | | | | | $12,739,144,966 |
| **6** | Net Actuarial Value of Assets as a percentage of Market Value of Assets **5 ÷ 1** | | | | | 98.1% |

(1) Total return minus expected return on a market value basis.

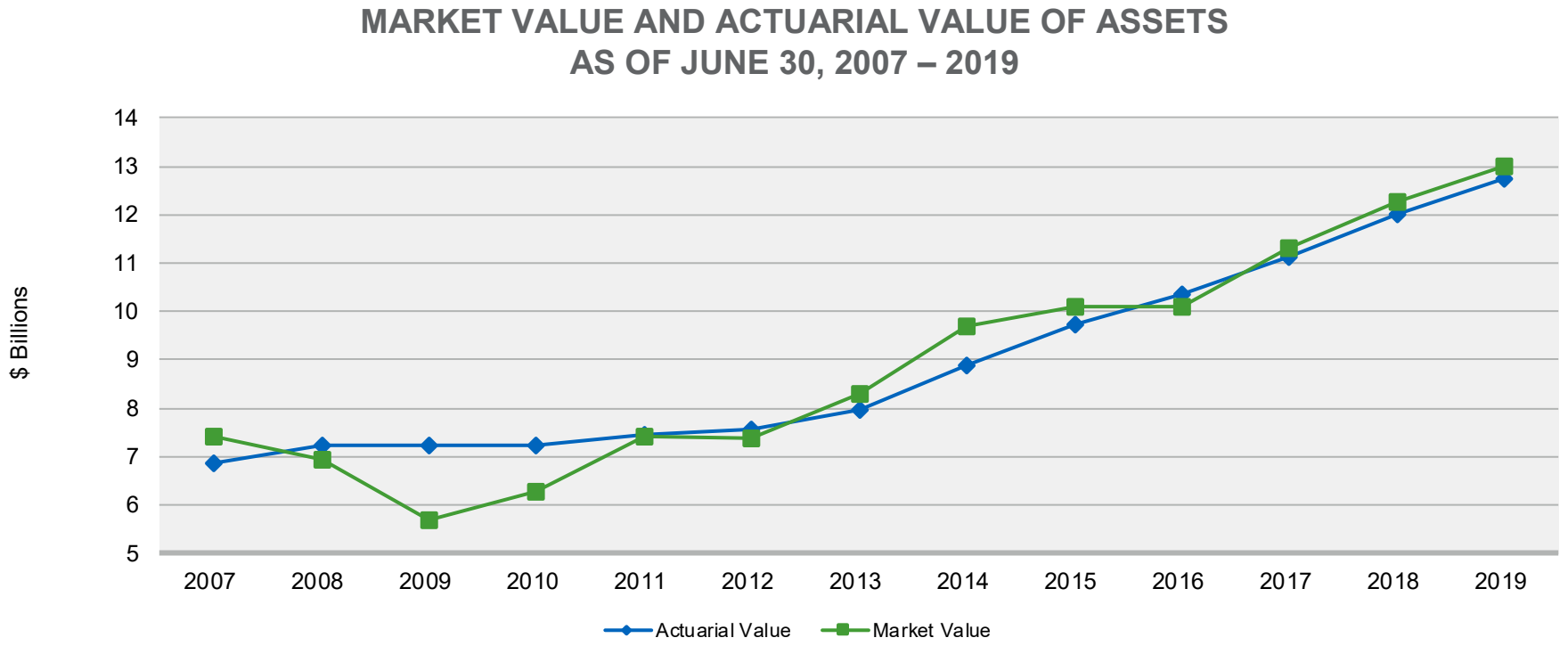
(2) Recognition at 20% per year over 5 years.

(3) Deferred return as of June 30, 2019 recognized in each of the next four years:

| | |
|---|---|
| (a) Amount recognized during 2019/2020 | -$6,986,659 |
| (b) Amount recognized during 2020/2021 | 127,211,969 |
| (c) Amount recognized during 2021/2022 | 16,903,898 |
| (d) Amount recognized during 2022/2023 | -19,058,043 |
| (e) Total unrecognized return as of June 30, 2019 | $118,071,165 |

The Market Value and Actuarial Value of Assets are representations of the WPERP's financial status. As investment gains and losses are gradually taken into account, the Actuarial Value of Assets tracks the Market Value of Assets. The Actuarial Value of Assets is significant because the WPERP's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the Unfunded Actuarial Accrued Liability is an important element in determining the contribution requirement.

Note that in the chart below, the Actuarial Value of Assets are exclusive of a small portion of the General Reserve (and Reserve for Investment Gains and Losses prior to June 30, 2017) while that Reserve is included in the Market Value of Assets.



## 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 $67.8 million, which includes $56.8 million from investment losses, a gain of $6.8 million from contribution experience and $17.8 million in losses from all other sources. The net experience variation from individual sources other than investments and contributions was 0.13% of the Actuarial Accrued Liability. A discussion of the major components of the actuarial experience is on the following pages.

### ACTUARIAL EXPERIENCE FOR YEAR ENDED JUNE 30, 2019

| | | |
|---|---|---|
| 1 | Net loss from investments[1] | -$56,782,268 |
| 2 | Net gain from contribution experience | 6,773,681 |
| 3 | Net loss from other experience[2] | -17,806,843 |
| 4 | Net experience loss: 1 + 2 + 3 | -$67,815,430 |

[1] Details on next page.

[2] See *Subsection E* for further details. Does not include the effect of plan or assumption changes, if any.

## Investment Experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the WPERP's investment policy. The rate of return on the Market Value of Assets was 6.47% for the year ended June 30, 2019.

For valuation purposes, the assumed rate of return on the Actuarial Value of Assets was 7.25% for the 2018-2019 plan year (based on the July 1, 2018 valuation). The actual rate of return on an actuarial basis for the 2018-2019 plan year was 6.78%. Since the actual return for the year was less than the assumed return, the WPERP experienced an actuarial loss during the year ended June 30, 2019 with regard to its investments.

### INVESTMENT EXPERIENCE FOR YEAR ENDED JUNE 30, 2019

| | | Market Value | Actuarial Value |
|---|---|---|---|
| 1 | Net investment income | $791,832,113 | $810,976,311 |
| 2 | Average value of assets | 12,236,170,076 | 11,969,083,843 |
| 3 | Rate of return: 1 ÷ 2 | 6.47% | 6.78% |
| 4 | Assumed rate of return | 7.25% | 7.25% |
| 5 | Expected investment income: 2 x 4 | $887,122,330 | $867,758,579 |
| 6 | Actuarial gain/(loss): 1 – 5 | ($95,290,217) | ($56,782,268) |

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

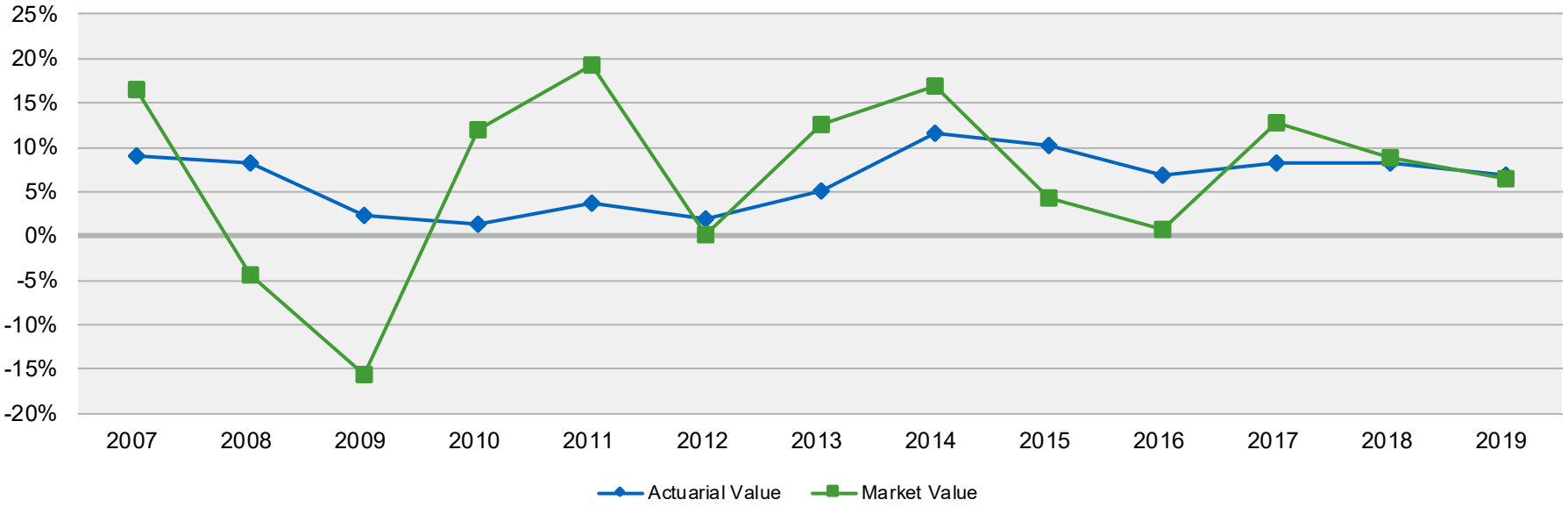
## INVESTMENT RETURN – MARKET VALUE AND ACTUARIAL VALUE: 2010 – 2019

| Year Ended June 30 | Net Interest and Dividend Income | | Recognition of Capital Appreciation | | Actuarial Value Investment Return | | Market Value Investment Return | |
|---|---|---|---|---|---|---|---|---|
| | Amount | Percent | Amount | Percent | Amount | Percent | Amount | Percent |
| 2010 | $165,427,697 | 2.30% | -$61,931,590 | -0.86% | $103,496,107 | 1.44% | $675,223,168 | 11.96% |
| 2011 | 189,663,213 | 2.63 | 76,943,548 | 1.06 | 266,606,761 | 3.69 | 1,197,629,301 | 19.18 |
| 2012 | 171,625,847 | 2.30 | -28,332,250 | -0.38 | 143,293,597 | 1.92 | 5,273,279 | 0.07 |
| 2013 | 173,531,364 | 2.29 | 211,568,037 | 2.79 | 385,099,401 | 5.08 | 922,455,661 | 12.48 |
| 2014 | 165,507,432 | 2.08 | 760,631,032 | 9.56 | 926,138,464 | 11.64 | 1,406,480,292 | 16.93 |
| 2015 | 156,994,160 | 1.77 | 755,549,754 | 8.53 | 912,543,914 | 10.30 | 416,474,352 | 4.30 |
| 2016 | 146,128,493 | 1.50 | 520,157,840 | 5.36 | 666,286,333 | 6.86 | 82,810,914 | 0.82 |
| 2017 | 177,862,393 | 1.72 | 676,239,873 | 6.56 | 854,102,266 | 8.28 | 1,281,254,293 | 12.73 |
| 2018 | 187,896,485 | 1.69 | 723,985,458 | 6.51 | 911,881,943 | 8.20 | 998,777,227 | 8.84 |
| 2019 | 219,107,479 | 1.83 | 591,868,832 | 4.95 | 810,976,311 | 6.78 | 791,832,113 | 6.47 |
| Total | $1,753,744,563 | | $4,226,680,534 | | $5,980,425,097 | | $7,778,210,600 | |
| | | | | Most recent five-year average return | | 8.00% | | 6.69% |
| | | | | Most recent ten-year average return | | 6.69% | | 8.79% |

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

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

## MARKET AND ACTUARIAL RATES OF RETURN FOR YEARS ENDED JUNE 30, 2007 – 2019



## Contributions

Contributions for the year ended June 30, 2019 totaled $515.7 million, compared to the projected amount of $509.2 million. This resulted in a gain of $6.8 million for the year, when adjusted for timing.

## Other Experience

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

- the extent of turnover among participants,
- retirement experience (earlier or later than projected),
- mortality (more or fewer deaths than projected),
- salary increases (greater or smaller than projected), and
- cost-of-living adjustments (COLAs) higher or lower than anticipated.

The net loss from this other experience for the year ended June 30, 2019 amounted to $17.8 million, which is 0.13% of the Actuarial Accrued Liability. This loss was mainly due to higher than expected individual salary increases for actives offset to some extent by lower than expected COLA increases for retirees and beneficiaries. See *Subsection E* for a detailed development of the Unfunded Actuarial Accrued Liability.

## D. Other Changes in the Actuarial Accrued Liability

The Actuarial Accrued Liability as of July 1, 2019 is $13.8 billion, an increase of $624.4 million, or 4.7%, from the Actuarial Accrued Liability as of the prior valuation date. The liability is expected to grow each year with Normal Cost and interest, and to decline due to benefit payments made. Additional fluctuations can occur due to actual experience that differs from expected (as discussed in the previous subsection).

### Actuarial Assumptions

- The assumption changes reflected in this report were based on the July 1, 2015 through June 30, 2018 Actuarial Experience Study report dated June 12, 2019.
  - These changes increased the Actuarial Accrued Liability by 0.06% and increased the Normal Cost by 3.74%.
  - The assumption changes include changes to inflation, investment return, individual salary increases, retirement, mortality, termination, and future service accruals.
- Details on actuarial assumptions and methods are in *Section 4, Exhibit I*.

### Plan Provisions

- There were no changes in plan provisions since the prior valuation.
- A summary of plan provisions is in *Section 4, Exhibit II*.

## E. Development of Unfunded/(Overfunded) Actuarial Accrued Liability

### DEVELOPMENT FOR YEAR ENDED JUNE 30, 2019

| | | | |
|---|---|---|---|
| 1 | Unfunded Actuarial Accrued Liability at beginning of year | | $1,177,543,700 |
| 2 | Total Normal Cost at beginning of year | | 243,262,953 |
| 3 | Total expected employer and employee contributions | | -509,196,467 |
| 4 | Interest | | |
| | a) For whole year on 1 + 2 | 103,008,483 | |
| | b) For half year on 3 | -18,458,372 | |
| | c) Total interest | | 84,550,111 |
| 5 | Expected Unfunded Actuarial Accrued Liability at end of year | | $996,160,297 |
| 6 | Changes due to: | | |
| | a) Actual contributions greater than expected | -$6,773,681 | |
| | b) Investment return less than expected | 56,782,268 | |
| | c) Individual salary increases higher than expected | 31,927,051 | |
| | d) 2018 COLA increases lower than expected | -12,754,301 | |
| | e) Other experience gain | -1,365,907 | |
| | f) Assumption changes | 8,835,790 | |
| | Total changes | | 76,651,220 |
| 7 | Unfunded Actuarial Accrued Liability at end of year | | $1,072,811,517 |

Note: The sum of items 6c through 6e equals the "Net gain/(loss) from other experience" shown in *Subsection C*.

## F. Required Contribution

The required Department contribution is equal to (a) the employer Normal Cost and (b) the amortization of the Unfunded or Overfunded Actuarial Accrued Liability. For this year, an amortization base was created for the actuarial loss during the plan year ending June 30, 2019 and for the actuarial assumption changes. This produces a net total amortization charge of $237,432,376.

Under the current funding policy, the Department's required contribution rate decreased as a percentage of pay. This was mainly the result of the effect of the increases in total payroll on the UAAL amortization rate, the 2004 UAAL amortization layer becoming fully amortized, and an increased proportion of Tier 2 members with a lower employer Normal Cost partially offset by the investment return on an actuarial value basis being lower than assumed and assumption changes.

The Board sets the funding policy used to calculate the required contribution based on layered amortization periods. See *Section 4, Exhibit I* for further details on the elements of the funding policy.

The contribution requirements as of July 1, 2019 are based on the data previously described, the actuarial assumptions and Plan provisions described in *Section 4*, including all changes affecting future costs adopted at the time of the actuarial valuation, actuarial gains and losses, and changes in the actuarial assumptions.

The chart below shows the required Department contribution for the total Plan. At the end of this subsection, the development of the aggregate required contribution is shown, along with similar information for Tier 1 and Tier 2 separately.

### AGGREGATE REQUIRED CONTRIBUTION FOR YEAR BEGINNING JULY 1, 2019

| All Tiers Combined (Aggregate) | Amount | % of Payroll |
|---|---|---|
| 1. Total Normal Cost | $263,472,814 | 23.07% |
| 2. Expected employee contributions | 82,011,259 | 7.18% |
| 3. Employer Normal Cost: 1 - 2 | $181,461,555 | 15.89% |
| 4. Amortization of Unfunded Actuarial Accrued Liability | 237,432,376 | 20.79% |
| 5. Total required contribution: 3 + 4, adjusted for timing[1] | $433,555,219 | 37.97% |
| 6. Projected compensation | $1,141,875,615 | |

[1] Required contributions are assumed to be paid at the middle of every year.

## Reconciliation of Aggregate Required Contribution Rate

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

### RECONCILIATION OF AGGREGATE REQUIRED CONTRIBUTION RATE FROM JULY 1, 2018 TO JULY 1, 2019

| | Contribution Rate |
|---|---|
| Aggregate Required Contribution Rate as of July 1, 2018 | 40.15% |
| • Effect of actual contributions greater than expected | -0.06% |
| • Effect of investment return lower than expected | 0.54% |
| • Effect of individual salary increases higher than expected | 0.30% |
| • Effect of 2018 COLA increases lower than expected | -0.12% |
| • Effect of changes in member demographics (including increase in Tier 2 membership) on Normal Cost | -0.63% |
| • Effect of net other experience gains [(1)] | -0.04% |
| • Effect of increase in total payroll on UAAL amortization rate | -1.30% |
| • Effect of the 2004 UAAL layer becoming fully amortized | -1.75% |
| • Effect of assumption changes | 0.88% |
| Total change | -2.18% |
| Aggregate Required Contribution Rate as of July 1, 2019 | 37.97% |

(1) Includes effect of differences in actual versus expected experience including mortality, disability, termination, and retirement experience.

## Required Contribution

| | Year Beginning July 1 | | | |
|---|---|---|---|---|
| | 2019 | | 2018 | |
| | Amount | % of Payroll | Amount | % of Payroll |
| **All Tiers Combined (Aggregate)** | | | | |
| 1. Total Normal Cost | $263,472,814 | 23.07% | $243,262,953 | 22.66% |
| 2. Expected employee contributions | 82,011,259 | 7.18% | 76,065,712 | 7.09% |
| 3. Employer Normal Cost: 1 - 2 | $181,461,555 | 15.89% | $167,197,241 | 15.57% |
| 4. Actuarial Accrued Liability | 13,811,956,483 | | 13,187,542,730 | |
| 5. Actuarial Value of Assets | 12,739,144,966 | | 12,009,999,030 | |
| 6. Unfunded Actuarial Accrued Liability: 4 - 5 | $1,072,811,517 | | $1,177,543,700 | |
| 7. Amortization of Unfunded Actuarial Accrued Liability | 237,432,376 | 20.79% | 248,722,911 | 23.17% |
| 8. Total required contribution: 3 + 7, adjusted for timing[(1)] | 433,555,219 | 37.97% | 430,997,257 | 40.15% |
| 9. Projected compensation | $1,141,875,615 | | $1,073,554,607 | |

(1) Required contributions are assumed to be paid at the middle of every year.

## Required Contribution (continued)

| | Year Beginning July 1 | | | |
|---|---|---|---|---|
| | 2019 | | 2018 | |
| | Amount | % of Payroll | Amount | % of Payroll |
| **Tier 1** | | | | |
| 1. Total Normal Cost | $200,397,332 | 24.91% | $197,704,487 | 24.25% |
| 2. Expected employee contributions | 48,749,066 | 6.06% | 50,401,728 | 6.18% |
| 3. Employer Normal Cost: 1 - 2 | $151,648,266 | 18.85% | $147,302,759 | 18.07% |
| 4. Actuarial Accrued Liability | 13,596,525,236 | | 13,056,939,158 | |
| 5. Amortization of Unfunded Actuarial Accrued Liability[1] | $167,252,565 | 20.79% | $188,903,375 | 23.17% |
| 6. Total required contribution: 3 + 5, adjusted for timing[2] | 330,062,360 | 41.03% | 348,393,606 | 42.73% |
| 7. Employer match (110% of 2), adjusted for timing[2] | $55,500,812 | 6.90% | $57,451,670 | 7.05% |
| 8. Greater of employer match 7 or total required contribution 6 | $330,062,360 | 41.03% | $348,393,606 | 42.73% |
| 9. Projected compensation | $804,362,186 | | $815,357,490 | |

(1) The same UAAL contribution rate is charged to both Tier 1 and Tier 2.
(2) Required contributions are assumed to be paid at the middle of every year.

## Required Contribution (continued)

| | Year Beginning July 1 | | | |
|---|---|---|---|---|
| | 2019 | | 2018 | |
| | Amount | % of Payroll | Amount | % of Payroll |
| **Tier 2** | | | | |
| 1. Total Normal Cost | $63,075,482 | 18.69% | $45,558,466 | 17.64% |
| 2. Expected employee contributions | 33,262,193 | 9.86% | 25,663,984 | 9.94% |
| 3. Employer Normal Cost: 1 - 2 | $29,813,289 | 8.83% | $19,894,482 | 7.70% |
| 4. Actuarial Accrued Liability | 215,431,247 | | 130,603,572 | |
| 5. Amortization of Unfunded Actuarial Accrued Liability[1] | 70,179,811 | 20.79% | 59,819,536 | 23.17% |
| 6. Total required contribution: 3 + 5, adjusted for timing[2] | 103,492,859 | 30.66% | 82,603,651 | 31.99% |
| 7. Projected compensation | $337,513,429 | | $258,197,117 | |

(1) The same UAAL contribution rate is charged to both Tier 1 and Tier 2.
(2) Required contributions are assumed to be paid at the middle of every year.

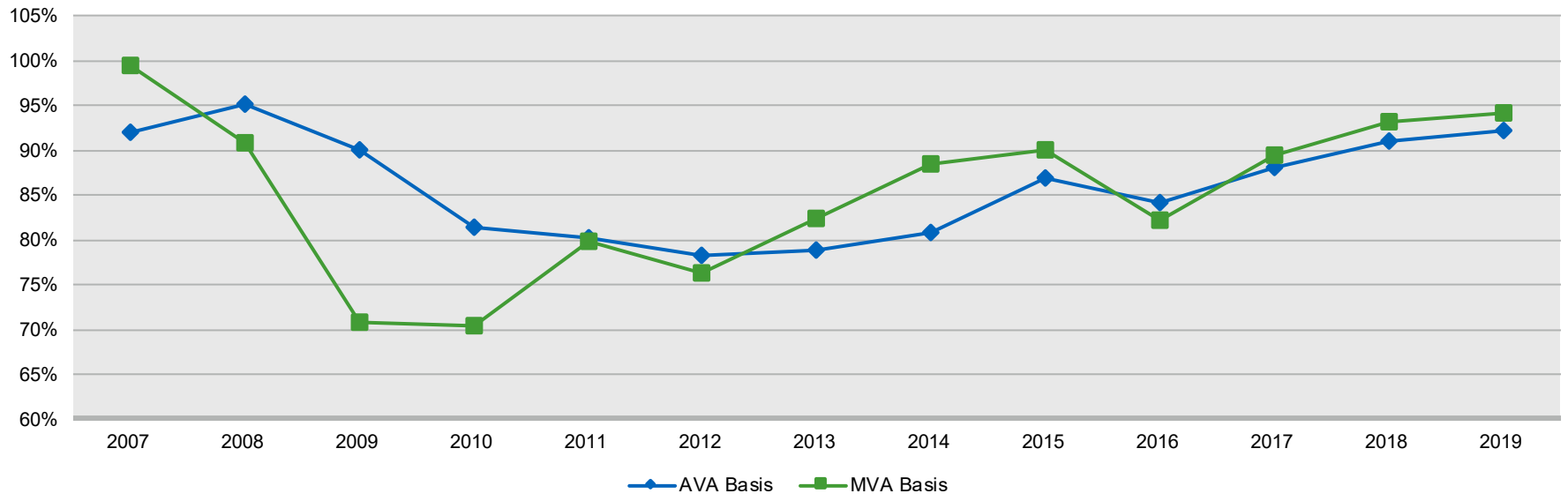
## G. Funded Status

A commonly reported piece of information regarding the Plan's financial status is the funded ratio. These ratios compare the Market and Actuarial Value of Assets to the Actuarial Accrued Liability of the Plan. High ratios indicate a well-funded plan with assets sufficient to cover the Plan's Actuarial Accrued Liability. Lower ratios may indicate recent changes to benefit structures, funding of the plan below actuarial requirements, poor asset performance, or a variety of other changes.

The chart below depicts a history of the funded ratio for the Plan. The chart on the next page shows the Plan's schedule of funding progress for the last ten years.

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 settling the Plan's benefit obligations. As the chart below shows, the measures are different depending on whether the Actuarial or Market Value of Assets is used.

**FUNDED RATIO**
**FOR YEARS ENDING JUNE 30, 2007 – 2019**



## SCHEDULE OF FUNDING PROGRESS
## FOR YEARS ENDING JUNE 30, 2010 – 2019

| Actuarial Valuation Date as of July 1, | Actuarial Value of Assets (a) | Actuarial Accrued Liability (AAL) (b) | Unfunded/ (Overfunded) AAL (UAAL) (b) - (a) | Funded Ratio (%) (a) / (b) | Covered Payroll (c) | UAAL as a Percentage of Covered Payroll (%) [(b) - (a)] / (c) |
|---|---|---|---|---|---|---|
| 2010 | $7,244,429,689 | $8,893,618,433 | $1,649,188,744 | 81.46% | $856,089,559 | 192.64% |
| 2011 | 7,465,183,643 | 9,297,204,318 | 1,832,020,675 | 80.29% | 870,203,423 | 210.53% |
| 2012 | 7,573,885,754 | 9,692,602,852 | 2,118,717,098 | 78.14% | 886,539,366 | 238.99% |
| 2013 | 7,958,487,587 | 10,094,867,871 | 2,136,380,284 | 78.84% | 900,254,454 | 237.31% |
| 2014 | 8,877,594,529 | 10,975,550,617 | 2,097,956,088 | 80.89% | 900,126,274 | 233.07% |
| 2015 | 9,750,343,300 | 11,218,445,567 | 1,468,102,267 | 86.91% | 920,781,074 | 159.44% |
| 2016 | 10,344,355,801 | 12,289,229,001 | 1,944,873,200 | 84.17% | 928,888,680 | 209.38% |
| 2017 | 11,133,708,386 | 12,657,101,266 | 1,523,392,880 | 87.96% | 991,814,994 | 153.60% |
| 2018 | 12,009,999,030 | 13,187,542,730 | 1,177,543,700 | 91.07% | 1,073,554,607 | 109.69% |
| 2019 | 12,739,144,966 | 13,811,956,483 | 1,072,811,517 | 92.23% | 1,141,875,615 | 93.95% |

## H. Actuarial Balance Sheet

An overview of the Plan's funding is given by an Actuarial Balance Sheet. In this approach, the amount and timing of all future payments that will be made by the Plan for current participants is determined first. Then these payments are discounted at the valuation interest rate to the date of the valuation, thereby determining the present value, referred to as the Actuarial Present Value of Future Benefits of the Plan.

Second, this Actuarial Present Value of Future Benefits is compared to the assets. The "assets" for this purpose include the net amount of assets already accumulated by the Plan, the present value of future member contributions, the present value of future Department Normal Cost contributions, and the present value of future Department amortization payments (or credits) for the Unfunded (or Overfunded) Actuarial Accrued Liability.

### ACTUARIAL BALANCE SHEET

| | July 1, 2019 | July 1, 2018 |
|---|---|---|
| Actuarial Present Value of Future Benefits | | |
| • Present value of benefits for retired members and beneficiaries | $7,738,487,474 | $7,324,080,162 |
| • Present value of benefits for inactive vested members | 224,906,012 | 220,277,427 |
| • Present value of benefits for active members | 8,660,484,036 | 8,106,105,532 |
| **Total Actuarial Present Value of Future Benefits** | **$16,623,877,522** | **$15,650,463,121** |
| Current and future assets | | |
| • Total Actuarial Value of Assets | $12,739,144,966 | $12,009,999,030 |
| • Present value of future contributions by members | 996,034,620 | 863,003,392 |
| • Present value of future employer contributions for: | | |
| » Entry age Normal Cost | 1,815,886,419 | 1,599,916,999 |
| » Unfunded Actuarial Accrued Liability | 1,072,811,517 | 1,177,543,700 |
| **Total of Current and Future Assets** | **$16,623,877,522** | **$15,650,463,121** |

# I. Reserves and Designated Balances

| | June 30, 2019 | June 30, 2018 |
|---|---|---|
| 1. Reserve for retirement allowance for retired members | $7,853,587,427 | $7,409,140,493 |
| 2. Contribution accounts: | | |
| a) Members | 1,753,563,838 | 1,667,598,977 |
| b) Department of Water and Power | (1,441,549,089) | (1,382,598,166) |
| 3. General Reserve[1] | 2,406,274,766 | 2,388,641,092 |
| 4. Total | $10,571,876,942 | $10,082,782,396 |

[1] Out of the total General Reserve, $129,870,870 and $122,770,853 are not included as valuation assets as of June 30, 2019 and June 30, 2018, respectively.

## J. Adjusted Reserves

Each year the Retirement Board adjusts its retired reserves to agree with the value calculated during the valuation. The following table presents the required transfers.

| Adjusted Reserves | June 30, 2019 | June 30, 2018 |
|---|---|---|
| 1. Retired reserve balance | $7,853,587,427 | $7,409,140,493 |
| 2. Actuarially computed present value | 7,738,487,474 | 7,324,080,162 |
| 3. Actuarial gain (loss): 1 - 2 | 115,099,953 | 85,060,331 |
| 4. Transfer from (to) DWP contribution accounts to (from) retired reserves | (115,099,953) | (85,060,331) |

## K. 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 measurement since it is based on the current level of assets.

The current AVR is about 11.4. This means that a 1% asset gain or loss (relative to the assumed investment return) translates to about 11.4% of one-year's payroll. Since actuarial gains and losses are amortized over 15 years, there would be a 1.2% 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. The current LVR is about 12.1. This is about 6% higher than the AVR. Therefore, we would expect that contribution volatility will increase over the long term.

The chart on the next page shows how the asset and liability volatility ratios have varied over time.

## VOLATILITY RATIOS FOR YEARS ENDED JUNE 30, 2010 – 2019

| Year Ended June 30 | Asset Volatility Ratio | Liability Volatility Ratio |
|---|---|---|
| 2010 | 7.3 | 10.4 |
| 2011 | 8.5 | 10.7 |
| 2012 | 8.3 | 10.9 |
| 2013 | 9.2 | 11.2 |
| 2014 | 10.8 | 12.2 |
| 2015 | 11.0 | 12.2 |
| 2016 | 10.9 | 13.2 |
| 2017 | 11.4 | 12.8 |
| 2018 | 11.4 | 12.3 |
| 2019 | 11.4 | 12.1 |

## L. Risk Assessment

Since the actuarial valuation results are dependent on a fixed set of assumptions and data as of a specific date, there is risk that emerging results may differ, perhaps significantly, as actual experience is fluid and will not exactly track current assumptions. This potential divergence may have a significant impact on the future financial condition of the plan.

This section does not contain a detailed analysis of the potential range of future measurements, but does include a concise discussion of some of the primary risks that may affect the Plan's future financial condition. We recommend a more detailed assessment of the risks to provide the Board with a better understanding of the risks inherent in the Plan that can inform both financial preparation and future decision making. This assessment may include scenario testing, sensitivity testing, stress testing and stochastic modeling. This section provides descriptions and basic assessments of the primary risks that are likely to have an ongoing influence on the Plan's financial health:

- Asset/Liability Mismatch Risk (the potential that future plan experience does not affect asset and liability values in the same way, causing them to diverge)

  The most significant asset/liability mismatch risk to the Plan is investment risk, as discussed below. In fact, investment risk has the potential to impact asset/liability mismatch in two ways. The first mismatch is evident in annual valuations: when asset values deviate from assumptions, they are typically independent from liability changes. The second mismatch can be caused when systemic asset deviations from assumptions may signal the need for an assumption change, which causes liability values and contribution rates to move in the opposite direction from any changes in the expected experience of asset growth rates.

  Asset/liability mismatch can also be caused by demographic assumption risk such as longevity, which affects liabilities but have no impact on asset levels. This risk is also discussed below.

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

  The investment return assumption is a long-term, static assumption for valuation purposes even though in reality market experience can be quite volatile in any given year. That volatility can cause significant changes in the financial health of the system, affecting both funded status and contribution rates. The inherent year-to-year volatility is reduced by smoothing through the actuarial value of assets, however investment experience can still have a sizable impact. As discussed in the Volatility Ratios section on page 37, a 1% asset gain or loss (relative to the assumed investment return) translates to about 11.4% of one-year's payroll. Since actuarial gains and losses are amortized over 15 years, there would be a 1.2% of payroll decrease/(increase) in the required contribution for each 1% asset gain/(loss).

  The market value rate of return over the last 10 years has ranged from a low of 0.07% to a high of 19.18%.

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

  The actuarial valuation includes current life expectancy assumptions and an expectation of future improvement in life expectancy, which are significant assumptions given the relatively long duration of liabilities for pension plans. Emerging plan experience that does not match these expectations will result in increases or decreases in the actuarially determined contribution over time. This risk can be reduced by using tables appropriate for the Plan (public experience tables) that are weighted by benefit levels, and by using generational mortality projections.

Some plans also carry significant contribution risk, defined as the potential for actual future contributions deviating from expected future contributions. However, the employer has a proven track-record of making the Actuarially Determined Contributions based on the Board's Actuarial Funding Policy, so contribution risk is minimal.

- Evaluation of Historical Trends

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

  - The funded percentage on the actuarial value of assets has increased from 81.5% to 92.2%. This is primarily due to contributions made to amortize the UAAL (i.e., amortizing each layer of UAAL over 15 years in level dollar amounts) and average investment returns over recent years higher than the assumption on a smoothed basis. For a more detailed history see the Schedule of Funding Progress on page 33.
  - The average geometric investment return over the last 10 years was 8.79% on a Market Value basis. This includes a high of 19.18% return and a low of 0.07%. The average over the last 5 years was 6.69%. For more details see the Investment Return table on page 22.
  - The primary source of new UAAL was the strengthening assumptions through multiple assumption changes. For example, the assumption change in 2016 changed the discount rate from 7.50% to 7.25% and updated mortality tables, adding $723 million unfunded liability. The assumption change in 2019 changed the discount rate from 7.25% to 7.00% and updated mortality tables, adding $9 million unfunded liability. For more details on unfunded liability changes see the Table of Amortization Bases on page 52.
  - The plan's funding policy effectively deals with these unfunded liabilities over time. This can be seen most clearly in the projection graphs provided on pages 53 and 54.

- Maturity Measures

  In the last 10 years the ratio of members in pay status to active participants has decreased slightly from 0.91 to 0.90. This ratio has fluctuated between 0.90 and 0.99 during the last 10 years but has recently decreased due to increased hiring of active members. An increasing ratio indicates that the plan has grown in maturity over time. Unless there will be continued increases in hiring, this is to be

expected, but also is informative for understanding plan sensitivity to particular risks. For more details see the Member Population table on page 13.

As pension plans mature, the cash needed to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Plan's asset allocation is aligned to meet emerging pension liabilities. For the prior year, benefits paid were $82 million more than contributions received. Plans with high levels of negative cash flows have a need for a larger allocation of liquid assets, which can create a drag on investment return. However, this plan currently has relatively low levels of negative cash flows. For more details on historical cash flows see the Comparison of Contributions with Benefits on page 17.

A further discussion of plan maturity measures and how they relate to changes in assets and liabilities is included in the preceding Volatility Ratios section starting on page 37.

# Section 3: Supplemental Information

## EXHIBIT A – TABLE OF PLAN COVERAGE
## TOTAL PLAN

| Category | Year Ended July 1 | | Change From Prior Year |
|---|---|---|---|
| | 2019 | 2018 | |
| **Active members in valuation:** | | | |
| • Number | 10,362 | 10,114 | 2.5% |
| • Average age | 47.2 | 47.5 | -0.3 |
| • Average years of service | 14.6 | 15.1 | -0.5 |
| • Total projected compensation | $1,141,875,615 | $1,073,554,608 | 6.4% |
| • Average projected compensation | 110,198 | 106,145 | 3.8% |
| • Account balances | 1,468,721,928 | 1,419,279,675 | 3.5% |
| **Inactive vested members:**(1) | | | |
| • Number | 1,663 | 1,728 | -3.8% |
| • Average age | 51.7 | 53.4 | -1.7 |
| • Average account balances | $65,917 | $61,701 | 6.8% |
| **Retired members:** | | | |
| • Number in pay status | 7,355 | 7,199 | 2.2% |
| • Average age | 72.9 | 72.9 | 0.0 |
| • Average monthly benefit | $6,008 | $5,761 | 4.3% |
| **Beneficiaries:** | | | |
| • Number in pay status | 1,960 | 1,966 | -0.3% |
| • Average age | 80.7 | 80.7 | 0.0 |
| • Average monthly benefit | $3,513 | $3,384 | 3.8% |

(1) Includes terminated members due a refund of member contributions and members receiving PTD benefits.

# EXHIBIT A – TABLE OF PLAN COVERAGE (CONTINUED)
## TIER 1

| Category | Year Ended July 1 | | Change From Prior Year |
|---|---|---|---|
| | 2019 | 2018 | |
| **Active members in valuation:** | | | |
| • Number | 6,801 | 7,196 | -5.5% |
| • Average age | 51.7 | 51.2 | 0.5 |
| • Average years of service | 20.8 | 20.4 | 0.4 |
| • Total projected compensation | $804,362,186 | $815,357,490 | -1.3% |
| • Average projected compensation | 118,271 | 113,307 | 4.4% |
| • Account balances | 1,388,162,104 | 1,370,810,105 | 1.3% |
| **Inactive vested members:**(1) | | | |
| • Number | 1,264 | 1,407 | -10.2% |
| • Average age | 54.4 | 55.7 | -1.3 |
| • Average account balances | $84,256 | $74,285 | 13.4% |
| **Retired members:** | | | |
| • Number in pay status | 7,352 | 7,198 | 2.1% |
| • Average age | 72.9 | 72.9 | 0.0 |
| • Average monthly benefit | $6,010 | $5,761 | 4.3% |
| **Beneficiaries:** | | | |
| • Number in pay status | 1,960 | 1,965 | -0.3% |
| • Average age | 80.7 | 80.7 | 0.0 |
| • Average monthly benefit | $3,513 | $3,386 | 3.8% |

(1) Includes terminated members due a refund of member contributions and members receiving PTD benefits.

# EXHIBIT A – TABLE OF PLAN COVERAGE (CONTINUED)
# TIER 2

| Category | Year Ended July 1 | | Change From Prior Year |
|---|---|---|---|
| | 2019 | 2018 | |
| **Active members in valuation:** | | | |
| • Number | 3,561 | 2,918 | 22.0% |
| • Average age | 38.7 | 38.6 | 0.1 |
| • Average years of service | 2.7 | 2.2 | 0.5 |
| • Total projected compensation | $337,513,429 | $258,197,117 | 30.7% |
| • Average projected compensation | 94,781 | 88,484 | 7.1% |
| • Account balances | 80,559,824 | 48,469,570 | 66.2% |
| **Inactive vested members:**(1) | | | |
| • Number | 399 | 321 | 24.3% |
| • Average age | 43.2 | 43.2 | 0.0 |
| • Average account balances | $7,821 | $6,545 | 19.5% |
| **Retired members:** | | | |
| • Number in pay status | 3 | 1 | 200.0% |
| • Average age | 62.9 | 61.4 | 1.5 |
| • Average monthly benefit | $925 | $2,149 | -57.0% |
| **Beneficiaries:** | | | |
| • Number in pay status | 0 | 1 | N/A |
| • Average age | N/A | 91.7 | N/A |
| • Average monthly benefit | N/A | $893 | N/A |

(1) Includes terminated members due a refund of member contributions and members receiving PTD benefits.

# EXHIBIT B – MEMBERS IN ACTIVE SERVICE AS OF JULY 1, 2019
# BY AGE, YEARS OF SERVICE, AND AVERAGE PROJECTED COMPENSATION
# TOTAL PLAN

| | Years of Service | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | Total | 0 - 4 | 5 - 9 | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 | 40 & over |
| Under 25 | 141 | 140 | 1 | -- | -- | -- | -- | -- | -- | -- |
| | $91,126 | $91,130 | $90,461 | -- | -- | -- | -- | -- | -- | -- |
| 25 - 29 | 641 | 590 | 50 | -- | -- | -- | -- | -- | -- | -- |
| | 98,269 | 95,878 | 125,764 | $134,594 | -- | -- | -- | -- | -- | -- |
| 30 - 34 | 981 | 723 | 151 | 106 | 1 | -- | -- | -- | -- | -- |
| | 100,727 | 92,879 | 121,665 | 124,750 | $66,332 | -- | -- | -- | -- | -- |
| 35 - 39 | 1,249 | 642 | 135 | 349 | 120 | 3 | -- | -- | -- | -- |
| | 107,668 | 92,659 | 118,932 | 124,598 | 125,907 | $113,431 | -- | -- | -- | -- |
| 40 - 44 | 1,324 | 486 | 103 | 318 | 334 | 82 | 1 | -- | -- | -- |
| | 108,227 | 92,310 | 109,580 | 114,520 | 123,015 | 116,045 | $122,692 | -- | -- | -- |
| 45 - 49 | 1,413 | 397 | 76 | 257 | 365 | 221 | 88 | 9 | -- | -- |
| | 108,762 | 92,397 | 108,361 | 109,800 | 113,257 | 115,085 | 143,822 | $124,057 | -- | -- |
| 50 - 54 | 1,712 | 269 | 64 | 195 | 322 | 180 | 366 | 305 | 11 | -- |
| | 117,254 | 95,395 | 106,343 | 106,639 | 109,424 | 118,231 | 136,259 | 130,005 | $130,803 | -- |
| 55 - 59 | 1,582 | 153 | 56 | 156 | 237 | 136 | 290 | 417 | 135 | 2 |
| | 118,389 | 99,456 | 101,833 | 105,427 | 108,234 | 110,007 | 121,075 | 132,992 | 136,937 | $128,323 |
| 60 - 64 | 879 | 60 | 22 | 91 | 121 | 80 | 181 | 184 | 122 | 18 |
| | 114,864 | 100,146 | 114,518 | 100,961 | 106,923 | 106,700 | 117,819 | 121,424 | 128,061 | 138,105 |
| 65 - 69 | 333 | 12 | 13 | 33 | 73 | 36 | 50 | 56 | 35 | 25 |
| | 106,303 | 89,299 | 96,558 | 95,031 | 100,781 | 102,369 | 115,587 | 113,693 | 109,280 | 116,909 |
| 70 & over | 107 | 3 | 2 | 5 | 16 | 10 | 20 | 18 | 13 | 20 |
| | 106,336 | 51,912 | 69,130 | 91,351 | 100,431 | 104,541 | 105,327 | 112,601 | 123,173 | 112,015 |
| **Total** | **10,362** | **3,475** | **673** | **1,511** | **1,589** | **748** | **996** | **989** | **316** | **65** |
| | **$110,198** | **$93,705** | **$114,041** | **$113,501** | **$113,523** | **$113,368** | **$127,483** | **$128,373** | **$129,667** | **$121,624** |

## EXHIBIT B – MEMBERS IN ACTIVE SERVICE AS OF JULY 1, 2019 (CONTINUED)
## BY AGE, YEARS OF SERVICE, AND AVERAGE PROJECTED COMPENSATION
## TIER 1

| | Years of Service | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | Total | 0 - 4 | 5 - 9 | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 | 40 & over |
| Under 25 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 25 - 29 | 57 | 15 | 41 | 1 | -- | -- | -- | -- | -- | -- |
| | $116,352 | $88,182 | $126,212 | $134,594 | -- | -- | -- | -- | -- | -- |
| 30 - 34 | 240 | 20 | 114 | 105 | 1 | -- | -- | -- | -- | -- |
| | 122,314 | 105,192 | 123,948 | 124,334 | $66,332 | -- | -- | -- | -- | -- |
| 35 - 39 | 582 | 15 | 98 | 346 | 120 | 3 | -- | -- | -- | -- |
| | 123,301 | 90,532 | 121,529 | 124,406 | 125,907 | $113,431 | -- | -- | -- | -- |
| 40 - 44 | 824 | 20 | 69 | 318 | 334 | 82 | 1 | -- | -- | -- |
| | 117,472 | 91,547 | 113,376 | 114,520 | 123,015 | 116,045 | $122,692 | -- | -- | -- |
| 45 - 49 | 1,003 | 14 | 51 | 256 | 365 | 220 | 88 | 9 | -- | -- |
| | 115,010 | 94,811 | 107,355 | 109,782 | 113,257 | 115,167 | 143,822 | $124,057 | -- | -- |
| 50 - 54 | 1,438 | 19 | 41 | 194 | 322 | 180 | 366 | 305 | 11 | -- |
| | 121,213 | 89,091 | 109,412 | 106,436 | 109,424 | 118,231 | 136,259 | 130,005 | $130,803 | -- |
| 55 - 59 | 1,415 | 8 | 35 | 155 | 237 | 136 | 290 | 417 | 135 | 2 |
| | 120,404 | 76,889 | 99,520 | 105,472 | 108,234 | 110,007 | 121,075 | 132,992 | 136,937 | $128,323 |
| 60 - 64 | 816 | 4 | 15 | 91 | 121 | 80 | 181 | 184 | 122 | 18 |
| | 115,635 | 81,376 | 106,341 | 100,961 | 106,923 | 106,700 | 117,819 | 121,424 | 128,061 | 138,105 |
| 65 - 69 | 321 | 3 | 10 | 33 | 73 | 36 | 50 | 56 | 35 | 25 |
| | 106,615 | 75,011 | 92,642 | 95,031 | 100,781 | 102,369 | 115,587 | 113,693 | 109,280 | 116,909 |
| 70 & over | 105 | 2 | 1 | 5 | 16 | 10 | 20 | 18 | 13 | 20 |
| | 106,704 | 46,623 | 26,664 | 91,351 | 100,431 | 104,541 | 105,327 | 112,601 | 123,173 | 112,015 |
| **Total** | **6,801** | **120** | **475** | **1,504** | **1,589** | **747** | **996** | **989** | **316** | **65** |
| | **$118,271** | **$90,787** | **$115,852** | **$113,386** | **$113,523** | **$113,389** | **$127,483** | **$128,373** | **$129,667** | **$121,624** |

## EXHIBIT B – MEMBERS IN ACTIVE SERVICE AS OF JULY 1, 2019 (CONTINUED)
## BY AGE, YEARS OF SERVICE, AND AVERAGE PROJECTED COMPENSATION
## TIER 2

| | Years of Service | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | Total | 0 - 4 | 5 - 9 | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 | 40 & over |
| Under 25 | 141 | 140 | 1 | -- | -- | -- | -- | -- | -- | -- |
| | $91,126 | $91,130 | $90,461 | -- | -- | -- | -- | -- | -- | -- |
| 25 - 29 | 584 | 575 | 9 | -- | -- | -- | -- | -- | -- | -- |
| | 96,504 | 96,078 | 123,720 | -- | -- | -- | -- | -- | -- | -- |
| 30 - 34 | 741 | 703 | 37 | 1 | -- | -- | -- | -- | -- | -- |
| | 93,735 | 92,529 | 114,633 | $168,478 | -- | -- | -- | -- | -- | -- |
| 35 - 39 | 667 | 627 | 37 | 3 | -- | -- | -- | -- | -- | -- |
| | 94,026 | 92,710 | 112,055 | 146,758 | -- | -- | -- | -- | -- | -- |
| 40 - 44 | 500 | 466 | 34 | -- | -- | -- | -- | -- | -- | -- |
| | 92,992 | 92,343 | 101,877 | -- | -- | -- | -- | -- | -- | -- |
| 45 - 49 | 410 | 383 | 25 | 1 | -- | 1 | -- | -- | -- | -- |
| | 93,479 | 92,309 | 110,412 | 114,433 | -- | $97,032 | -- | -- | -- | -- |
| 50 - 54 | 274 | 250 | 23 | 1 | -- | -- | -- | -- | -- | -- |
| | 96,477 | 95,874 | 100,872 | 146,024 | -- | -- | -- | -- | -- | -- |
| 55 - 59 | 167 | 145 | 21 | 1 | -- | -- | -- | -- | -- | -- |
| | 101,314 | 100,701 | 105,690 | 98,373 | -- | -- | -- | -- | -- | -- |
| 60 - 64 | 63 | 56 | 7 | -- | -- | -- | -- | -- | -- | -- |
| | 104,882 | 101,487 | 132,038 | -- | -- | -- | -- | -- | -- | -- |
| 65 - 69 | 12 | 9 | 3 | -- | -- | -- | -- | -- | -- | -- |
| | 97,949 | 94,062 | 109,610 | -- | -- | -- | -- | -- | -- | -- |
| 70 & over | 2 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- |
| | 87,044 | 62,491 | 111,596 | -- | -- | -- | -- | -- | -- | -- |
| **Total** | **3,561** | **3,355** | **198** | **7** | -- | **1** | -- | -- | -- | -- |
| | **$94,781** | **$93,809** | **$109,696** | **$138,226** | -- | **$97,032** | -- | -- | -- | -- |

## EXHIBIT C – RECONCILIATION OF MEMBER DATA

| | Active Members | Inactive Vested Members[1] | Retired Members | Beneficiaries | Total |
|---|---|---|---|---|---|
| **Number as of July 1, 2018** | **10,114** | **1,728** | **7,199** | **1,966** | **21,007** |
| • New members | 776 | N/A | N/A | N/A | 776 |
| • Terminations – with vested rights | -136 | 136 | N/A | N/A | 0 |
| • Contribution refunds | -28 | -143 | N/A | N/A | -171 |
| • Retirements | -363 | -35 | 398 | N/A | 0 |
| • Rehire | 25 | -25 | 0 | 0 | 0 |
| • Died with beneficiary | -5 | 0 | -101 | 106 | 0 |
| • Died without beneficiary | -21 | -24 | -141 | -129 | -315 |
| • Data adjustments | 0 | 26[2] | 0 | 17[3] | 43 |
| **Number as of July 1, 2019** | **10,362** | **1,663** | **7,355** | **1,960** | **21,340** |

(1) Includes terminated members due a refund of member contributions and members receiving PTD benefits.

(2) Terminated members due a refund of member contributions.

(3) New beneficiaries from either death of retired members or divorce settlements.

# EXHIBIT D – SUMMARY STATEMENT OF INCOME AND EXPENSES ON A MARKET VALUE BASIS

| | Year Ended June 30, 2019 | | Year Ended June 30, 2018 | |
|---|---|---|---|---|
| Net assets at market value at the beginning of the year | | $12,277,085,263 | | $11,313,899,335 |
| **Contribution income:** | | | | |
| • Employer contributions | $410,165,124 | | $433,412,569 | |
| • Member contributions | 104,741,925 | | 93,659,240 | |
| • Net administrative expense contributions | 826,142 | | 549,417 | |
| Net contribution income | | $515,733,191 | | $527,621,226 |
| **Investment income:** | | | | |
| • Interest, dividends and other income | $257,939,211 | | $225,612,064 | |
| • Asset appreciation | 572,724,634 | | 810,880,742 | |
| • Less investment fees | -38,831,732 | | -37,715,579 | |
| Net investment income | | $791,832,113 | | $998,777,227 |
| **Total income available for benefits** | | **$1,307,565,304** | | **$1,526,398,453** |
| **Less benefit payments:** | | | | |
| • Retirement benefits paid | -$591,461,776 | | -$558,900,946 | |
| • Refund of members' contributions | -6,101,790 | | -4,311,579 | |
| Net benefit payments | | -$597,563,566 | | -$563,212,525 |
| **Change in net assets at market value** | | **$710,001,738** | | **$963,185,928** |
| **Net assets at market value at the end of the year** | | **$12,987,087,001** | | **$12,277,085,263** |

Note: Results may be slightly off due to rounding.

## EXHIBIT E – SUMMARY STATEMENT OF PLAN ASSETS

| | Year Ended June 30, 2019 | | Year Ended June 30, 2018 | |
|---|---|---|---|---|
| **Cash equivalents** | | $8,239,491 | | $8,066,188 |
| **Accounts receivable:** | | | | |
| • Accrued investment income | $37,291,739 | | $32,914,444 | |
| • Open investment trades and others | 72,196,047 | | 263,176,793 | |
| • Department of Water and Power | 55,310,152 | | 59,147,316 | |
| Total accounts receivable | | $164,797,938 | | $355,238,553 |
| **Investments:** | | | | |
| • Fixed income | 2,993,027,511 | | 2,848,790,689 | |
| • Equities | 6,854,961,546 | | 6,689,840,829 | |
| • Other assets | 3,149,208,674 | | 2,668,708,078 | |
| Total investments at market value | | $12,997,197,731 | | $12,207,339,596 |
| Total assets | | $13,170,235,160 | | $12,570,644,337 |
| **Less accounts payable** | | -$183,148,159 | | -$293,559,074 |
| **Net assets at market value** | | **$12,987,087,001** | | **$12,277,085,263** |
| **Net assets at actuarial value** | | **$12,739,144,966** | | **$12,009,999,030** |

Note: Results may be slightly off due to rounding.

## EXHIBIT F – DEVELOPMENT OF THE FUND THROUGH JUNE 30, 2019

| Year Ended June 30 | Employer Contributions | Member Contributions[1] | Other Contributions | Net Investment Return[2] | Benefit Payments | Market Value of Assets at Year-End | Actuarial Value of Assets at Year-End | Actuarial Value as a Percent of Market Value |
|---|---|---|---|---|---|---|---|---|
| 2010 | $201,034,807 | $71,246,053 | $4,463,141 | $670,760,027 | $380,068,530 | $6,266,313,282 | $7,244,429,689 | 115.6% |
| 2011 | 286,699,384 | 65,965,607 | 5,672,227 | 1,191,957,074 | 398,517,798 | 7,418,089,776 | 7,465,183,643 | 100.6% |
| 2012 | 321,688,919 | 60,105,653 | 5,428,297 | (155,018) | 416,386,058 | 7,388,771,569 | 7,573,885,754 | 102.5% |
| 2013 | 368,426,348 | 69,633,449 | 4,392,846 | 918,062,815 | 438,557,365 | 8,310,729,662 | 7,958,487,587 | 95.8% |
| 2014 | 384,265,892 | 72,299,526 | 4,872,432 | 1,401,607,860 | 463,596,940 | 9,710,178,432 | 8,877,594,529 | 91.4% |
| 2015 | 376,902,022 | 68,552,375 | 717,370 | 416,474,352 | 485,966,910 | 10,086,857,641 | 9,750,343,300 | 96.7% |
| 2016 | 362,359,894 | 75,068,523 | 791,047 | 82,810,914 | 510,493,296 | 10,097,394,723 | 10,344,355,801 | 102.4% |
| 2017 | 391,717,359 | 83,239,105 | 655,190 | 1,281,254,293 | 540,361,335 | 11,313,899,335 | 11,133,708,386 | 98.4% |
| 2018 | 433,412,569 | 93,659,240 | 549,417 | 998,777,227 | 563,212,525 | 12,277,085,263 | 12,009,999,030 | 97.8% |
| 2019 | 410,165,124 | 104,741,925 | 826,142 | 791,832,113 | 597,563,566 | 12,987,087,001 | 12,739,144,966 | 98.1% |

[1] Includes member normal contributions, Additional Annuity program contributions, contributions due to open contracts for purchased service, and member contributions transferred from LACERS.

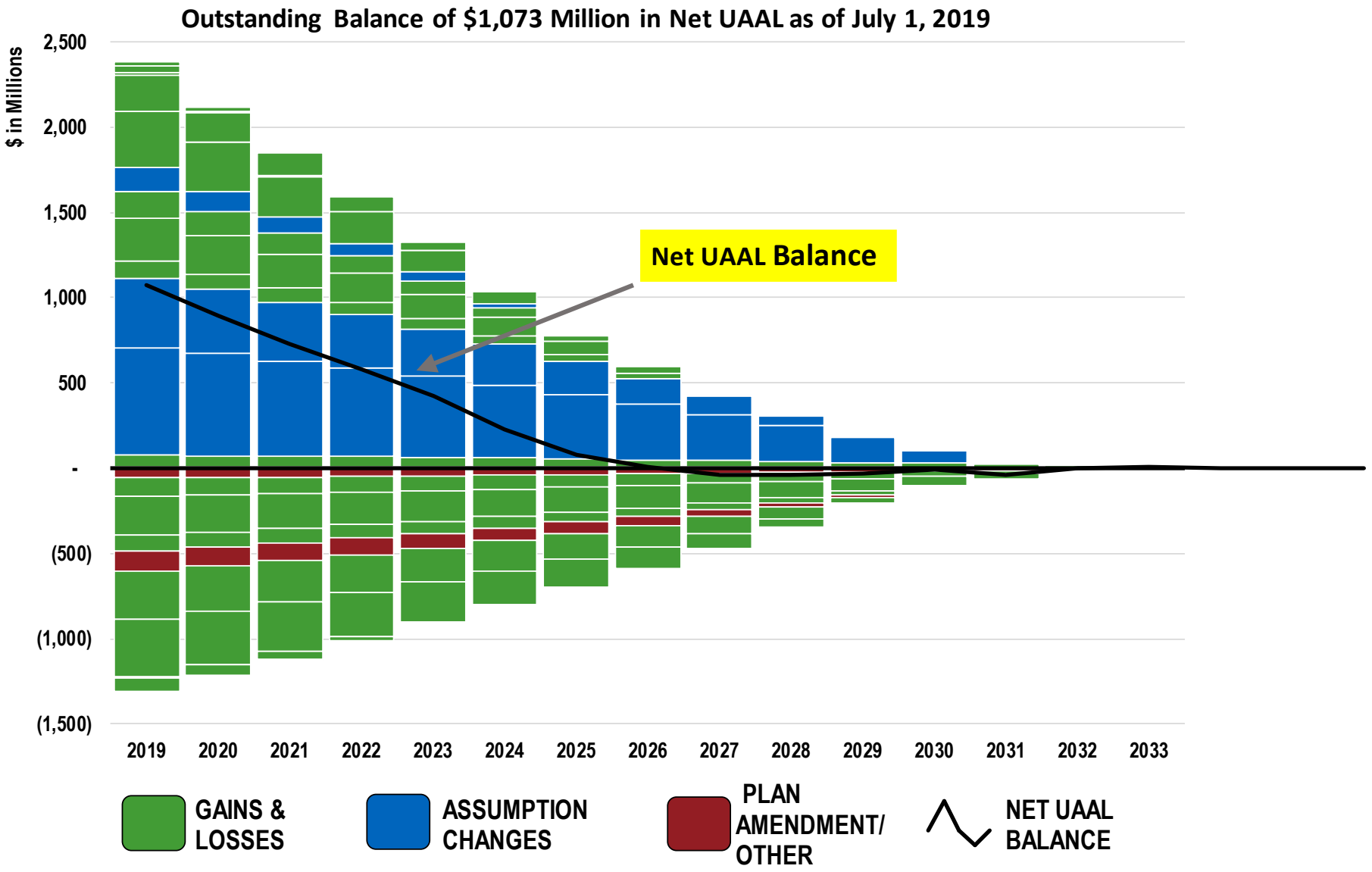
[2] On a market value basis. Net of investment fees and administrative expenses prior to 2015. Starting in 2015, administrative expenses are included as an offset to "other contributions."

## EXHIBIT G – TABLE OF AMORTIZATION BASES

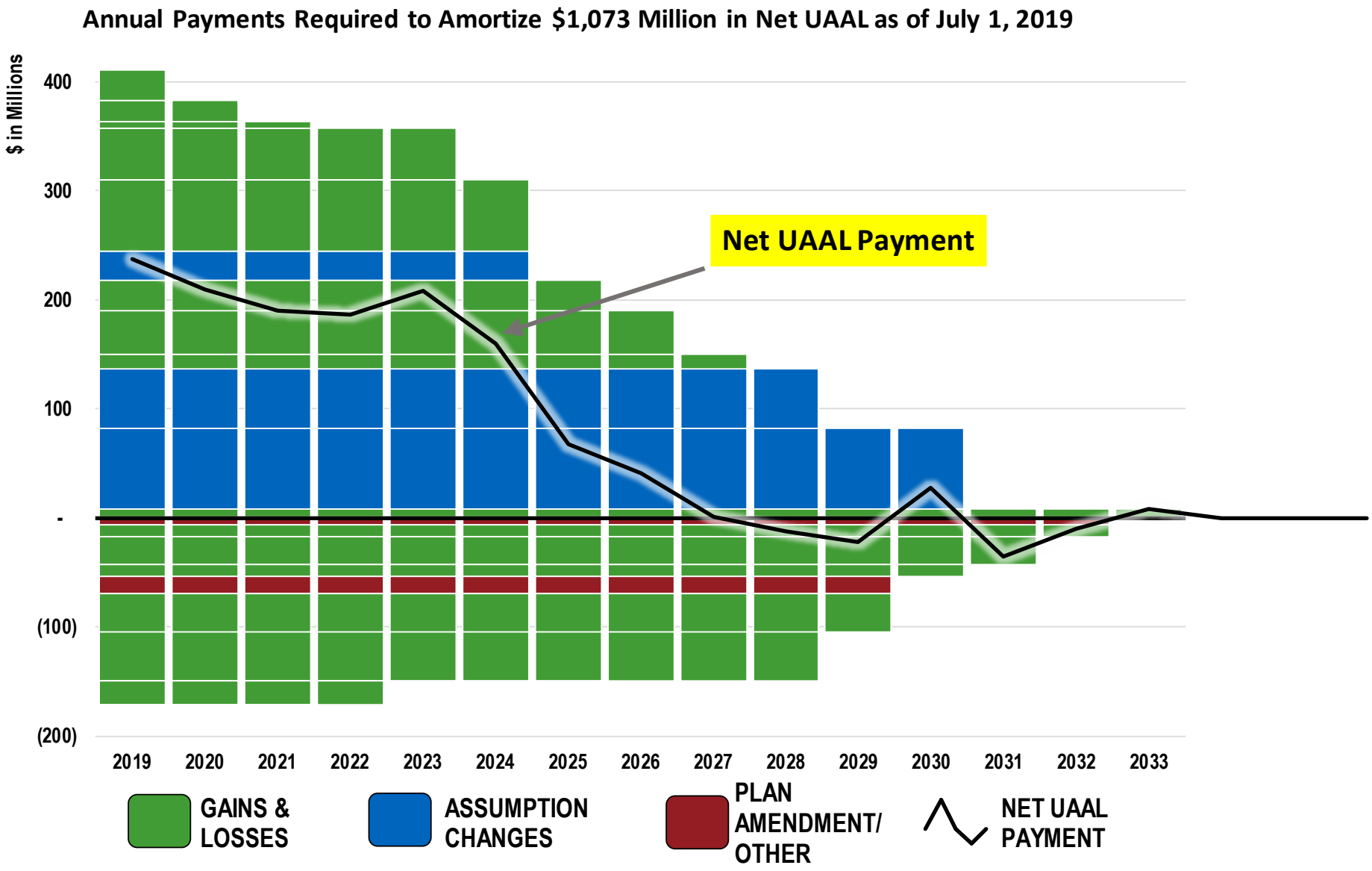
| Type | Date Established | Initial Amount | Initial Period | Outstanding Balance | Years Remaining | Annual Payment[1] |
|---|---|---|---|---|---|---|
| Actuarial Loss | 07/01/2005 | $267,915,003 | 15 | $28,476,509 | 1 | $28,476,509 |
| Actuarial Loss | 07/01/2006 | 183,420,211 | 15 | 37,565,150 | 2 | 19,417,735 |
| Actuarial Loss | 07/01/2007 | 47,238,833 | 15 | 13,988,125 | 3 | 4,981,494 |
| Assumption Changes | 07/01/2007 | -18,102,738 | 15 | -5,360,490 | 3 | -1,908,994 |
| Actuarial Gain | 07/01/2008 | -204,179,457 | 15 | -77,741,786 | 4 | -21,450,057 |
| Actuarial Loss | 07/01/2009 | 457,336,004 | 15 | 210,011,444 | 5 | 47,869,006 |
| Plan Amendments | 07/01/2009 | 2,239,982 | 15 | 1,028,615 | 5 | 234,458 |
| Actuarial Loss | 07/01/2010 | 626,174,290 | 15 | 333,081,138 | 6 | 65,307,499 |
| Assumption Changes | 07/01/2010 | 255,885,598 | 15 | 136,113,328 | 6 | 26,687,855 |
| Actuarial Loss | 07/01/2011 | 268,017,929 | 15 | 160,751,951 | 7 | 27,876,675 |
| Plan Amendments | 07/01/2011 | -6,948,892 | 15 | -4,167,811 | 7 | -722,758 |
| Actuarial Loss | 07/01/2012 | 380,800,633 | 15 | 252,389,246 | 8 | 39,501,927 |
| Actuarial Loss | 07/01/2013 | 133,360,391 | 15 | 96,191,902 | 9 | 13,798,276 |
| Actuarial Gain | 07/01/2014 | -434,196,395 | 15 | -336,773,104 | 10 | -44,812,069 |
| Assumption Changes | 07/01/2014 | 525,443,921 | 15 | 407,546,866 | 10 | 54,229,444 |
| Actuarial Gain | 07/01/2015 | -341,001,627 | 15 | -281,902,030 | 11 | -35,134,189 |
| Plan Amendments | 07/01/2015 | -144,007,904 | 15 | -119,049,637 | 11 | -14,837,468 |
| Actuarial Gain | 07/01/2016 | -109,018,791 | 15 | -95,304,318 | 12 | -11,214,022 |
| Assumption Changes | 07/01/2016 | 722,927,661 | 15 | 631,983,965 | 12 | 74,362,652 |
| Actuarial Gain | 07/01/2017 | -248,943,494 | 15 | -228,804,135 | 13 | -25,585,616 |
| Actuarial Gain | 07/01/2018 | -111,501,612 | 15 | -107,149,185 | 14 | -11,450,436 |
| Plan Amendments | 07/01/2018 | -59,019,242 | 15 | -56,715,446 | 14 | -6,060,864 |
| Actuarial Loss | 07/01/2019 | 67,815,430 | 15 | 67,815,430 | 15 | 6,958,663 |
| Assumption Changes | 07/01/2019 | 8,835,790 | 15 | 8,835,790 | 15 | 906,656 |
| **Total** | | | | **$1,072,811,517** | | **$237,432,376** |

[1] Level dollar amount.

## EXHIBIT H – PROJECTION OF UAAL BALANCES AND PAYMENTS



## EXHIBIT H – PROJECTION OF UAAL BALANCES AND PAYMENTS (CONTINUED)



## EXHIBIT I – DEFINITION OF PENSION TERMS

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

| | |
|---|---|
| **Actuarial Accrued Liability for Actives:** | The equivalent of the accumulated Normal Costs allocated to the years before the valuation date. |
| **Actuarial Accrued Liability for Pensioners and Beneficiaries:** | Actuarial Present Value of lifetime benefits to existing pensioners and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits. |
| **Actuarial Cost Method:** | A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the required contribution. |
| **Actuarial Gain or Loss:** | A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected. |
| **Actuarially Equivalent:** | Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions. |
| **Actuarial Present Value (APV):** | The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is:<br>Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.)<br>Multiplied by the probability of the occurrence of an event (such as survival, death, disability, termination, etc.) on which the payment is conditioned, and<br>Discounted according to an assumed rate (or rates) of return to reflect the time value of money. |

| | |
|---|---|
| **Actuarial Present Value of Future Benefits:** | The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund of member contributions or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due. |
| **Actuarial Valuation:** | The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan, as well as Actuarially Determined Contributions. |
| **Actuarial Value of Assets (AVA):** | The value of the Plan's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the Actuarially Determined Contribution. |
| **Actuarially Determined:** | Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the Plan. |
| **Actuarially Determined Contribution (ADC):** | The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the employer Normal Cost and the Amortization Payment. |
| **Amortization Method:** | A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase. |
| **Amortization Payment:** | The portion of the pension plan contribution, or ADC, that is intended to payoff the Unfunded Actuarial Accrued Liability. |

| | |
|---|---|
| **Assumptions or Actuarial Assumptions:** | The estimates upon which the cost of the Plan is calculated, including:<br>Investment return - the rate of investment yield that the Plan will earn over the long-term future;<br>Mortality rates - the rate or probability of death at a given age for employees and pensioners;<br>Retirement rates - the rate or probability of retirement at a given age or service;<br>Disability rates – the rate or probability of disability retirement at a given age;<br>Termination rates - the rate or probability at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement;<br>Salary increase rates - the rates of salary increase due to inflation, real wage growth and merit and promotion increases. |
| **Closed Amortization Period:** | A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 20 years, it is 19 years at the end of one year, 18 years at the end of two years, etc. See Open Amortization Period. |
| **Decrements:** | Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or termination. |
| **Defined Benefit Plan:** | A retirement plan in which benefits are defined by a formula based on the member's compensation, age and/or years of service. |
| **Defined Contribution Plan:** | A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance. |
| **Experience Study:** | A periodic review and analysis of the actual experience of the Plan that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified based on recommendations from the Actuary. |
| **Funded Ratio:** | The ratio of the Actuarial Value of Assets (AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes also calculate a market funded ratio, using the Market Value of Assets (MVA), rather than the AVA. |
| **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. |
| **Normal Cost:** | The portion of the Actuarial Present Value of Future Benefits allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of the Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of member contributions and employer Normal Cost unless otherwise specifically stated. |

| | |
|---|---|
| **Open Amortization Period:** | An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in each future year in determining the Amortization Period. |
| **Unfunded Actuarial Accrued Liability:** | The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus or an Overfunded Actuarial Accrued Liability. |
| **Valuation Date or Actuarial Valuation Date:** | The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Benefits is determined. The expected benefits to be paid in the future are discounted to this date. |

# Section 4: Actuarial Valuation Basis

## EXHIBIT I – ACTUARIAL ASSUMPTIONS AND METHODS

| | |
|---|---|
| **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, 2015 through June 30, 2018 Actuarial Experience Study dated June 12, 2019. Unless otherwise noted, all actuarial assumptions and methods shown below apply to both Tier 1 and Tier 2 members. |
| **Economic Assumptions** | |
| **Net Investment Return:** | 7.00%; net of investment expenses.<br>Based on the Actuarial Experience Study referenced above, expected investment expenses represent about 0.35% of the average Market Value of Assets. |
| **Employee Contribution, Additional Annuity and Matching Account Crediting Rate:** | 7.00%, based on Plan provisions. |
| **Consumer Price Index:** | Increase of 2.75% per year. Retiree COLA increases due to CPI are subject to a 3% maximum change per year for Tier 1 and 2% maximum change per year for Tier 2. |
| **Administration Expenses:** | Offset by additional employer contributions. |
| **Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit:** | Increase of 2.75% per year from the valuation date. |

**Salary Increases:**

The annual rate of compensation increase includes: inflation at 2.75%, plus "across the board" salary increases of 0.50% per year, plus the following merit and promotion increases:

| Merit and Promotion Increases | |
|---|---|
| **Years of Service** | **Rate (%)** |
| Less than 1 | 7.00 |
| 1 – 2 | 7.00 |
| 2 – 3 | 6.50 |
| 3 – 4 | 5.25 |
| 4 – 5 | 3.75 |
| 5 – 6 | 2.75 |
| 6 – 7 | 2.25 |
| 7 – 8 | 2.00 |
| 8 – 9 | 1.70 |
| 9 – 10 | 1.60 |
| 10 – 11 | 1.50 |
| 11 – 12 | 1.45 |
| 12 – 13 | 1.40 |
| 13 – 14 | 1.35 |
| 14 – 15 | 1.30 |
| 15 & Over | 1.25 |

| **Demographic Assumptions** | |
|---|---|
| **Post-Retirement Mortality Rates:** | *Service Retirement and Disability Retirement*<br>• Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) times 105% for males and 100% for females, projected generationally with the two-dimensional mortality improvement scale MP-2018.<br>*Beneficiaries*<br>• Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.<br>*Optional Form of Payment Amounts at Retirement and Conversion of Contribution Balance to Annuities at Retirement*<br>• *Members:* Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table times 105% for males and 100% for females, projected generationally with the two-dimensional improvement scale MP-2018 associated with a retirement year of 2022, weighted 75% male and 25% female.<br>• *Beneficiaries*: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table, projected generationally with the two-dimensional improvement scale MP-2018 associated with a retirement year of 2022, weighted 25% male and 75% female.<br>The Pub-2010 mortality tables and adjustments as shown above reasonably reflect the mortality experience as of the measurement date. These mortality tables were adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years. |

**Pre-Retirement Mortality Rates:**

- Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

| | Rate (%) | |
|---|---|---|
| Age | Male | Female |
| 25 | 0.024 | 0.008 |
| 30 | 0.031 | 0.013 |
| 35 | 0.041 | 0.021 |
| 40 | 0.057 | 0.033 |
| 45 | 0.085 | 0.051 |
| 50 | 0.129 | 0.076 |
| 55 | 0.190 | 0.112 |
| 60 | 0.276 | 0.169 |
| 65 | 0.405 | 0.270 |
| 70 | 0.609 | 0.445 |

5% of pre-retirement deaths are assumed to be duty related, with the remaining being non-duty related. Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

**Disability Incidence Rates:**

| Disability Incidence | | |
|---|---|---|
| | Rate (%) | |
| Age | Male | Female |
| 25 | 0.006 | 0.000 |
| 30 | 0.012 | 0.006 |
| 35 | 0.012 | 0.036 |
| 40 | 0.018 | 0.072 |
| 45 | 0.030 | 0.102 |
| 50 | 0.054 | 0.138 |
| 55 | 0.126 | 0.168 |

**Termination Rates:**

| Total Termination | |
|---|---|
| **Years of Service** | **Rate (%)** |
| Less than 1 | 10.00 |
| 1 – 2 | 5.25 |
| 2 – 3 | 3.75 |
| 3 – 4 | 3.50 |
| 4 – 5 | 2.50 |
| 5 – 6 | 2.00 |
| 6 – 7 | 1.50 |
| 7 – 8 | 1.50 |
| 8 – 9 | 1.50 |
| 9 – 10 | 1.00 |
| 10 – 20 | 0.75 |
| 20 & over | 0.50 |

| Tier 1 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations | | |
|---|---|---|
| **Years of Service** | **Ordinary Withdrawals** | **Vested Terminations** |
| Less than 1 | 100 | 0 |
| 1 – 9 | 30 | 70 |
| 10 & Over | 15 | 85 |

| Tier 2 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations | | |
|---|---|---|
| **Years of Service** | **Ordinary Withdrawals** | **Vested Terminations** |
| Less than 5 | 100 | 0 |
| 5 & Over | 15 | 85 |

Ordinary withdrawals are assumed to receive their account balance at termination. Vested terminations are assumed to receive a deferred retirement benefit. No termination is assumed after a member is first eligible to retire.

**Retirement Rates:**

| Age | Retirement Rates (%) | | | |
|---|---|---|---|---|
| | Tier 1 | | Tier 2 | |
| | Under 30 Years of Service | 30 or More Years of Service | Under 30 Years of Service | 30 or More Years of Service |
| 50 | 0.00 | 1.00 | 0.00 | 0.00 |
| 51 | 0.00 | 0.00 | 0.00 | 0.00 |
| 52 | 0.00 | 0.00 | 0.00 | 0.00 |
| 53 | 0.00 | 0.00 | 0.00 | 0.00 |
| 54 | 0.00 | 0.00 | 0.00 | 0.00 |
| 55 | 4.25 | 27.00 | 0.00 | 25.00 |
| 56 | 2.00 | 20.00 | 0.00 | 14.00 |
| 57 | 2.50 | 17.50 | 0.00 | 13.00 |
| 58 | 3.50 | 17.50 | 0.00 | 13.00 |
| 59 | 3.50 | 17.50 | 0.00 | 13.00 |
| 60 | 5.50 | 22.00 | 5.50 | 17.50 |
| 61 | 6.50 | 22.00 | 3.50 | 10.00 |
| 62 | 7.00 | 22.00 | 2.50 | 10.00 |
| 63 | 8.00 | 25.00 | 20.00 | 25.00 |
| 64 | 8.50 | 27.00 | 12.00 | 25.00 |
| 65 | 11.50 | 30.00 | 11.00 | 28.00 |
| 66 | 12.00 | 30.00 | 11.00 | 28.00 |
| 67 | 12.50 | 30.00 | 12.00 | 28.00 |
| 68 | 13.00 | 30.00 | 12.50 | 28.00 |
| 69 | 17.00 | 30.00 | 15.00 | 28.00 |
| 70 | 22.00 | 25.00 | 50.00 | 50.00 |
| 71 | 22.00 | 25.00 | 50.00 | 50.00 |
| 72 | 22.00 | 25.00 | 50.00 | 50.00 |
| 73 | 22.00 | 25.00 | 50.00 | 50.00 |
| 74 | 22.00 | 25.00 | 50.00 | 50.00 |
| 75 & Over | 100.00 | 100.00 | 100.00 | 100.00 |

| | |
|---|---|
| **Retirement Age and Benefit for Inactive Vested Members:** | For Tier 1, inactive vested members are assumed to retire at age 60 with a Money Purchase Annuity. For Tier 2, inactive vested members are assumed to retire at age 63. Tier 1 and Tier 2 members receiving Permanent Total Disability benefits are assumed to retire at the earlier of age 65 or age 55 with 30 years of service. |
| **Definition of Active Members:** | First day of biweekly payroll following employment. |
| **Unknown Data for Members:** | Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male. |

| | |
|---|---|
| **Data Adjustments:** | Data as of March 31 has been adjusted to June 30 by adding three months of age and, for active employees, three months of service. Contribution account balances were also increased by three months of interest. For members in pay status, we have increased their benefits by the assumed July 1 COLA. |
| **Percent Married/Domestic Partner:** | 85% of male members and 60% of female members are assumed to have an eligible spouse or domestic partner at pre-retirement death or retirement. The assumption is also applied for current retirees retired before April 1, 2012 with Options Full, A, B, or C since they are missing this data. Spousal gender is assumed to be opposite that of the member. |
| **Age of Spouse:** | Male retirees are 3 years older than their spouses, and female retirees are 2 years younger than their spouses. |
| **Future Benefit Accruals:** | 1.0 year of service per year. |
| **Additional Service Accrual:** | Tier 1 members are assumed to purchase an additional 0.07 years of service per year. Tier 2 members are assumed to purchase an additional 0.02 years of service per year. These service purchases exclude those priced at full actuarial cost.<br>The valuation reflects expected future member contributions that are associated with these assumed service purchases. |
| **Actuarial Funding Policy** | |
| **Actuarial Value of Assets:** | The market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the actual and expected returns on a market value basis and is recognized over a five-year period. As directed by the Retirement Office, the actuarial value of assets may be reduced by an amount classified as a non-valuation reserve. |
| **Actuarial Cost Method:** | Entry Age Actuarial Cost Method. Entry Age equals attained age less years of service. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are based on costs allocated as a level percent of salary, with Normal Cost determined as if the current benefit accrual rate had always been in effect ("replacement life within each tier"). |
| **Amortization Policy:** | The July 1, 2004 Unfunded Actuarial Liability is amortized over a fifteen-year period commencing July 1, 2004 (fully amortized as of July 1, 2019). Any subsequent change in Surplus or Unfunded Actuarial Accrued Liability are amortized over separate fifteen-year periods. All amortization amounts are determined in equal dollar amounts over the amortization period. The Board may, by resolution, adopt a separate period of not more than thirty years to amortize the change in Surplus or Unfunded Actuarial Accrued Liability resulting from an unusual event, plan amendment or change in assumptions or methods. |
| **Projected Compensation:** | Projected compensation for the year following the valuation date is calculated by annualizing the bi-weekly pay rate increased by the assumed rate of salary increase. For members with less than one year of service as of the valuation date, no salary increase assumption is applied to their annualized compensation. |

| **Other Actuarial Methods** | |
|---|---|
| **Internal Revenue Code Section 415:** | 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.<br>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.<br>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 $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.<br>Benefits in excess of the limits may be paid through a qualified governmental excess plan that meets the requirements of Section 415(m).<br>Legal Counsel's review and interpretation of the law and regulations should be sought on any questions in this regard.<br>Contribution rates determined in this valuation have not been reduced for the Section 415 limitations. Actual limitations will result in gains as they occur. |
| **Changed Actuarial Assumptions:** | The following assumptions have been changed since the prior valuation. Rationale for these changes are presented in the July 1, 2015 through June 30, 2018 Actuarial Experience Study: |
| *Net Investment Return:* | 7.25%; net of investment expenses. |
| *Employee Contribution, Additional Annuity and Matching Account Crediting Rate:* | 7.25%, based on Plan provisions. |
| *Consumer Price Index:* | Increase of 3.00% per year. Retiree COLA increases due to CPI are subject to a 3% maximum change per year for Tier 1 and 2% maximum change per year for Tier 2. The maximum COLA's are assumed to be paid for both Tier 1 and 2. |

| | |
|---|---|
| **Changed Actuarial Assumptions (continued):** | The following assumptions have been changed since the prior valuation as a result of the July 1, 2015 through June 30, 2018 Actuarial Experience Study (continued): |
| *Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit:* | Increase of 3.00% per year from the valuation date. |
| *Salary Increases:* | The annual rate of compensation increase includes: inflation at 3.00%, plus "across the board" salary increases of 0.50% per year, plus the following merit and promotion increases: |

**Merit and Promotion Increases**

| Years of Service | Rate (%) |
|---|---|
| Less than 1 | 6.50 |
| 1 – 2 | 6.00 |
| 2 – 3 | 5.50 |
| 3 – 4 | 4.50 |
| 4 – 5 | 3.00 |
| 5 – 6 | 2.00 |
| 6 – 7 | 1.50 |
| 7 – 8 | 1.40 |
| 8 – 9 | 1.30 |
| 9 – 10 | 1.20 |
| 10 & Over | 1.00 |

**Changed Actuarial Assumptions (continued):**

The following assumptions have been changed since the prior valuation as a result of the July 1, 2015 through June 30, 2018 Actuarial Experience Study (continued):

*Post-Retirement Mortality Rates:*

*Service Retirement, Disabled retirement, and Beneficiaries*

- Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table with no age adjustment for males and set back one year for females, projected generationally with the two-dimensional scale MP-2015 projection scale.

*Optional Form of Payment Amounts at Retirement and Conversion of Contribution Balance to Annuities at Retirement*

- *Members:* Headcount-Weighted RP-2014 Health Annuitant Mortality Table with no age adjustment for males and set back one year for females, projected generationally with the two-dimensional scale MP-2015 associated with a retirement year of 2019, weighted 75% male and 25% female
- *Beneficiaries*: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table with no age adjustment for males and set back one year for females, projected generationally with two-dimensional scale MP-2015 associated with a retirement year of 2019, weighted 25% male and 75% female.

*Pre-Retirement Mortality Rates:*

- Headcount-Weighted RP-2014 Employee Mortality Table multiplied by 80%, projected generationally with the two-dimensional scale MP-2015 projection scale.

| | Rate (%) | |
|---|---|---|
| Age | Male | Female |
| 25 | 0.049 | 0.017 |
| 30 | 0.048 | 0.022 |
| 35 | 0.053 | 0.029 |
| 40 | 0.064 | 0.039 |
| 45 | 0.098 | 0.058 |
| 50 | 0.167 | 0.100 |
| 55 | 0.273 | 0.168 |
| 60 | 0.452 | 0.241 |
| 65 | 0.799 | 0.356 |

5% of pre-retirement deaths are assumed to be duty related, with the remaining being non-duty related. Note that generational projections beyond the base year (2014) are not reflected in the above mortality rates.

**Changed Actuarial Assumptions (continued):**

The following assumptions have been changed since the prior valuation as a result of the July 1, 2015 through June 30, 2018 Actuarial Experience Study (continued):

*Termination Rates:*

| Total Termination | |
|---|---|
| **Years of Service** | **Rate (%)** |
| Less than 1 | 12.00 |
| 1 – 2 | 6.00 |
| 2 – 3 | 4.00 |
| 3 – 4 | 2.50 |
| 4 – 5 | 2.00 |
| 5 – 6 | 2.00 |
| 6 – 7 | 1.75 |
| 7 – 8 | 1.50 |
| 8 – 9 | 1.25 |
| 9 – 10 | 1.00 |
| 10 & over | 0.75 |

| Tier 1 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations | | |
|---|---|---|
| **Years of Service** | **Ordinary Withdrawals** | **Vested Terminations** |
| Less than 1 | 100 | 0 |
| 1 – 9 | 30 | 70 |
| 10 & Over | 15 | 85 |

| Tier 2 Allocation of Termination Rates (%) between Ordinary Withdrawals and Vested Terminations | | |
|---|---|---|
| **Years of Service** | **Ordinary Withdrawals** | **Vested Terminations** |
| Less than 5 | 100 | 0 |
| 5 & Over | 15 | 85 |

Ordinary withdrawals are assumed to receive their account balance at termination. Vested terminations are assumed to receive a deferred retirement benefit. No termination is assumed after a member is first eligible to retire.

**Changed Actuarial Assumptions (continued):** The following assumptions have been changed since the prior valuation as a result of the July 1, 2015 through June 30, 2018 Actuarial Experience Study (continued):

*Retirement Rates:*

| Age | Retirement Rates (%) | | | |
|---|---|---|---|---|
| | Tier 1 | | Tier 2 | |
| | Under 30 Years of Service | 30 or More Years of Service | Under 30 Years of Service | 30 or More Years of Service |
| 55 | 4.50 | 25.00 | 0.00 | 25.00 |
| 56 | 2.00 | 20.00 | 0.00 | 14.00 |
| 57 | 2.50 | 17.00 | 0.00 | 12.00 |
| 58 | 3.00 | 17.00 | 0.00 | 12.00 |
| 59 | 3.00 | 17.00 | 0.00 | 12.00 |
| 60 | 5.00 | 20.00 | 5.00 | 17.50 |
| 61 | 6.00 | 20.00 | 2.50 | 5.00 |
| 62 | 6.00 | 20.00 | 0.00 | 5.00 |
| 63 | 6.00 | 25.00 | 20.00 | 25.00 |
| 64 | 7.00 | 25.00 | 15.00 | 25.00 |
| 65 | 11.00 | 28.00 | 14.00 | 28.00 |
| 66 | 11.00 | 28.00 | 14.00 | 28.00 |
| 67 | 11.00 | 28.00 | 14.00 | 28.00 |
| 68 | 11.00 | 28.00 | 14.00 | 28.00 |
| 69 | 13.00 | 28.00 | 13.00 | 28.00 |
| 70 | 25.00 | 25.00 | 100.00 | 100.00 |
| 71 | 25.00 | 25.00 | 100.00 | 100.00 |
| 72 | 25.00 | 25.00 | 100.00 | 100.00 |
| 73 | 25.00 | 25.00 | 100.00 | 100.00 |
| 74 | 25.00 | 25.00 | 100.00 | 100.00 |
| 75 & Over | 100.00 | 100.00 | 100.00 | 100.00 |

*Age of Spouse:* Female retirees are 3 years younger than their spouses.

| | |
|---|---|
| **Changed Actuarial Assumptions (continued):** | The following assumptions have been changed since the prior valuation as a result of the July 1, 2015 through June 30, 2018 Actuarial Experience Study (continued): |
| *Additional Service Accrual:* | Tier 1 members are assumed to purchase an additional 0.10 years of service per year. Tier 2 members are assumed to purchase an additional 0.03 years of service per year. These service purchases exclude those priced at full actuarial cost.<br>The valuation reflects expected future member contributions that are associated with these assumed service purchases. |

## EXHIBIT II – SUMMARY OF PLAN PROVISIONS

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

| | |
|---|---|
| **Plan Year:** | July 1 through June 30 |
| **Census Date:** | March 31 |
| **Membership:** | |
| *Tier 1* | All members hired before January 1, 2014. Utility Pre-Craft Trainee, Construction Electrical Helper, or Construction Electrical Mechanic hired before January 1, 2014 and continuously employed until eligible for membership become Tier 1 members upon membership. |
| *Tier 2* | All members hired on or after January 1, 2014. |
| **Formula Retirement Benefit:** | |
| *Tier 1* | |
| *Age & Service Requirement* | Age 60 with 5 years of Department service; or<br>Age 55 with 10 years of Department service in the last 12 years; or<br>Any age with 30 years of Department service; or<br>Receiving permanent total disability benefits from the Plan<br>Note: To be eligible, the employee must have worked or been paid disability four of the last five years immediately preceding eligibility to retire, or while eligible to retire. |
| *Monthly Amount* | The greater of 2.1% of the Monthly Salary Base or $9.50 per year of service. For those age 55 or older with 30 or more years of service the factor is 2.3% of the Monthly Salary Base. Benefits are limited to 100% of Monthly Salary Base. |
| *Monthly Salary Base* | Equivalent of monthly average salary of highest successive 26 biweekly payroll periods (one year). |
| *Cost of Living Benefit* | Based on CPI subject to a maximum of 3% per year, excess “banked”. |

| | |
|---|---|
| **Formula Retirement Benefit (continued):** | |
| *Tier 2* | |
| *Age & Service Requirement* | Age 60 with 5 years of continuous Department Service with the Plan immediately prior to reaching eligibility; or<br>Age 60 with 10 years of Qualifying Service; or<br>Any age with 30 years of Qualifying Service; or<br>Receiving permanent total disability benefits from the Plan. |
| *Monthly Amount* | 1.5% x Monthly Salary Base x service credit at age 60 with 5 years of continuous Department Service (or 10 years of Qualifying Service).<br>2.0% x Monthly Salary Base x service credit at age 60 with 30 years of Qualifying Service; or<br>2.0% x Monthly Salary Base x service credit at age 55 with 30 years of Service Credit (Service Credit with the Department and with LACERS is combined for satisfying this requirement); or<br>2.0% x Monthly Salary Base x service credit at age 63 with 5 years of continuous Department Service (or 10 years of Qualifying Service); or<br>2.1% x Monthly Salary Base x service credit at age 63 with 30 years of Qualifying Service.<br>Benefits are limited to 80% of Monthly Salary Base. |
| *Monthly Salary Base* | Equivalent of monthly average salary of highest successive 78 biweekly payroll periods (three years). |
| *Cost of Living Benefit* | Based on CPI subject to a maximum of 2% per year. |
| **Money Purchase Annuity:** | |
| *Tier 1* | A monthly lifetime benefit equal in value to the employee normal contribution account plus Department matching contribution (current service contribution) account at retirement date. |
| *Tier 2* | Same as Tier 1 (except no Department matching contribution). |
| **Minimum Benefit:** | If the money purchase annuity amount exceeds the monthly amount of the formula retirement benefit and the retiree meets the eligibility requirements for the formula retirement benefit, the amount of the money purchase annuity is paid and the cost-of-living and death after retirement continuance features of the formula retirement benefit are also paid. |

**Early Retirement Reduction Factors:**

*Tier 1*

The early retirement factor is determined by the attained age on the effective date of retirement. Every three months of attained age will affect the factor.

| Attained Age at Actual Retirement | Exact Age | +3 Months | +6 Months | +9 Months |
|---|---|---|---|---|
| 48 | .7150 | .7225 | 0.7300 | 0.7375 |
| 49 | .7450 | .7525 | 0.7600 | 0.7675 |
| 50 | .7750 | .7825 | 0.7900 | 0.7975 |
| 51 | .8050 | .8125 | 0.8200 | 0.8275 |
| 52 | .8350 | .8425 | 0.8500 | 0.8575 |
| 53 | .8650 | .8725 | 0.8800 | 0.8875 |
| 54 | .8950 | .9025 | 0.9100 | 0.9175 |
| 55 | .9250 | .92875 | 0.9325 | 0.93625 |
| 56 | .9400 | .94375 | 0.9475 | 0.95125 |
| 57 | .9550 | .95875 | 0.9625 | 0.96625 |
| 58 | .9700 | .97375 | 0.9775 | 0.98125 |
| 59 | .9850 | .98875 | 0.9925 | 0.99625 |
| 60 & Over | 1.0000 | | | |

The factor is 1.0000 for those retiring at age 55 or later with at least 30 years of service.

*Tier 2*

Same as Tier 1. These are applied to the age 60 benefit for members (with 2.0% formula) who retire before age 60 with less than 30 years of service credit. Service Credit with the Department and with LACERS is combined for satisfying this requirement.

**Member Normal Contributions:**

*Tier 1*

If an employee became a plan member after May 31, 1984, the member normal contribution rate is 6% of pay.

If an employee became a plan member before June 1, 1984 or transferred from CERS with an entry age contribution rate, sample rates by entry age are as follows:

| Entry Age | Rate |
|---|---|
| 20 | 2.601% |
| 25 | 3.102% |
| 30 | 3.611% |
| 35 | 4.161% |
| 40 | 4.742% |
| 45 | 5.381% |
| 50 | 6.042% |
| 55 | 6.762% |
| 59 | 7.332% |

*Tier 2*

Normal contribution rate of 10% of pay.

**Department Current Service Contributions:**

*Tier 1*

The Department of Water and Power makes actuarially based contributions that are a minimum of 110% of employee contributions.

*Tier 2*

Same as Tier 1, except that the minimum contribution equal to 110% of employee contributions is not required.

**Disability:**

*Tier 1*

Disability benefits are paid from the Disability Fund. However, if a member is receiving permanent total disability benefits, the member may elect to retire. Other than a nominal amount, no service credit during disability is earned for the Formula benefit; however, credit is earned during disability toward the $9.50 minimum formula.

*Tier 2*

Same as Tier 1 (except no $9.50 minimum formula).

| | |
|---|---|
| **Deferred Retirement Benefit (Vested):** | |
| *Tier 1* | |
| *Age & Service Requirement* | Age 60 with one year of continuous membership; or<br>Age 55 with 10 years of contributing membership in the 12 years prior to separation from service. |
| *Amount* | Value of employee normal contribution account plus Department matching contribution (called current service contribution) account at retirement date. Does not include cost-of-living and death after retirement continuance features of the formula retirement benefit. |
| *Tier 2* | |
| *Age & Service Requirement* | Age 60 with 5 years of Service Credit with the Plan; or<br>Age 60 with 15 years of Service Credit (Plan and LACERS Service) |
| *Monthly Amount* | 1.5% x Monthly Salary Base x service credit at age 60 with 5 years of Service Credit (or 15 years of Service Credit (Plan and LACERS)); or<br>2.0% x Monthly Salary Base x service credit at age 63 with 5 years of Service Credit (or 15 years of Service Credit (Plan and LACERS)).<br>Does not include cost-of-living and death after retirement continuance features of the formula retirement benefit. |
| **Death Before Retirement:** | |
| *Tier 1 and Tier 2* | |
| *Age & Service Requirement* | None |
| *Amount* | Refund of member contributions with interest. |
| *Age, Service and Type of Death Requirement* | Any death of a member who is eligible for service retirement or attained 25 years of service.<br>In lieu of the refund of member contributions with interest, the member's spouse or domestic partner may elect an immediate lifetime monthly allowance. The monthly allowance payable to the surviving spouse or domestic partner is the amount the spouse or domestic partner would have received had the member retired and elected a 100% joint and survivor allowance. |

| | |
|---|---|
| **Death Before Retirement (continued):** | |
| *Age, Service and Type of Death Requirement* | Duty death, but prior to service retirement eligibility or attainment of 25 years of service. |
| *Amount* | In lieu of the refund of member contributions with interest, the member's spouse or domestic partner may elect either:<br>(a) A lifetime monthly allowance commencing when the member would have been eligible for a service retirement or attained 25 years of service; or<br>(b) A lifetime monthly allowance calculated with up to five years added to the member's age or service. This option is only available if the member has attained age 50 or attained 20 years of service.<br>The monthly allowance payable is the amount the spouse or domestic partner would have received had the member retired and elected a 100% joint and survivor allowance. |
| **Death After Retirement:** | |
| *Tier 1 and Tier 2* | 50% of retiree's unmodified allowance continued to eligible spouse or domestic partner (reduced if difference in ages is greater than five years). |
| **Withdrawal of Contributions Benefit (Ordinary Withdrawal):** | |
| *Tier 1 and Tier 2* | Refund of employee contributions with interest. |
| **Post-retirement Cost-of-Living Benefits:** | |
| *Tier 1* | Future changes based on the Consumer Price Index to a maximum of 3% per year, excess "banked." |
| *Tier 2* | Future changes based on the Consumer Price Index to a maximum of 2% per year. Member may purchase additional 1% COLA protection at full actuarial cost. |
| **Changes in Plan Provisions:** | There have been no changes in plan provisions since the last valuation, other than a technical amendment to update the reference to the Consumer Price Index as published by the Bureau of Labor Statistics of the United States Department of Labor for the Los Angeles Area. |

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

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