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

**ACTUARIAL EXPERIENCE STUDY**

**Analysis of Actuarial Experience During the
Period July 1, 2012 through June 30, 2015**

# Segal Consulting

May 23, 2016

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

**Re:    Actuarial Experience Study for 2012 through 2015**

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience of the Water and Power Employees' Retirement Plan for the period from July 1, 2012 through June 30, 2015.  This study utilizes the census data from the last four actuarial valuations to analyze experience for the three-year period ending on June 30, 2015. It includes the proposed actuarial assumptions, both economic and demographic, for use in future actuarial valuations, beginning with the July 1, 2016 valuation.

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.

We look forward to reviewing this report with you and answering any questions you may have.

Sincerely,

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

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

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**TABLE OF CONTENTS**

Page

# I. INTRODUCTION, SUMMARY, AND RECOMMENDATIONS

To project the cost and liabilities of the Retirement Plan, assumptions are made about all future events that could affect the amount and timing of the benefits to be paid and the assets to be accumulated. Each year actual experience is compared against the assumptions, and to the extent there are differences, the future contribution requirement is adjusted.

If assumptions are modified, contribution requirements are adjusted to take into account a change in the projected experience in all future years. There is a great difference in both philosophy and cost impact between recognizing the actuarial deviations as they occur annually and changing the actuarial assumptions. Taking into account one year's gains or losses without making a change in the assumptions means that that year's experience was temporary and that, over the long run, experience will return to what was originally assumed. Changing assumptions reflects a basic change in thinking about the future, and it has a much greater effect on the current contribution requirements than recognizing gains or losses as they occur.

The use of realistic actuarial assumptions is important in maintaining adequate funding, while paying promised benefit amounts to participants already retired and to those near retirement. The actuarial assumptions used do not determine the "actual cost" of the plan. The actual cost is determined solely by the benefits and administrative expenses paid out, offset by investment income received. However, it is desirable to estimate as closely as possible what the actual cost will be so as to permit an orderly method for setting aside contributions today to provide benefits in the future, and to maintain equity among generations of participants and taxpayers.

This study was undertaken in order to review the economic and demographic actuarial assumptions and to compare the actual experience with that expected under the current assumptions during the three-year experience period from July 1, 2012 through June 30, 2015. The study was performed in accordance with Actuarial Standard of Practice (ASOP) No. 27, "Selection of Economic Assumptions for Measuring Pension Obligations" and ASOP No. 35, "Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations". These Standards of Practice put forth guidelines for the selection of the various actuarial assumptions utilized in a pension plan actuarial valuation. Based on the study's results and expected near-term experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for inflation, investment return, promotional and merit salary increases, retirement from active employment, pre-retirement mortality, healthy life mortality, disabled life mortality and turnover (vested and ordinary).

Our recommendations for the major actuarial assumption categories are as follows:

*Ref: Pg. 6*  **Inflation** – Future increases in the Consumer Price Index (CPI) which drives investment returns and active member salary increases, as well as cost-of-living adjustments (COLAs) to retired employees.
*Recommendation:  Reduce the assumed rate of price inflation from 3.25% per annum to 3.00% per annum as discussed in Section III(A).*

*Ref: Pg. 9*  **Investment Return –** The estimated average future net rate of return on current and future assets of the Plan as of the valuation date.  This rate is used to discount liabilities.
*Recommendation: Reduce the current investment return assumption rate from 7.50% per annum to 7.25% per annum as developed in Section III(B).*

*Ref: Pg. 18*  **Individual Salary Increases** – Increases in the salary of a member between the date of the valuation to the date of separation from active service.  This assumption has three components:

> ➤ Inflationary salary increases,
> ➤ Real "across the board" salary increases, and
> ➤ Promotional and merit increases.

*Recommendation:  Reduce the current inflationary salary increase assumption from 3.25% to 3.00%. Reduce the current real "across the board" salary increase assumption from 0.75% to 0.50%. In addition to the combined inflationary and real "across the board" salary increases of 3.50%, increase the promotional and merit increase rates to those developed in Section III(C).*

*Ref: Pg. 22*  **Retirement Rates** – The probability of retirement at each age at which participants are eligible to retire.
*Recommendation: For active members, adjust the current retirement rates to those developed in Section IV(A).*

*Ref: Pg. 31*  **Mortality Rates** – The probability of dying at each age.  Mortality rates are used to project life expectancies.
*Recommendation: Change the current mortality table to a generational mortality table as developed in Section IV(B).*

*Ref: Pg. 37* **Termination Rates** – The probability of leaving employment at each age and receiving either a refund of contributions or a deferred vested benefit.

*Recommendation: Decrease the current total termination rates to those developed in Section IV(C). In addition, adjust the assumptions for future Tier 1 ordinary withdrawals (i.e., refund of member contributions) and deferred vested terminations.*

*Ref: Pg. 41* **Disability Incidence Rates** – The probability of becoming disabled at each age.

*Recommendation: Maintain the current rates as discussed in Section IV(D).*

*Ref: Pg. 44* **Future Service Accruals** – The annual increase in service.

*Recommendation: Maintain the assumed annual future service increase of 1.0 year as developed in Section IV(E). In addition, reduce the assumption for purchases of service for Tier 1 members from 0.15 years to 0.10 years for each future year.*

We have estimated the impact of proposed assumption changes as if they were applied to the July 1, 2015 actuarial valuation. If all of the proposed assumption changes were implemented, the employer's required contributions would have increased by 9.0% of payroll (or $82 million). The estimated cost increase is mainly a result of the proposed changes to the assumptions for investment return and mortality, offset slightly by the proposed change to the salary increase assumption.

Section II provides some background on the basic principles and methodology used for the experience study and for the review of economic and demographic actuarial assumptions. A detailed discussion of each assumption and reasons for the proposed changes is found in Section III for the economic assumptions and Section IV for the demographic assumptions. The cost impact of the proposed changes is shown in Section V.

Note that if these assumptions are adopted by the Board, the actuarial factors used for optional forms of payment, present value calculations, etc. should be reviewed for consistency with the investment return, mortality and other assumptions proposed in this report. This would ensure that the optional forms of payment, etc. are actuarially equivalent to the Full Retirement Allowance form of payment that is used in the determination of employer contribution rates. This work would be a separate project that is beyond the scope of this experience study.

## II.  BACKGROUND AND METHODOLOGY

In this report, we analyzed both economic and demographic ("non-economic") assumptions.  The primary economic assumptions reviewed are inflation, investment return, and salary increases.  Demographic assumptions include the probabilities of certain events occurring in the population of members, referred to as "decrements," e.g., termination from service, disability incidence, service retirement, and death after retirement.  In addition to decrements, other demographic assumptions reviewed in this study include the percentage of members with an eligible spouse or domestic partner, the spousal age difference, and the assumption used to anticipate future service accruals including the purchase of service by active members.

### *Economic Assumptions*

Economic assumptions consist of:

*Inflation* – Increases in the price of goods and services.  The inflation assumption reflects the basic return that investors expect from securities markets.  It also reflects the expected basic salary increase for active employees and drives increases in the allowances of retired members.

*Investment Return* – Expected long term rate of return on the Plan's investments after expenses.  This assumption has a significant impact on contribution rates.

*Salary Increases* – In addition to inflationary increases, it is assumed that salaries will also grow by any real "across the board" pay increases in excess of price inflation.  It is also assumed that employees will receive raises above these average increases as they advance in their careers. These are commonly referred to as promotional and merit increases.

The setting of these economic assumptions is described in Section III.

### *Demographic Assumptions*

In order to determine the probability of an event occurring, we examine the "decrements" and "exposures" of that event.  For example, taking termination from service, we compare the number of employees who actually terminate in a certain age and/or service category (i.e., the number of "decrements") with those "who could have terminated" (i.e., the number of "exposures").  For example, if there were 500 active employees in the 20-24 age group at the beginning of the year and 50 of them terminate during the year, we would say the probability of termination in that age group is $50 \div 500$ or 10%.

The reliability of the resulting probability is highly dependent on both the number of decrements and the number of exposures. For example, if there are only a few people in a high age category at the beginning of the year (number of exposures), we would not lend as much credence to the probability of termination developed for that age category, especially if it is out of line with the pattern shown for the other age groups. Similarly, if we are considering the death decrement, there may be a large number of exposures in, say, the age 20-24 category, but very few decrements (actual deaths); therefore, we would not be able to rely heavily on the probability developed for that category.

One reason we use several years of experience for such a study is to have more exposures and decrements, and therefore more statistical reliability. Another reason for using several years of data is to smooth out fluctuations that may occur from one year to the next. However, we also calculate the rates on a year-to-year basis to check for any trend that may be developing in the later years.

## III.  ECONOMIC ASSUMPTIONS

**A.   INFLATION**

Unless an investment grows at least as fast as prices increase, investors will experience a reduction in the inflation-adjusted value of their investment.  There may be times when "riskless" investments return more or less than inflation, but over the long term, investment market forces will generally require an issuer of fixed-income securities to maintain a minimum return which protects investors from inflation.

The inflation assumption is long term in nature, so it is set using primarily historical information. Following is an analysis of 15- and 30-year moving averages of historical inflation rates:

**Historical Consumer Price Index – 1930 to 2015**
(U.S. City Average – All Urban Consumers)

|  | 25th Percentile | Median | 75th Percentile |
|---|---|---|---|
| 15-year moving averages | 2.5% | 3.4% | 4.6% |
| 30-year moving averages | 3.1% | 4.1% | 4.9% |

The average inflation rates have continued to decline gradually over the last several years due to the relatively low inflationary period over the past two decades.  Also, the more recent 15-year averages during the period are lower as they do not include the high inflation years of the mid-1970s and early-1980s.

For 2015, the public fund survey published by the National Association of State Retirement Administrators (NASRA) no longer contains the distribution of the inflation assumptions used by the responding retirement systems included in their survey. We contacted the NASRA staff and we were able to obtain the inflation assumptions used by 76 large public retirement funds in their 2014 valuations. The median value of those inflation assumptions is 3.00%. In California, CalPERS, Contra Costa County and Marin County use an inflation assumption of 2.75% while CalSTRS, LACERA, OCERS and eight other 1937 Act CERL systems use an inflation assumption of 3.00%.

LADWP's investment consultant, RVK, anticipates an annual inflation rate of 2.50%. The average inflation rate used by a sample of eight investment advisory firms is 2.44%. Note that, in general, investment consultants use a time horizon for this assumption that is shorter than the time horizon we

use for the actuarial valuation. Also, the investment firms' capital market assumptions may be influenced by the current low levels of market expectations of inflation.

To find a forecast of inflation based on a longer time horizon, we referred to the 2015 report on the financial status of the Social Security program. The projected average increase in the Consumer Price Index (CPI) over the next 75 years under the intermediate cost assumptions used in that report was 2.70%. We also compared the yields on the thirty-year inflation indexed U. S. Treasury bonds to comparable traditional U. S. Treasury bonds. As of March 2016, the difference in yields is 1.69%, which provides a current measure of market expectations of inflation.

In Cheiron's recent actuarial audit they recommended consideration of a reduction to the inflation assumption.

**Based on all of the above information, we recommend that the current 3.25% annual inflation assumption be reduced to 3.00% for the July 1, 2016 valuation.**

*Retiree Cost-of-Living Increases*

We are also recommending that we maintain the assumption used to value the post-retirement COLA benefit. The current and proposed COLA assumptions are shown below:

| Tier | Maximum COLA | Current Assumption | Proposed Assumption |
|------|------|------|------|
| Tier 1 | 3.00% | 3.00% | 3.00% |
| Tier 2 | 2.00% | 2.00% | 2.00% |

In developing the COLA assumptions, we also considered the results of a stochastic approach that would attempt to account for the possible impact of low inflation that could occur before COLA banks are able to be established for the member. Although the results of this type of analysis might justify the use of a lower COLA assumption, we are not recommending that at this time. The reasons for this conclusion include the following:

➤ The results of the stochastic modeling are significantly dependent on assuming that lower levels of inflation will persist in the early years of the projections. If this is not assumed, then the stochastic modeling will produce results similar to our proposed COLA assumptions.

➤ Using a lower long-term COLA assumption based on a stochastic analysis would mean that an actuarial loss would occur even when the inflation assumption of 3.00% is met in a year. We question the reasonableness of this result.

We do not see the stochastic possibility of COLAs averaging less than those predicted by the assumed rate of inflation as a reliable source of cost savings that should be anticipated in our COLA assumptions. Therefore, we continue to recommend setting the COLA assumptions based on the long-term annual inflation assumption, as we have in prior years.

## B.    INVESTMENT RETURN

The investment return assumption is comprised of two primary components, inflation and real rate of investment return, with adjustments for expenses and risk.

### *Real Rate of Investment Return*

This component represents the portfolio's incremental investment market returns over inflation. Theory has it that as an investor takes a greater investment risk, the return on the investment is expected to also be greater, at least in the long run. This additional return is expected to vary by asset class and empirical data supports that expectation. For that reason, the real rate of return assumptions are developed by asset class. Therefore, the real rate of return assumption for a retirement plan's portfolio will vary with the Board's asset allocation among asset classes.

The next page shows the Plan's current target asset allocation and the assumed real rate of return assumptions by asset class. The first column of real rate of return assumptions are determined by reducing RVK's total or "nominal" return assumptions by their assumed 2.50% inflation rate. The second column of returns (except for Custom Fixed Income, Real Return, Private Equity, and Hedge Fund) represents the average of a sample of real rate of return assumptions, where each firm's nominal returns have been reduced by that firm's assumed inflation rate. The sample includes the expected annual real rates of return provided to us by RVK and by seven other investment advisory firms retained by Segal's California public sector retirement clients. We believe these averages are a reasonable consensus forecast of long term future market returns in excess of inflation[1].

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[1] Note that, just as for the inflation assumption, in general the time horizon used by the investment consultants in determining the real rate of return assumptions is shorter than the time horizon we use for the actuarial valuation.

**WPERP's Target Asset Allocation and Assumed Arithmetic Real Rate of Return Assumptions by Asset Class and for the Portfolio**

| Asset Class | Percentage of Portfolio | RVK's Assumed Real Rate of Return[1] | Average Real Rate of Return from a Sample of Consultants to Segal's Public Sector Clients[2] |
|---|---|---|---|
| Domestic Equity | 29.0% | 4.56% | 5.76% |
| International Equity | 19.0% | 6.35% | 7.25% |
| Custom Fixed Income | 25.0% | 1.74% | 1.74%[3] |
| Real Estate | 8.0% | 4.00% | 4.37% |
| Real Return | 5.0% | 2.39% | 2.39%[3] |
| Private Equity | 8.0% | 7.75% | 7.75%[3] |
| Hedge Fund | 5.0% | 3.50% | 3.50%[3] |
| Cash and Cash Equivalents | 1.0% | -0.25% | -0.46% |
| Total | 100.0% | 4.19% | 4.74% |

[1] Derived by reducing RVK's total rate of return assumptions by their assumed 2.50% inflation assumption.

[2] These are based on the projected arithmetic real returns provided by the investment advisory firms serving the WPERP, the county retirement systems of Alameda, San Diego, Sonoma, Mendocino, Ventura, the LA City Employees' Retirement System and the East Bay Municipal Utility District Retirement Plan. These return assumptions are gross of any applicable investment expenses.

[3] For these asset classes, RVK's assumption is applied in lieu of the average either because this is an asset class not found in the survey of investment firms or because there is a large disparity in returns for these asset classes among firms surveyed and also because using RVK's assumption should more closely reflect the underlying investments made specifically for WPERP.

The above are representative of "indexed" returns and do not include any additional returns ("alpha") from active management. This is consistent with the Actuarial Standard of Practice No. 27, Section 3.6.3.e, which states:

> "Investment Manager Performance - Anticipating superior (or inferior) investment manager performance may be unduly optimistic (pessimistic). The actuary should not assume that superior or inferior returns will be achieved, net of investment expenses, from an active investment management strategy compared to a passive investment

management strategy unless the actuary believe, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

The following are some observations about the returns provided above:

1.  The investment consultants to our California public sector clients have each provided us with their expected real rates of return for each asset class, over various future periods of time. However, in general, the returns available from investment consultants are projected over time periods shorter than the durations of a retirement plan's liabilities.

2.  The investment return assumptions utilized by RVK are lower than the average assumptions utilized by the investment consultants to Segal's public clients in the sample.

3.  Using a sample average of expected real rates of return allows the Plan's investment return assumption to reflect a broader range of capital market information and should help reduce year to year volatility in WPERP's investment return assumption.

4.  Therefore, we recommend that the 4.74% portfolio real rate of return be used to determine the Plan's investment return assumption. This is 0.05% lower than the return calculated three years ago. The difference is due to changes in WPERP's target asset allocation (+0.15%), changes in the real rate of return assumptions provided to us by the investment advisory firms (-0.11%) and the effect of the interaction between those two changes[2] (-0.09%).

*Plan Expenses*

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for investment expenses expected to be paid from investment income. The following table provides these expenses in relation to the market value of assets for the five years ending June 30, 2015.

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[2] This includes the joint effect of the changes in WPERP's target asset allocation and the changes in the average real rate of return assumptions for each asset category as provided to us by the investment advisory firms.

**Investment Expenses as a Percentage
of Market Value of Assets (All dollars in 000's)**

| Year Ending June 30 | Average Market Value of Assets | Total Investment Expenses | Total % |
|---|---|---|---|
| 2015 | $9,683,420 | $30,858 | 0.32% |
| 2014 | 8,300,495 | 28,007 | 0.34% |
| 2013 | 7,383,895 | 23,496 | 0.32% |
| 2012 | 7,393,041 | 20,489 | 0.28% |
| 2011 | 6,243,349 | 21,253 | 0.34% |
| Average | | | 0.32% |

Note: The information shown above is from audited financial statements. For the years ending June 30, 2011 and 2012, our previous study showed slightly different amounts as those numbers were based on the preliminary financial statements that were used in the funding valuation.

The average expense percentage over this five-year period was 0.32%. Based on this experience, we have increased the future expense assumption from 0.25% to 0.30%. This assumption will be re-examined in subsequent assumption review as new data becomes available.

Note related to investment expenses paid for active asset management – As cited above under Section 3.8.3.d of ASOP No. 27, the effect of an active investment management strategy should be considered "net of investment expenses…unless the actuary believes, based on relevant data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

We have not performed a detailed analysis to measure how much of the investment expenses paid to active managers might have been offset by additional returns ("alpha") earned by that active management. We believe that such a review would not have a significant impact on the recommended investment return assumption using the above expense assumption. For now, we will continue to use the current approach of treating any "alpha" that may be identified as an implicit increase in the risk adjustment and corresponding confidence level in developing the investment return assumption rather than as an explicit offset to any related active management expenses.[3]

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[3]    As noted earlier, Actuarial Standard of Practice (ASOP) No. 27, Section 3.8.3.d states "Investment Manager Performance - Anticipating superior (or inferior) investment manager performance may be unduly optimistic (pessimistic). The actuary should not assume that superior or inferior returns will be achieved, **net of investment expenses**, from an active investment management strategy compared to a passive investment management strategy unless the actuary believe, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period." (emphasis added). We believe this means that assuming only enough superior return to cover related investment expenses would not require the relevant supporting data referenced in ASOP No. 27.

*Risk Adjustment*

The real rate of return assumption for the portfolio generally is adjusted to reflect the potential risk of shortfalls in the return assumptions. The Plan's asset allocation determines this portfolio risk, since risk levels are driven by the variability of returns for the various asset classes and the correlation of returns among those asset classes. This portfolio risk is incorporated into the real rate of return assumption through a risk adjustment.

The purpose of the risk adjustment (as measured by the corresponding confidence level) is to increase the likelihood of achieving the actuarial investment return assumption in the long term.[4] The 4.74% expected real rate of return developed earlier in this report was based on expected mean or average arithmetic returns. This means there is a 50% chance of the actual return in each year being at least as great as the average (assuming a symmetrical distribution of future returns). The risk adjustment is intended to increase that probability somewhat above the 50% level. This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not. Note that, based on the investment return assumptions recently adopted by systems that have been analyzed under this model, we observe a confidence interval generally in the range of 50% to 60%.

In the last review of this assumption, the Board adopted an investment return assumption of 7.50%. That return implied a risk adjustment of 0.29%, reflecting a confidence level of 53% that the actual average return over 15 years would not fall below the assumed return assuming that the distribution of returns over that period follows the normal statistical distribution.[5]

In our model, the confidence level associated with a particular risk adjustment represents the likelihood that the actual average return would equal or exceed the assumed value over a 15-year period. For example, if we set our real rate of return assumption using a risk adjustment that produces a confidence level of 60%, then there is a 60% chance (6 out of 10) that the average return over 15 years will be equal to or greater than the assumed value. The 15-year time horizon represents an approximation of the "duration" of the Plan's liabilities, where the duration of a liability represents the sensitivity of that liability to interest rate variations.

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[4] This type of risk adjustment is sometimes referred to as a "margin for adverse deviation."

[5] Based on an annual portfolio return standard deviation of 12.4% provided by PCA in 2013. Strictly speaking, future compounded long-term investment returns will tend to follow a log-normal distribution. However, we believe the normal distribution assumption is reasonable for purposes of setting the risk adjustment.

If we use the same 53% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 12.2% provided by RVK, the corresponding risk adjustment would be 0.29%. Together with the other investment return components, this would result in a net investment return assumption of 7.15%, which is substantially lower than the current assumption of 7.50%.

Based on the general practice of using one-quarter percentage point increments for economic assumptions, we evaluated the effect on the confidence level of an alternative investment return assumption. In particular, a net investment return assumption of 7.25%, together with the other investment return components, would produce a risk adjustment of 0.19%, which corresponds to a confidence level of 52%. We believe this analysis supports reducing the current assumption from 7.50% to 7.25%. This is also consistent with Cheiron's recommendation from their recent actuarial audit.

The table below shows WPERP's investment return assumptions and, for the years when an analysis was performed, the risk adjustments and corresponding confidence levels as determined in those prior studies.

**Historical Investment Return Assumptions, Risk Adjustments and Confidence Levels Based on Assumptions Adopted by the Board**

| Year Ending June 30 | Investment Return | Risk Adjustment | Corresponding Confidence Level |
|---|---|---|---|
| 2007 – 2009 | 8.00% | 0.89% | 62% |
| 2010 – 2013 | 7.75% | 0.89% | 61% |
| 2014 – 2015 | 7.50% | 0.29% | 53% |
| (Recommended) | 7.25% | 0.19% | 52% |

As we have discussed in prior years, the risk adjustment model and associated confidence level is most useful as a means for comparing how WPERP has positioned itself relative to risk over periods of time[6]. The use of a 52% confidence level should be considered in context with other factors, including:

1. As noted above, the confidence level is more of a relative measure than an absolute measure, and so can be reevaluated and reset for future comparisons.

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[6] In particular, it would not be appropriate to use this type of risk adjustment as a measure of determining an investment return rate that is "risk-free."

2. The confidence level is based on the standard deviation of the portfolio that is determined and provided to us by RVK. The standard deviation is a statistical measure of the future volatility of the portfolio and so is itself based on assumptions about future portfolio volatility and can be considered somewhat of a "soft" number.

3. A lower level of inflation should reduce the overall risk of failing to meet the investment return assumption. Lowering the confidence level to some extent could be justified as consistent with the change in the inflation assumption.

4. A confidence level of 52% is near the low end of the range of about 51% to 55% that corresponds to the risk adjustments used by most of Segal's other California public retirement system clients. Most public retirement systems that have recently reviewed their investment return assumptions have considered adopting more conservative investment return assumptions for their valuations, in part to maintain some likelihood that future actual market return will meet or exceed the investment return assumption.

5. As with any model, the results of the risk adjustment model should be evaluated for reasonableness and consistency. This is discussed in the letter section on "Comparison with Other Public Sector Retirement Systems."

Taking into account the factors above, our recommendation is to reduce the net investment return assumption from 7.50% to 7.25%. As noted above, this return implies a 0.19% risk adjustment reflecting a confidence level of 52% that the actual average return over 15 years would not fall below the assumed return.

### *Recommended Investment Return Assumption*

The following table summarizes the components of the net investment return assumption developed in previous discussion. For comparison purposes, we have also included similar values from the last study.

### Calculation of Net Investment Return Assumption

| Assumption Component | Recommended July 1, 2016 Value | Prior Adopted Value |
|---|---|---|
| Inflation | 3.00% | 3.25% |
| Plus Portfolio Real Rate of Return | 4.74% | 4.79% |
| Minus Expense Adjustment | (0.30%) | (0.25%) |
| Minus Risk Adjustment | (0.19%) | (0.29%) |
| Total | 7.25% | 7.50% |
| Confidence level | 52% | 53% |

**Based on this calculation, we recommend that the investment return assumption be decreased from 7.50% to 7.25% per annum.**

### *Comparing with Other Public Retirement Systems*

One final test of the recommended investment return assumption is to compare it against those used by other public retirement systems, both in California and nationwide.

We note that 7.25% is still one of the most common investment return assumptions among those California public sector retirement systems. In particular, the 7.25% assumption is used by six county employees retirement systems. To our knowledge, there are only two California county employees retirement system who have recently adopted a 7.00% investment return assumption.

The following table compares the WPERP's recommended net investment return assumptions against those of the nationwide public retirement systems that participated in the NASRA 2015 Public Fund Survey for 125 large public retirement funds in their 2014 valuations:

| Assumption | LADWP | NASRA 2015 Public Fund Survey | | |
|---|---|---|---|---|
| | | Low | Median | High |
| Net Investment Return | 7.25% | 6.50% | 7.75% | 8.50% |

The detailed survey results show that more than one-half of the systems have an investment return assumption in the range of 6.75% to 7.75%. The survey also notes that several plans have reduced their investment return assumption during the last year, and others are considering doing so. State systems

outside of California tend to change their economic assumptions less frequently and so may lag behind emerging practices in this area.

In summary, we believe that both the risk adjustment model and other considerations indicate a lower earnings assumption. The recommended assumption of 7.25% provides for some margin for adverse deviation within the risk adjustment model and is consistent with WPERP's current practice relative to other public systems.

## C.    SALARY INCREASE

Salary increases impact plan costs by increasing the members' benefits (since benefits are a function of the members' highest average pay) and future normal cost collections.   The components of the assumption are discussed below.

As an employee progresses through his or her career, increases in pay are expected to come from three sources:

1.    Inflation – Unless pay grows at least as fast as consumer prices grow, employees will experience a reduction in their standard of living.   There may be times when pay increases lag or exceed inflation, but over the long term, labor market forces will require an employer to maintain its employees' standards of living.

    **As discussed earlier in this report, we are recommending that the assumed rate of inflation be reduced from 3.25% to 3.00%.   This inflation component is used as part of the salary increase assumption.**

2.    Real "Across the Board" Pay Increases – These increases are sometimes termed productivity increases since they are considered to be derived from the ability of an organization or an economy to produce goods and services in a more efficient manner.   As that occurs, at least some portion of the value of these improvements can provide a source for pay increases.  These increases are typically assumed to extend to all employees "across the board".  The State and Local Government Workers Employment Cost Index produced by the Department of Labor provides evidence that real "across the board" pay increases have averaged about 0.6% - 0.9% annually during the last ten to twenty years.

    We also referred to the annual report on the financial status of the Social Security program published in July 2015.  In that report, real "across the board" pay increases are forecast to be 1.2% per year under the intermediate assumptions.

    The real pay increase assumption is generally considered a more "macroeconomic" assumption, that is not necessarily based on individual plan experience. However, recent salary experience with public systems in California as well as anecdotal discussion with plans and plan sponsors indicate lower future real wage growth expectations for public sector employers. We note that the actual average inflation plus "across the board" increase (i.e., wage inflation) over the three year experience period was 0.6%.

**Considering these factors, we recommend reducing the real "across the board" salary increase assumption from 0.75% to 0.50%. This means that the combined inflation and "across the board" salary increase assumption (e.g., wage growth) will decrease from 4.00% to 3.50%. This recommendation is consistent with Cheiron's recommendation in their recent actuarial audit to consider a reduction in the wage growth assumption.**

3.  Merit and Promotional and Increases – As the name implies, these increases come from an employee's career advances. This form of pay increase differs from the previous two, since it is specific to the individual. For the Retirement Plan, the assumption is structured as a function of an employee's years of service.

    The annual merit and promotional increases are determined by measuring the actual increases received by members over the experience period, net of the inflationary and real "across the board" pay increases. This is accomplished by:

    ➤ Measuring each continuing member's actual salary increase over each year of the experience period;

    ➤ Excluding any members with increases of more than 30% or decreases of more than 10% during any particular year.

    ➤ Categorizing these increases according to member demographics;

    ➤ Removing the wage inflation component from these increases (assumed to be equal to the increase in the members' average salary during the year);

    ➤ Averaging these annual increases over the three-year experience period; and

    ➤ Modifying current assumptions to reflect some portion of these measured increases reflective of their "credibility".

    The following table compares the actual average merit and promotional increases by years of service over the three-year period from July 1, 2012 through June 30, 2015 along with the actual average increases based on a combination of increases in the current three-year period and those shown in the prior experience study. The current and proposed assumptions are also shown. The actual increases for the most recent three-year period and the prior three-year period were reduced by the actual average inflation plus "across the board" increases (i.e., wage inflation) for each year over each of the three-year experience periods (0.6% and 3.0% respectively, on average, estimated as the increase in the average salaries).

**Merit and Promotional Increases**

| Years of Service | Current Assumptions | July 1, 2012 through June 30, 2015 Actual Average Increase | Actual Average Increase from Current and Prior Study | Proposed Assumptions |
|---|---|---|---|---|
| Less than 1 | 6.00% | 7.03% | 6.20% | 6.50% |
| 1 | 5.50 | 9.34 | 7.86% | 6.00 |
| 2 | 5.00 | 6.19 | 6.18% | 5.50 |
| 3 | 4.00 | 5.10 | 4.93% | 4.50 |
| 4 | 2.50 | 4.00 | 3.28% | 3.00 |
| 5 | 1.50 | 3.09 | 2.53% | 2.00 |
| 6 | 1.10 | 2.45 | 1.75% | 1.50 |
| 7 | 1.00 | 2.14 | 1.45% | 1.40 |
| 8 | 0.90 | 2.02 | 1.32% | 1.30 |
| 9 | 0.80 | 1.76 | 1.29% | 1.20 |
| 10 & over | 0.75 | 1.25 | 0.64% | 1.00 |

We realize that the most recent three-year experiences period may not be indicative of typical future long-term promotional and merit salary increases. Members received virtually no "across the board" salary increases (based on the very low increase in the average wages). Note that, in this situation, our model may lead to higher estimated promotional and merit increases. For that reason, we also examined the promotional and merit salary experience used in the prior experience study. We believe that when the experience from the last two studies are combined into an average result, it provides a more reasonable representation of the potential future promotional and merit salary increases over the long term. Nevertheless, in our proposed changes to the promotional and merit increases, we have still given relatively less weight to the actual average increase experience during the last two studies.

Based on this experience, the proposed merit and promotional assumptions are higher than the current assumptions for all service categories. In total, assumed salary increases are lower due to the lower price inflation and real "across the board" pay increase assumptions.

Chart 1 provides a graphical comparison of the actual promotional and merit increases, compared to current and proposed assumptions.

**Chart 1**
**Promotional and Merit Salary Increase Rates**

Years of Service

Current — Actual — Actual Average of Last Two Studies — Proposed
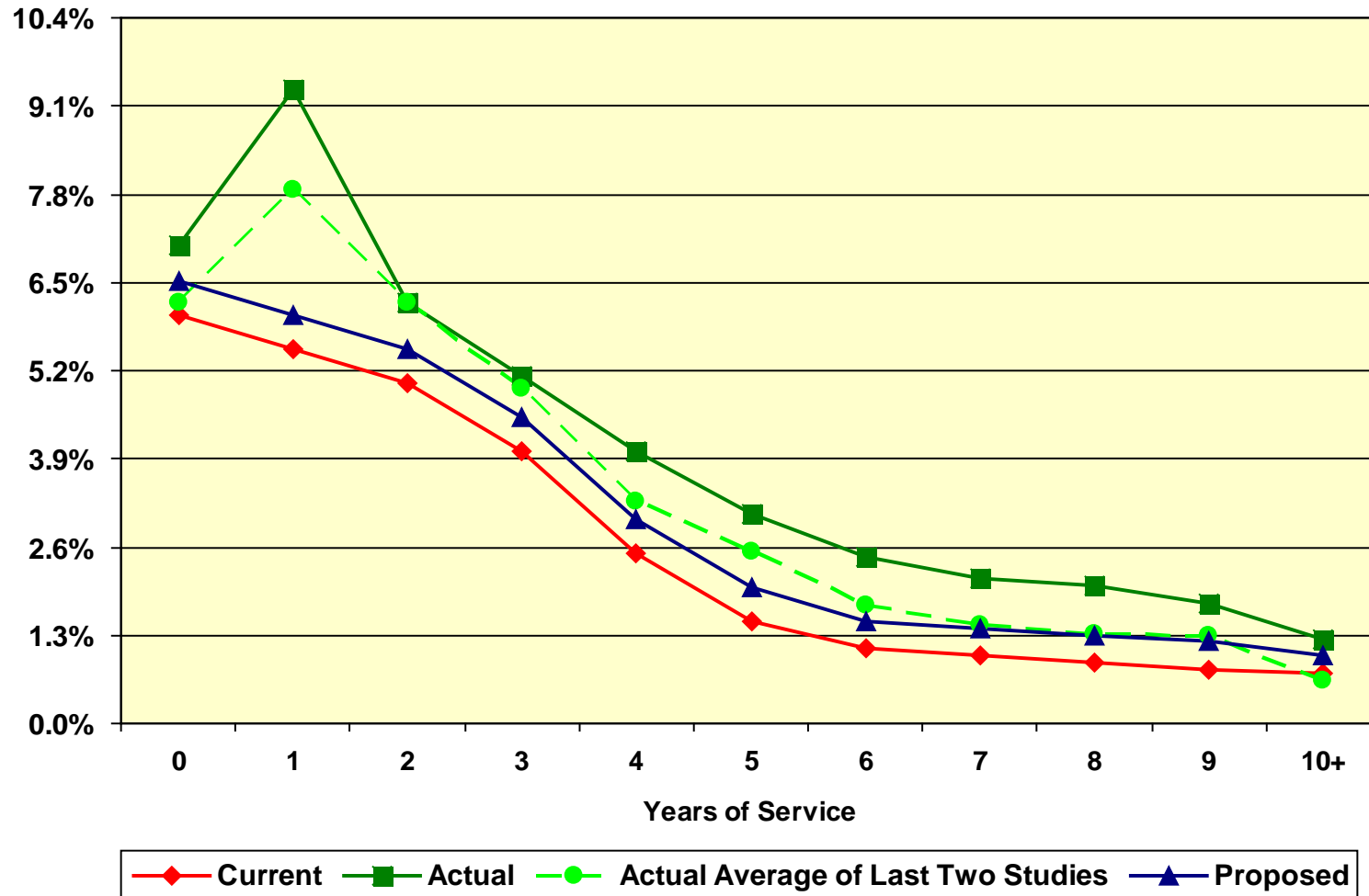
# IV. DEMOGRAPHIC ASSUMPTIONS

## A. RETIREMENT RATES

The age at which a member retires will affect both the amount of the benefits that will be paid to that member as well as the period over which funding must take place.

Based on the distinct retirement patterns for Tier 1 members with 30 or more years of service at retirement compared to those with under 30 years, we continue to recommend separate retirement rates for these groups of members. The tables below show the observed service (non-disability) retirement rates for Tier 1 members with under 30 years of service at retirement over the last three years, followed by rates for Tier 1 members with 30 or more years. The observed service retirement rates were determined by comparing those members who actually retired from service to those eligible to retire from service. This same methodology is followed throughout this report and was described in Section II. Also shown are the current rates assumed and the rates we propose:

**Tier 1 members with under 30 years of service at retirement:**

| Age | Current Rate of Retirement | Actual Rate of Retirement | Proposed Rate of Retirement |
|---|---|---|---|
| 55 | 5.00% | 3.52% | 4.50% |
| 56 | 3.00 | 1.07 | 2.00 |
| 57 | 3.00 | 1.74 | 2.50 |
| 58 | 3.00 | 3.72 | 3.00 |
| 59 | 3.00 | 3.52 | 3.00 |
| 60 | 5.00 | 5.76 | 5.00 |
| 61 | 6.00 | 5.33 | 6.00 |
| 62 | 6.00 | 7.26 | 6.00 |
| 63 | 6.00 | 6.97 | 6.00 |
| 64 | 7.00 | 7.35 | 7.00 |
| 65 | 12.00 | 10.23 | 11.00 |
| 66 | 12.00 | 9.72 | 11.00 |
| 67 | 12.00 | 11.11 | 11.00 |
| 68 | 12.00 | 8.96 | 11.00 |
| 69 | 15.00 | 11.67 | 13.00 |
| 70 | 30.00 | 12.00 | 25.00 |
| 71 | 30.00 | 13.95 | 25.00 |
| 72 | 30.00 | 3.57 | 25.00 |
| 73 | 30.00 | 10.53 | 25.00 |
| 74 | 30.00 | 23.08 | 25.00 |
| 75 & over | 100.00 | 16.22 | 100.00 |

As shown above, we are recommending decreases in retirement rates for ages 55 to 57 and 65 to 74. Overall, we are recommending decreases in the retirement rates for Tier 1 members with under 30 years of service at retirement.

Chart 2 that follows later in this Section provides a graphical comparison of the actual experience with current and proposed rates of retirement for Tier 1 members with under 30 years of service at retirement.

The table below shows the observed service retirement rates for Tier 1 members with 30 or more years at retirement over the last three years. Also shown are the current rates assumed and the rates we propose:

**Tier 1 members with 30 or more years of service at retirement:**

| Age | Current Assumed Rate of Retirement | Actual Rate of Retirement | Proposed Assumed Rate of Retirement |
|---|---|---|---|
| 50 | 0.00% | 1.30% | 0.00% |
| 51 | 0.00 | 0.00 | 0.00 |
| 52 | 0.00 | 0.00 | 0.00 |
| 53 | 0.00 | 0.35 | 0.00 |
| 54 | 0.00 | 0.00 | 0.00 |
| 55 | 25.00 | 28.01 | 25.00 |
| 56 | 18.00 | 22.40 | 20.00 |
| 57 | 15.00 | 18.03 | 17.00 |
| 58 | 15.00 | 19.01 | 17.00 |
| 59 | 15.00 | 17.31 | 17.00 |
| 60 | 20.00 | 22.73 | 20.00 |
| 61 | 15.00 | 29.25 | 20.00 |
| 62 | 15.00 | 20.22 | 20.00 |
| 63 | 25.00 | 23.60 | 25.00 |
| 64 | 20.00 | 31.20 | 25.00 |
| 65 | 25.00 | 34.02 | 28.00 |
| 66 | 25.00 | 28.77 | 28.00 |
| 67 | 25.00 | 18.75 | 28.00 |
| 68 | 25.00 | 28.81 | 28.00 |
| 69 | 25.00 | 31.43 | 28.00 |
| 70 | 30.00 | 15.63 | 25.00 |
| 71 | 30.00 | 22.22 | 25.00 |
| 72 | 30.00 | 28.00 | 25.00 |
| 73 | 30.00 | 21.43 | 25.00 |
| 74 | 30.00 | 9.09 | 25.00 |
| 75 & Over | 100.00 | 13.04 | 100.00 |

Based on the above experience, we are recommending increases in the rates for ages 56 to 59, 61 to 62 and 64 to 69. Decreases are being recommended for ages 70 to 74. Overall, these recommendations result in an increase in assumed retirements for Tier 1 members with 30 or more years of service at retirement.

Chart 3 provides a graphical comparison of the actual experience with current and proposed rates of retirements for Tier 1 members with 30 or more years of service at retirement.

Effective January 1, 2014, a new Tier 2 was implemented. For this new tier, we do not have credible experience from the past three years to propose new rates based on actual retirement from Tier 2 members. However, we are recommending slightly lowering the rates currently used for Tier 2 members with under 30 years of service at retirement and slightly increasing the rates currently used for Tier 2 members with 30 or more years of service, commensurate with the retirement assumptions that we are recommending for Tier 1. This is because the retirement rates for Tier 2 were partially developed based on the then current Tier 1 retirement rates when Tier 2 was first established.

The table below shows the current and proposed rates of retirement for Tier 2 members.

| Age | Tier 2 members with under 30 years of service | | Tier 2 members with 30 or more years of service | |
|---|---|---|---|---|
| | Current Assumed Rate of Retirement | Proposed Assumed Rate of Retirement | Current Assumed Rate of Retirement | Proposed Assumed Rate of Retirement |
| 55 | 0.00% | 0.00% | 25.00% | 25.00% |
| 56 | 0.00 | 0.00 | 12.50 | 14.00 |
| 57 | 0.00 | 0.00 | 10.00 | 12.00 |
| 58 | 0.00 | 0.00 | 10.00 | 12.00 |
| 59 | 0.00 | 0.00 | 10.00 | 12.00 |
| 60 | 5.00 | 5.00 | 17.50 | 17.50 |
| 61 | 2.50 | 2.50 | 5.00 | 5.00 |
| 62 | 0.00 | 0.00 | 5.00 | 5.00 |
| 63 | 20.00 | 20.00 | 25.00 | 25.00 |
| 64 | 15.00 | 15.00 | 20.00 | 25.00 |
| 65 | 15.00 | 14.00 | 25.00 | 28.00 |
| 66 | 15.00 | 14.00 | 25.00 | 28.00 |
| 67 | 15.00 | 14.00 | 25.00 | 28.00 |
| 68 | 15.00 | 14.00 | 25.00 | 28.00 |
| 69 | 15.00 | 13.00 | 25.00 | 28.00 |
| 70 & Over | 100.00 | 100.00 | 100.00 | 100.00 |

Chart 4 compares the current rates with the proposed rates of retirement for Tier 2 members with under 30 years of service at retirement. Chart 5 compares similar information for Tier 2 members with 30 or more years of service at retirement.

Deferred Vested Members

In prior valuations, Tier 1 inactive vested members were assumed to receive a deferred annuity at age 60. The average age at retirement over the prior three years was 59.7. We recommend maintaining the assumed retirement age for Tier 1 inactive vested members. We also recommend maintaining age 63 as the assumed retirement age for Tier 2 inactive vested members. We also recommend maintaining the assumption that Tier 1 inactive vested members will only receive a Money Purchase Annuity at age 60 whose value is equal to the employee contribution account plus the Department matching contribution account, since very few inactive vested members will be eligible for the Formula pension. In prior valuations, Tier 1 members receiving Permanent Total Disability benefits were assumed to retire at the earlier of age 60 or age 55 with 30 years of service and receive the Formula pension. The average age at retirement over the prior three years was 65.5. We recommend changing the assumed retirement age for Tier 1 and 2 members receiving Permanent Total Disability to the earlier of age 65 or age 55 with 30 years of service. We will continue to assume that members receiving Permanent and Total Disability will receive the Formula pension upon retirement.

Survivor Continuance

In prior valuations, it was assumed that 85% of active male members and 60% of active female members would have an eligible spouse or domestic partner when they retired. According to experience of members who retired since April 1, 2012, about 82% of all male members and 57% of all female members had an eligible spouse or domestic partner.

We recommend maintaining the current marriage assumptions of 85% for male members and 60% for female members. Also, we recommend applying this assumption to service retirees retired before April 1, 2012 with Options Full, A, B, or C to estimate whether there is a 50% continuance to the eligible spouse or domestic partner.

Since the value of the survivor's benefit is dependent on the survivor's age and sex, we must also have assumptions for the age and sex of the survivor. Based on the experience during the three-year period and studies done for other retirement systems, we believe that it is reasonable to continue to assume a three year age difference for the survivor's age as compared to the member's age. The recommended assumption for the age of the survivor is shown below.

| | **Survivor's Age as Compared to Member's Age** |
| **Beneficiary Sex** | **Recommended Assumption** |
| Male | 3 years older |
| Female | 3 years younger |

Since the majority of survivors are of the opposite sex, we will continue to assume that the survivor's sex is the opposite of the member. These assumptions will continue to be monitored in future experience studies.

**Chart 2**
**Retirement Rates**
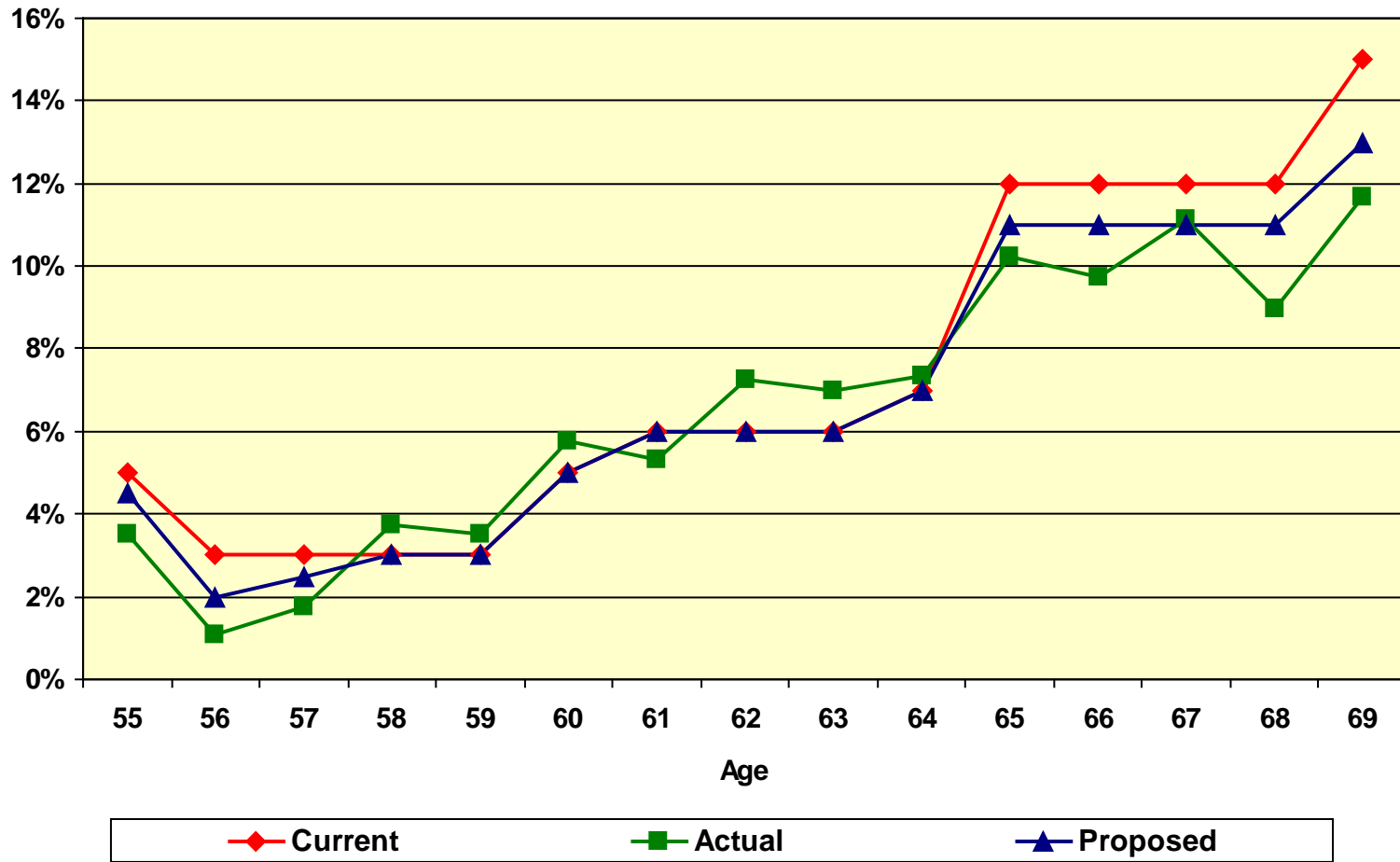**Tier 1 Members With Under 30 Years of Service**

**Chart 3**
**Retirement Rates**
**Tier 1 Members With 30 or More Years of Service**
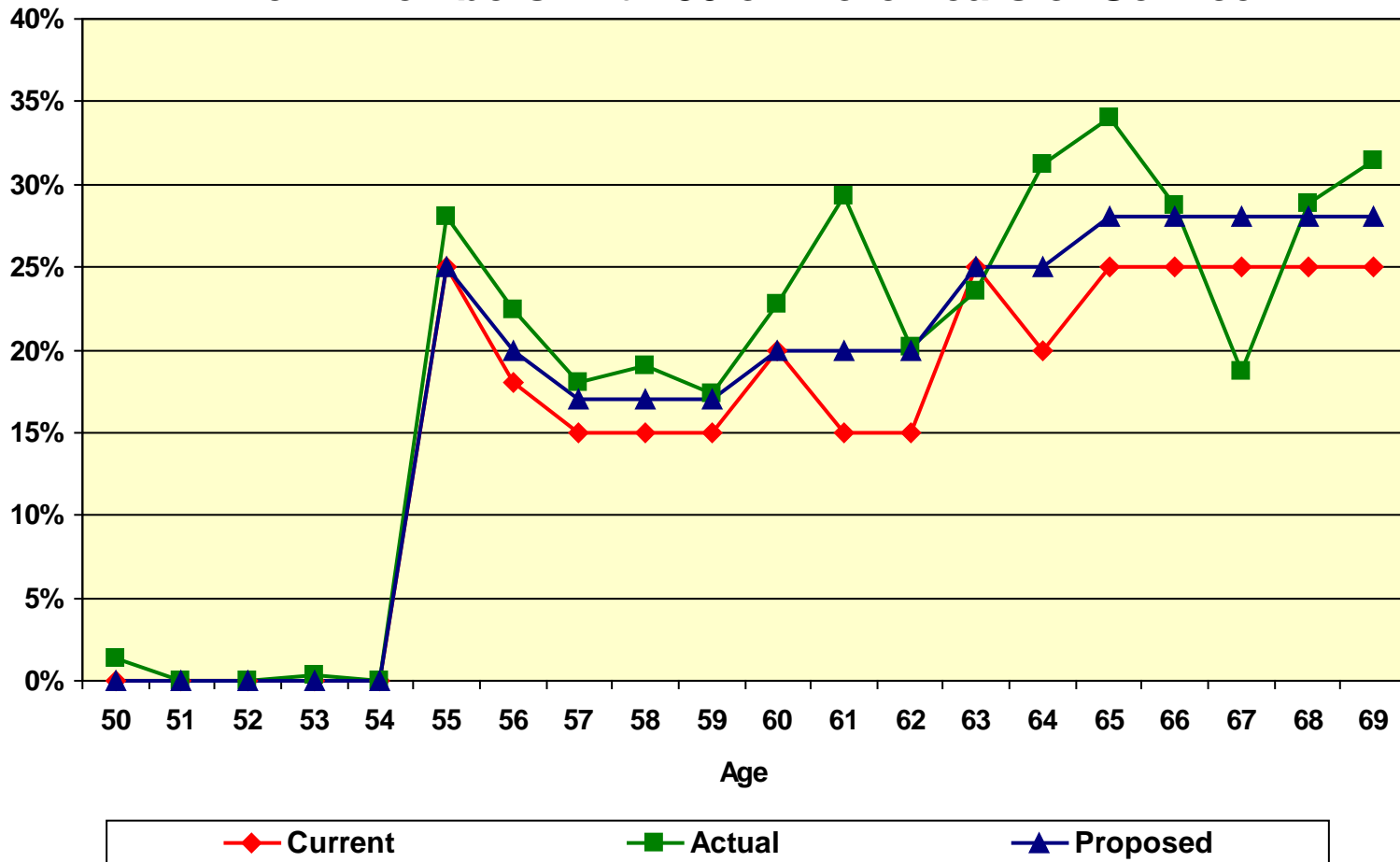
# Chart 4
# Retirement Rates
# Tier 2 Members With Under 30 Years of Service
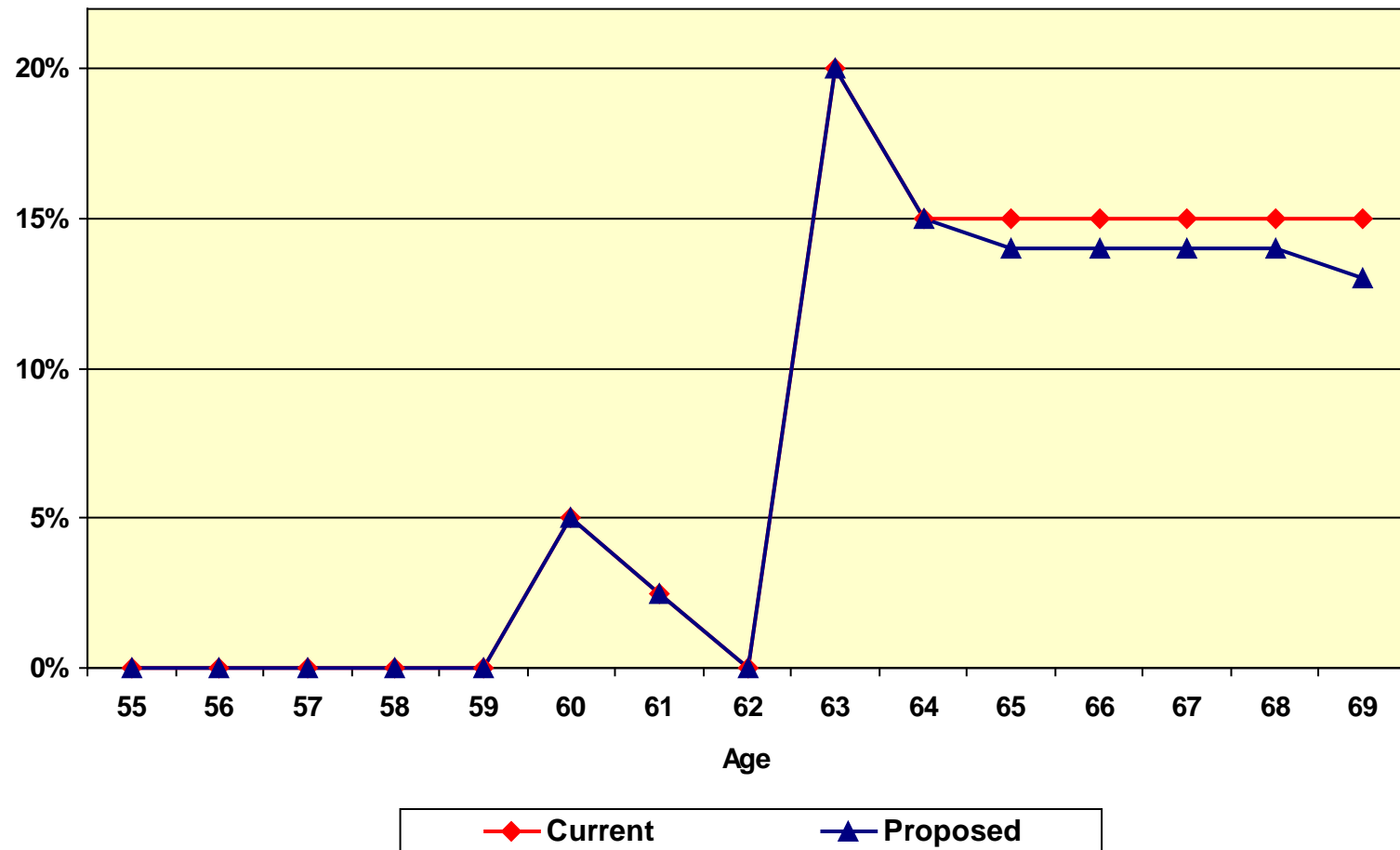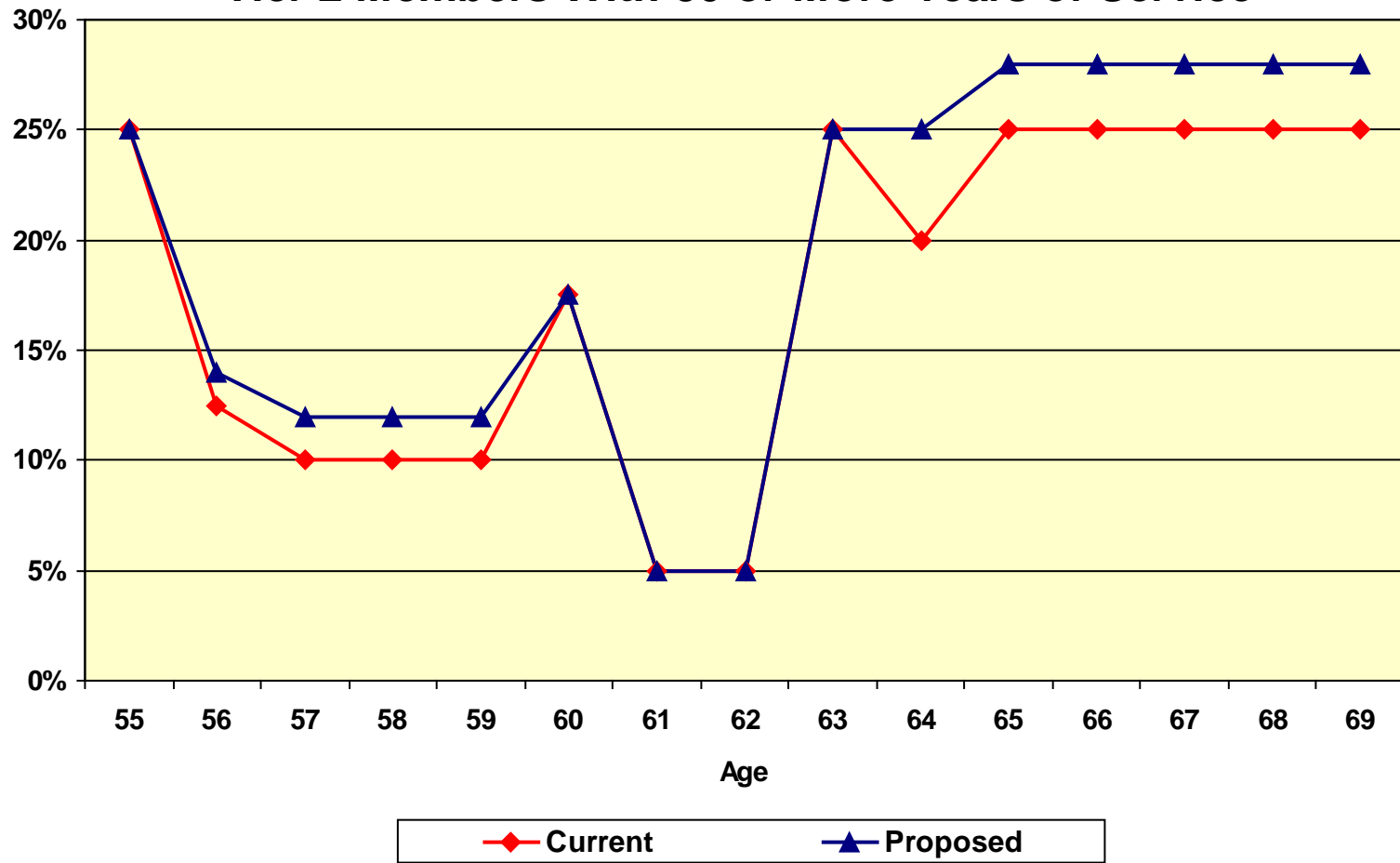
**Chart 5**
**Retirement Rates**
**Tier 2 Members With 30 or More Years of Service**

## B.    MORTALITY RATES

The "healthy" mortality rates project the life expectancy of a member who retires from service (i.e., who does not receive a Permanent Total Disability Benefit). Also, the "healthy" pre-retirement mortality rates project what proportion of members will die before retirement. The table currently being used for post-service retirement mortality rates is the RP-2000 Combined Healthy Mortality Table (separate tables for males and females) projected with Scale AA to 2030 with a one-year age setback for both males and females.

The Society of Actuaries (SOA) has recently published the RP-2014 family of mortality tables and associated mortality improvement scales. Within that family of mortality tables, there are mortality rates developed for annuitants on a "headcount" weighted basis that weight all retirees at the same age the same way without regard to the level of benefits those annuitants are receiving from a retirement plan. Mortality rates are also developed for annuitants on a "benefit" weighted basis, with higher credibility assigned to experience from annuitants receiving larger benefits. The headcount-weighted basis is the more common practice currently and is the approach used by Segal in the past for its California public system clients (including WPERP) and by other public sector actuaries in California.

As for the mortality improvement scales, they can be applied in one of two ways. Currently, the more common application is to use a "static" approach to anticipate a fixed level of mortality improvement for all annuitants receiving benefits from a retirement plan. This is in contrast to a "generational" approach where each future year has its own mortality table that reflects the forecasted improvements, using the published improvement scales. While the static approach is still most commonly used by Segal's California public system clients,  the "generational" approach is becoming the emerging practice within the actuarial profession.

A generational mortality table provides dynamic projections of mortality experience for each cohort of retirees. For example, the mortality rate for someone who is 65 next year will be slightly less than for someone who is 65 this year. In general, using generational mortality anticipates increases in the cost of the Plan over time as participants' life expectancies are projected to increase. This is in contrast to updating a static mortality assumption with each experience study as we have proposed in prior experience studies.

In Cheiron's recent actuarial audit they recommended that we consider using the newer RP-2014 tables and mortality improvement scale. They also suggested that we review the impact of a benefit weighted table as well as the generational mortality projection.

The SOA is in the process of collecting data from public sector plans so that they can develop mortality tables based on public sector experience comparable to the RP-2014 mortality tables developed using data collected from private and multi-employer plans. Furthermore, after publishing the two-dimensional MP-2014 mortality improvement scale, the SOA has replaced it with the two-dimensional MP-2015 mortality improvement scale to remove some of the conservatism built into the MP-2014 scale and to better reflect the most recent data on mortality improvement from the Social Security Administration. Segal believes that given the trend in the retirement industry to move towards generational mortality, it would be reasonable for the Board to adopt the Headcount-Weighted RP-2014 mortality table (adjusted for WPERP experience), and project the mortality improvement generationally using the MP-2015 mortality improvement scale.

Once the SOA has included data from public sector plans in developing the new tables, we will also include a discussion with the Board on whether to consider the benefit weighted mortality rates in the experience study. Note that in order to use more actual WPERP experience in our analysis, we have used experience for a six-year period from both the current and the last experience study periods to study this assumption.

In the table below, we have provided the approximate increase in the employer contribution rates based on the different approaches to build in margin for future mortality improvements.

| | **Employer Impact** |
|---|---|
| Headcount Weighted RP-2014 – Static approach with increased margin | 4% of payroll |
| Benefit Weighted RP-2014 – Static approach with increased margin | 7% of payroll |
| **Headcount Weighted RP-2014 – Generational approach** | **5% of payroll** |
| Benefit Weighted RP-2014 – Generational approach | 7% of payroll |

Pre-Retirement Mortality

In prior experience studies, the pre-retirement mortality rates for active members were set equal to the post-retirement mortality rates for retirees since the actual number of deaths among active members was not large enough to provide a statistically creditable analysis. However, this approach is not compatible with our current proposal because the post-retirement RP-2014 Healthy Annuitant table does not include rates for ages below 50.

From the RP-2014 family of tables, we recommend that pre-retirement mortality follow the Headcount-Weighted RP-2014 Employee Mortality Table (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2015 times 80%, all to account for the lower observed incidence of pre-retirement death. Note that we will continue to assume that 5% of pre-retirement deaths are duty related.

Post-Retirement Mortality

Our analysis starts with a table that shows, among all retired members, the actual deaths compared to the expected deaths under the current assumptions for the last six years. We also show the deaths under proposed assumptions. In prior years we have generally set the mortality assumption using a static mortality projection so that actual deaths will be at least 10% greater than those assumed. As noted above, we are recommending the use of a generational mortality table rather than static mortality. A generational mortality table incorporates a more explicit assumption for future mortality improvement. Accordingly, the goal is to start with a mortality table that closely matches the current experience (without a margin for future mortality improvement), and then reflecting mortality improvement by projecting lower mortality rates in future years. That is why the current actual to expected ratio shown in the table below for both males and females is 99%. In future years these ratios would remain around 100%, as long as actual mortality improved at the same rates as anticipated in the generational mortality tables. The actual deaths compared to the expected deaths under the current and proposed assumptions for the last six years are as follows:

| | **Healthy Pensioners – Male** | | | **Healthy Pensioners - Female** | | |
|---|---|---|---|---|---|---|
| | Expected Deaths | Actual Deaths | Proposed Expected Deaths | Expected Deaths | Actual Deaths | Proposed Expected Deaths |
| 6-year Total | 1,154 | 1,268 | 1,287 | 240 | 231 | 233 |
| Actual / Expected | 110% | | 99% | 96% | | 99% |
| Actual / Expected (Male and Female) | 108% | | 99% | | | |

The ratio of actual to expected deaths was 108%. We recommend updating the current table to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table (separate tables for males and females) with no age adjustment for males and set back one year for female, projected generationally with the two-dimensional mortality improvement scale MP-2015. This will bring the actual to expected ratio to 99%. This is consistent with ASOP 35 as we anticipate expected future improvement in life expectancy using the generational approach.

Chart 6 compares actual to expected deaths under the current and proposed assumptions over the past six years. Chart 7 shows the life expectancies (i.e., expected future lifetime) under both the current and proposed tables. The expected deaths (Chart 6) and life expectancies (Chart 7) under the proposed generational mortality table are based on mortality rates from 2014 which is the base year of the table. In practice, life expectancies will be increased after applying the mortality improvement scale.

Disabled Mortality

Disabled mortality was included in the development of assumed healthy mortality rates. This was done because the number of disabled pensioners who were receiving benefits from both the Permanent Total Disability Fund and the Retirement Plan is minimal compared to the total number of pensioners receiving only Retirement Plan benefits. We continue to recommend using the same mortality table for disabled members who received a Permanent Total Disability Benefit as is used for healthy service retired members.

Mortality Table for Optional Forms of Payment, Money Purchase Annuity and Present Value Calculations

If these mortality assumptions are adopted by the Board, the actuarial factors used for optional forms of payment, present value calculations, etc. should be reviewed for consistency with the mortality assumptions proposed in this report. This would ensure that the optional forms of payment, etc. are actuarially equivalent to the Full Retirement Allowance form of payment used in the determination of employer contribution rates.

However, there are administrative reasons why a generational mortality table may be difficult to implement. The emerging most common practice is to approximate the use of a generational mortality table by the use of a static table with projection of the mortality improvement over a period that is close to the duration of the benefit payments for active members. We would recommended use of this approximation and as appropriate will work with WPERP in developing and implementing such a mortality table.

# Chart 6
# Post-Retirement Deaths



July 1, 2009 - June 30, 2015

- Expected - Current
- Actual
- Expected - Proposed (2014 Base Year Rates)

**Chart 7**
**Life Expectancies**

Legend: Current (Male), Proposed (Male), Current (Female), Proposed (Female)

X-axis: Age (20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95-99)

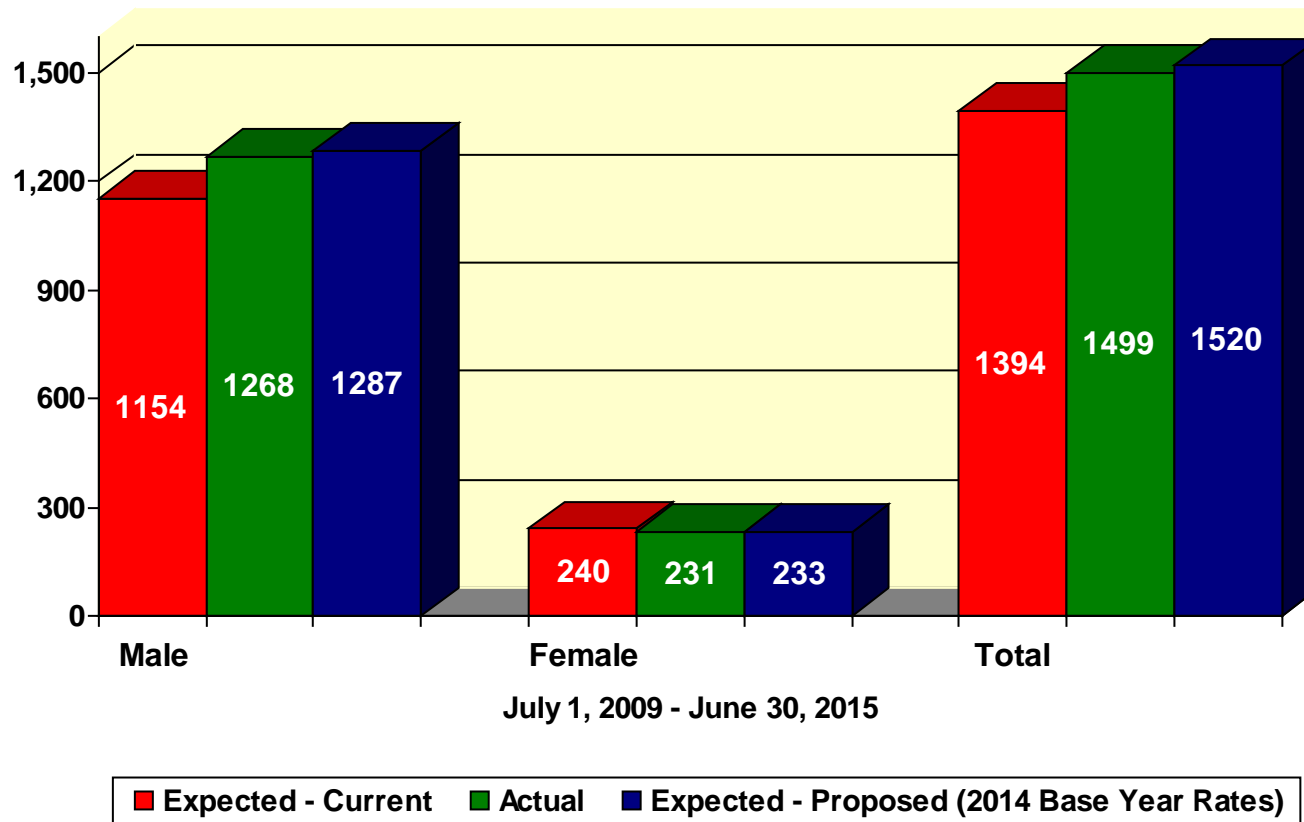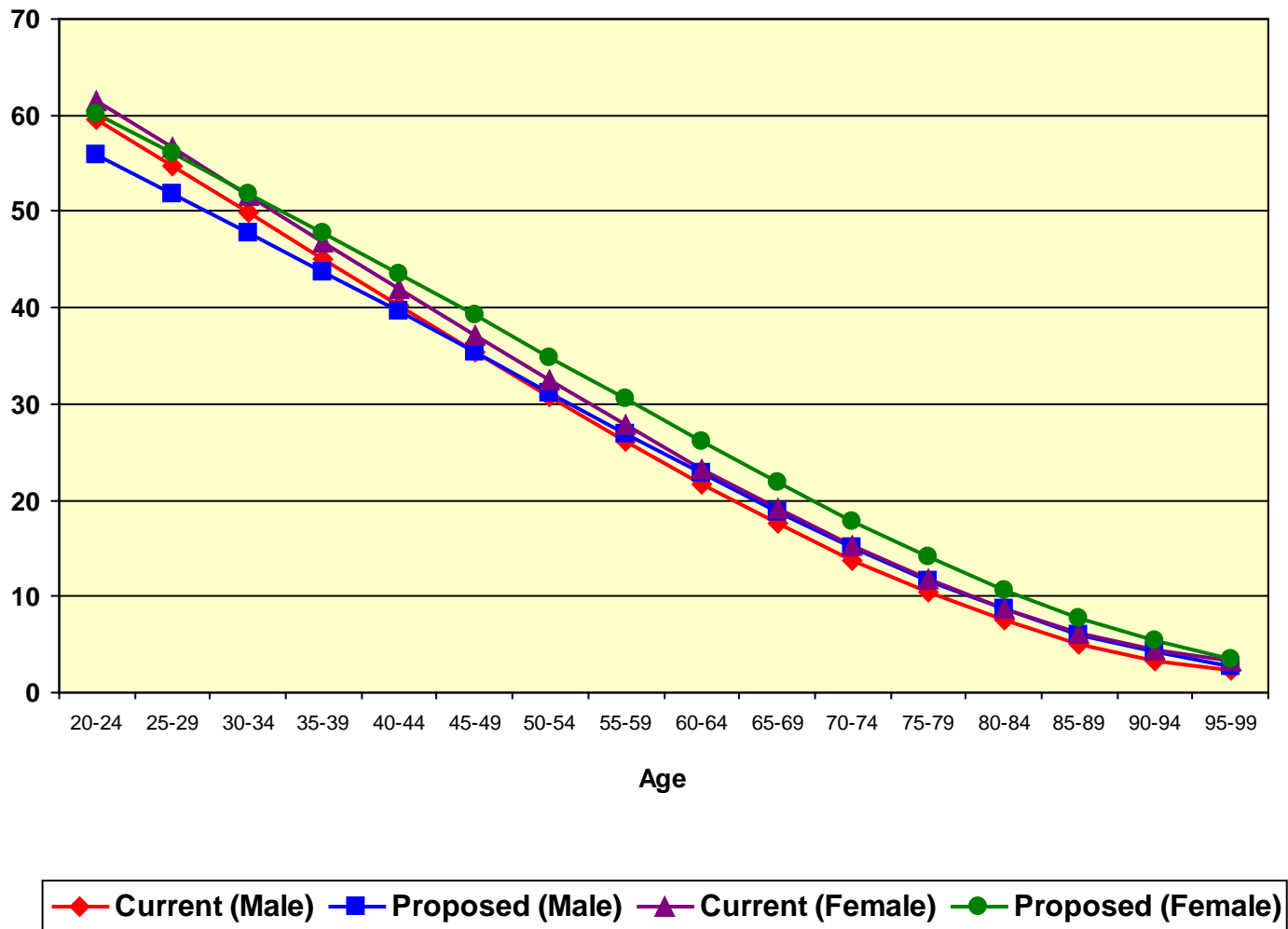## C. TERMINATION RATES

Termination rates include all terminations for reasons other than death, disability or retirement. Under the current assumptions there is an assumed overall incidence of termination combined with an assumption that 85% of Tier 1 terminated members with more than one year of service (15 years of service for Tier 2) will choose a deferred benefit (vested termination) and 15% will choose a refund of member contributions (ordinary withdrawal). For Tier 1 members terminating with less than one year of service (Tier 2 members terminating with less than 15 years of service), 100% are assumed to be ordinary withdrawals. With this experience study we are continuing to recommend that a combined set of withdrawal and termination assumptions be used with an assumption regarding the proportion of members who choose a deferred benefit or a refund of member contributions.

The termination experience over the last three years for active male and female members is shown by years of service in the following table. Please note that we have excluded any members that were eligible for retirement. We also show the current and proposed assumptions.

**Termination Rates**

| Years of Service | Current Rate | Actual Rate | Proposed Rate |
|---|---|---|---|
| Less than 1 | 9.00% | 19.07% | 12.00% |
| 1 | 4.00 | 7.62 | 6.00 |
| 2 | 3.50 | 4.14 | 4.00 |
| 3 | 3.00 | 1.72 | 2.50 |
| 4 | 2.75 | 1.58 | 2.00 |
| 5 | 2.50 | 1.55 | 2.00 |
| 6 | 2.25 | 1.02 | 1.75 |
| 7 | 2.00 | 0.89 | 1.50 |
| 8 | 1.75 | 1.17 | 1.25 |
| 9 | 1.50 | 0.94 | 1.00 |
| 10 | 1.25 | 0.42 | 0.75 |
| 11 & Over | 1.00 | 0.48 | 0.75 |

It is important to note that not every service category has enough exposures and/or decrements such that the results in that category are statistically credible.

Chart 8 compares actual to expected terminations over the past three years for both the current and proposed assumptions.

Chart 9 shows the actual, current and proposed termination rates by years of service.

The actual termination experience during the three-year period was lower than expected. This may be due to the economic circumstances that occurred during the period of this study. For that reason, while we are proposing reductions in the termination rates, we have not fully reflected the actual experience that occurred during this period.

We are recommending a change in the assumption regarding the proportion of total termination rates allocated between ordinary withdrawals (those who terminate and take a refund of employee contributions) and vested terminations (those who leave contributions in Plan and retire later). Currently, it is assumed that 100% of Tier 1 members terminating with less than one year of service (Tier 2 members terminating with less than 15 years of service) will be ordinary withdrawals. It is also assumed that 15% of Tier 1 terminated members with more than one year of service (15 years of service for Tier 2) will be ordinary withdrawals. During our review of the last three year's data, we observed that, consistent with plan provisions, very close to 100% of Tier 1 terminations are ordinary withdrawals for members with less than one year of service. Also, the percent of ordinary withdrawals for members with more than one year of service appears to have increased for members with one to ten years of service. Based on this experience, our recommended assumptions are shown in the table below:

**Tier 1 Ordinary Withdrawals**

| Years of Service | Current Assumption | Actual | Proposed Assumption |
|---|---|---|---|
| Less than 1 | 100% | 96% | 100% |
| 1 – 10 | 15% | 50% | 30% |
| 11 & Over | 15% | 20% | 15% |

**Tier 1 Vested Terminations**

| Years of Service | Current Assumption | Actual | Proposed Assumption |
|---|---|---|---|
| Less than 1 | 0% | 4% | 0% |
| 1 – 10 | 85% | 50% | 70% |
| 11 & Over | 85% | 80% | 85% |

For Tier 2 members, very limited experience was available over the three-year period and we recommend maintaining the current assumption of 100% ordinary withdrawals for Tier 2 members with less than 15 years of service and 15% of ordinary withdrawals for Tier 2 members with 15 or more years of service.

We will also continue to assume that termination rates are zero at any age for members eligible to retire. In other words, at those ages, members will either retire in accordance with the retirement rate assumptions or continue working, rather than terminate and defer their benefit.

# Chart 8
## Actual Number of Terminations Compared to Expected



| Year ended June 30, | Expected - Current | Actual | Expected - Proposed |
|---|---|---|---|
| 2012 | 95 | 28 | 76 |
| 2013 | 95 | 76 | 79 |
| 2014 | 102 | 119 | 94 |
| Total | 292 | 223 | 249 |

**Year ended June 30,**

■ Expected - Current  ■ Actual  ■ Expected - Proposed
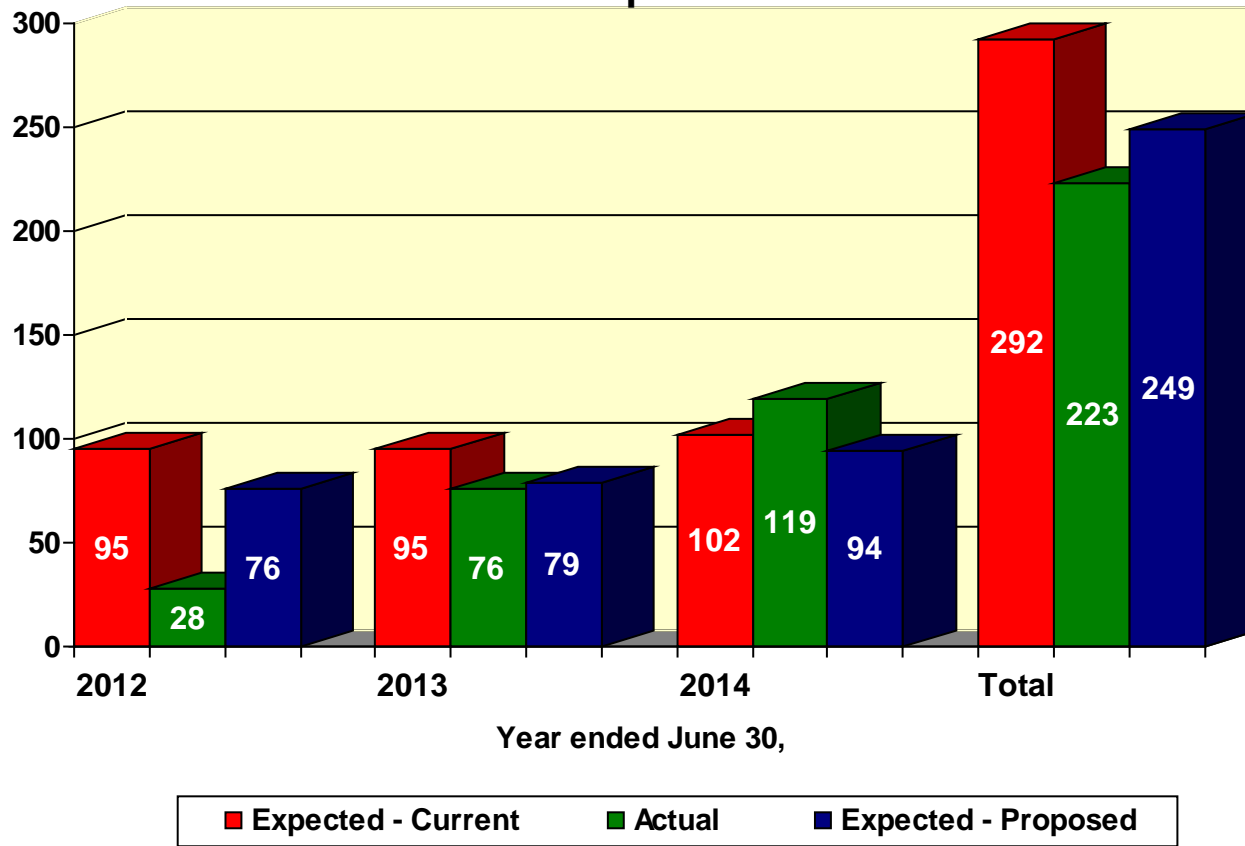
# Chart 9
# Termination Rates - All Active Members



**Years of Service**

Legend: Current — Actual — Proposed
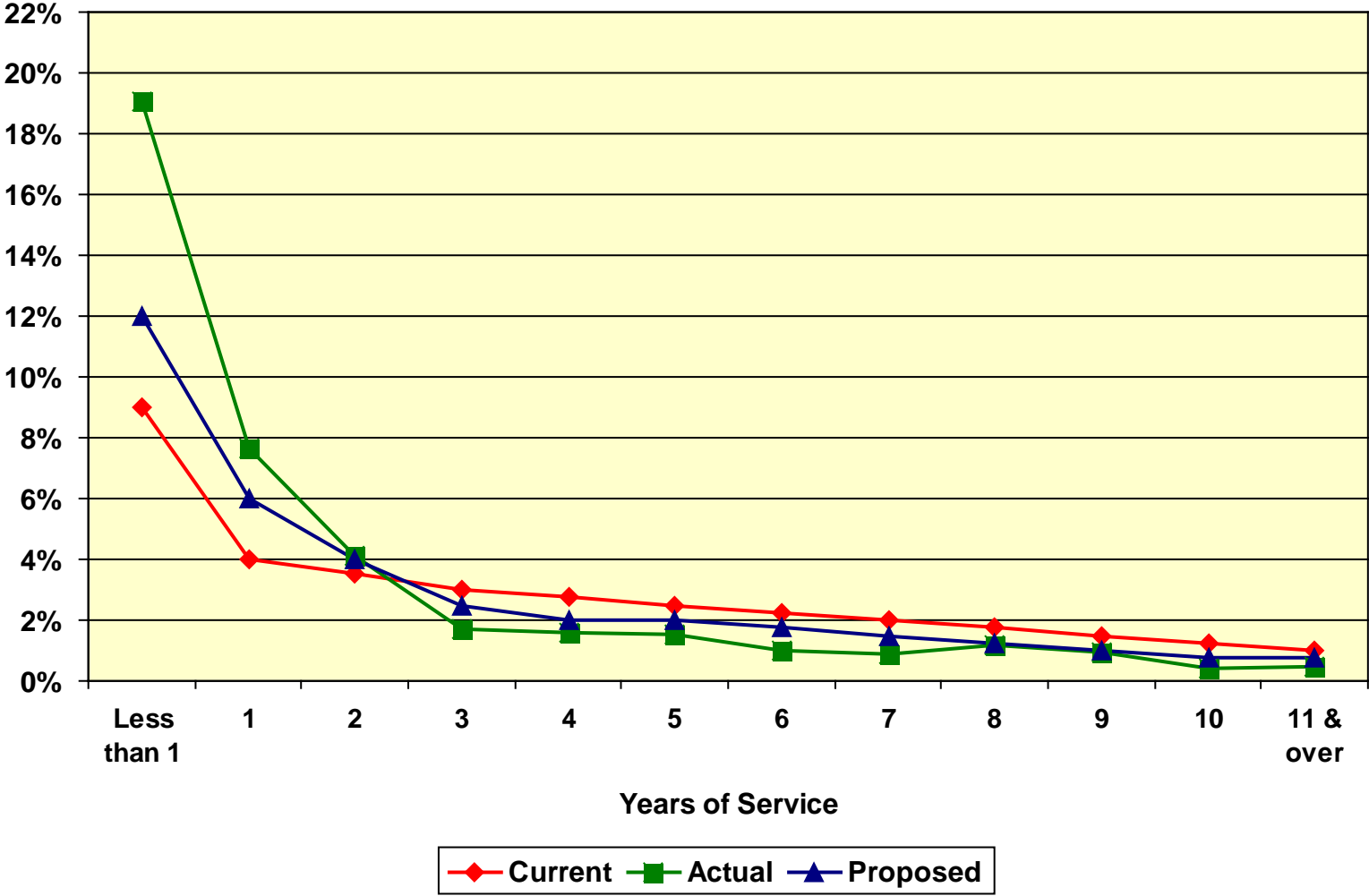
## D.    DISABILITY INCIDENCE RATES

When a member becomes disabled, he or she may be entitled to a Permanent Total Disability benefit from the Disability Fund.  The following summarizes the actual incidence of permanent total disabilities over the past three years compared to the current and proposed assumptions:

### Rates of Disability Incidence

| Age | Males Current / Proposed Rate | Females Current / Proposed Rate |
|---|---|---|
| 20 – 24 | 0.000% | 0.000% |
| 25 – 29 | 0.006 | 0.000 |
| 30 – 34 | 0.012 | 0.018 |
| 35 – 39 | 0.012 | 0.048 |
| 40 – 44 | 0.024 | 0.084 |
| 45 – 49 | 0.036 | 0.114 |
| 50 – 54 | 0.084 | 0.150 |
| 55 – 59 | 0.162 | 0.180 |
| 60 – 64 | 0.300 | 0.000 |

|  | Total Expected Disabilities | Actual Disabilities |
|---|---|---|
|  | 24 | 23 |
| Ratio to Actual | 104% |  |

Since the actual number of permanent total disabilities was in line with those expected under the current assumptions over the past three years as shown above, we do not recommend changing the current rates. Furthermore, a refinement to this assumption would not materially impact the plan liabilities due to the low number of disabilities.

Chart 10 compares the actual to expected disabilities under the current/proposed assumptions over the last three years. Chart 11 shows current (proposed) rates.

**Chart 10**
**Actual Number of Disabilities**
**Compared to Expected**

July 1, 2012 through June 30, 2015

Total

■ Expected - Current/Proposed    ■ Actual
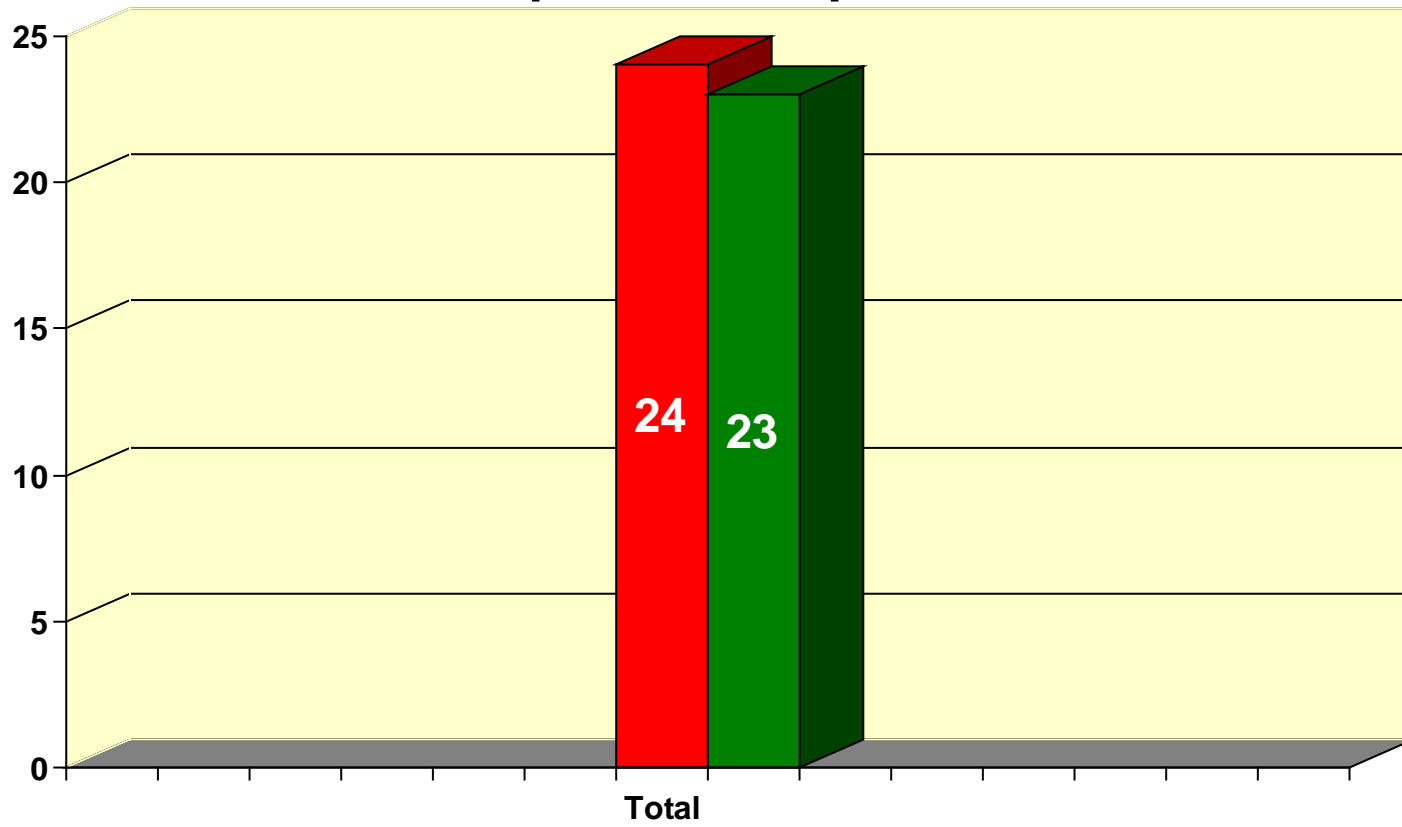
# Chart 11
# Disability Incidence Rates



Legend: Current/Proposed (Male) · Current/Proposed (Female)
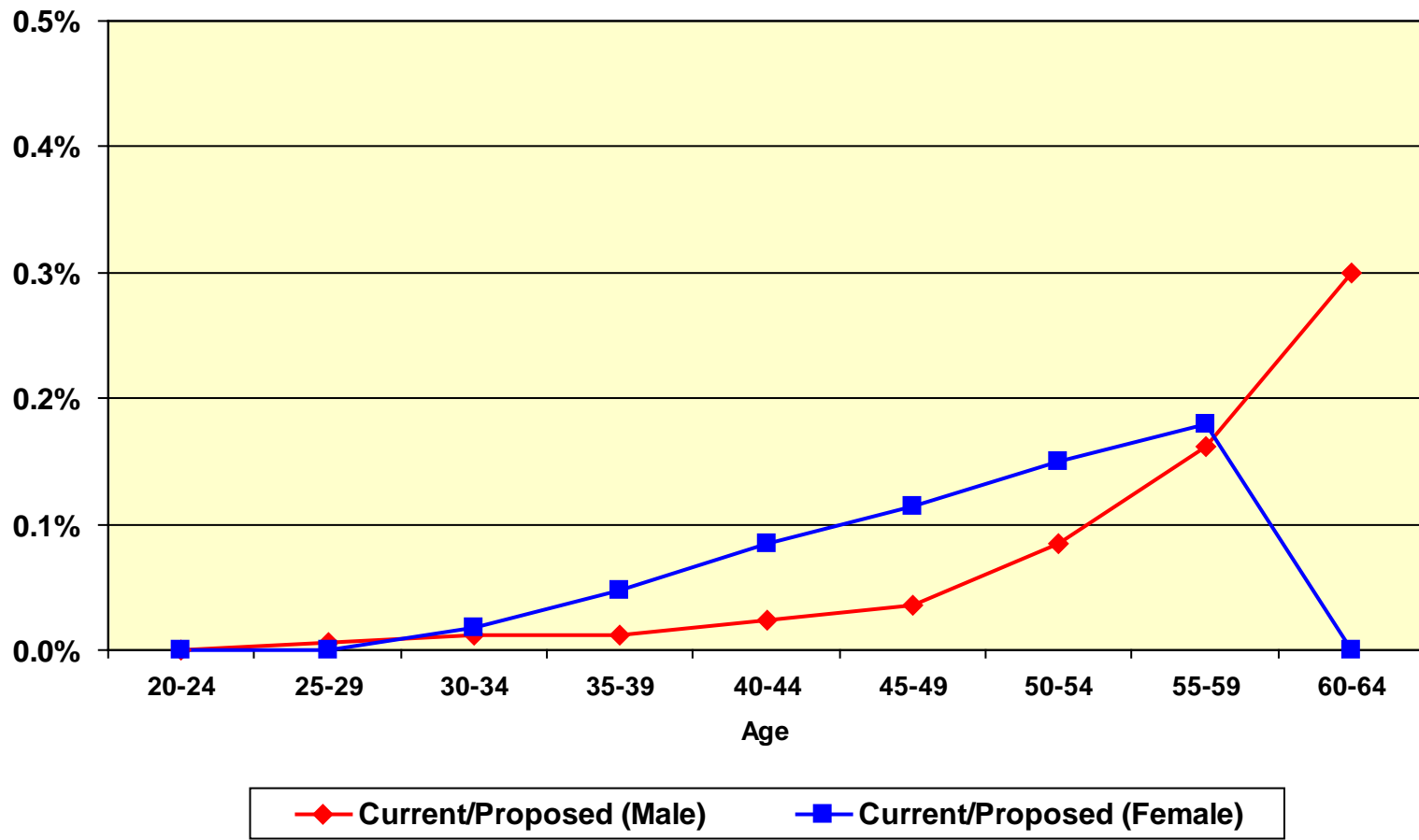
## E.    FUTURE SERVICE ACCRUALS

Plan retirement benefits are based on a member's total service, including any purchased service. In order to project benefits and determine the liabilities, an assumption about the amount of service earned and purchased by members each year is necessary. The current assumption is that each Tier 1 active member will earn 1.00 year of service and purchase an additional 0.15 years of service for each future year of employment.

The actual average annual service increase for continuing Tier 1 active members was 1.05 years over the past three years. Based on this experience, we recommend reducing the Tier 1 active member purchase of additional service from 0.15 years to 0.10 years for each future year of employment.

For Tier 2 members, we recommend maintaining the current assumption of 0.03 years of purchase of additional service for each future year of employment. These service purchases exclude those priced at full actuarial cost.

# V.  COST IMPACT

As developed in the July 1, 2015 actuarial valuation, the employers' annual cost is 42.77% of compensation under the current set of assumptions. If all of the recommended assumption changes from this experience study were implemented in the 2015 valuation, the annual cost in the July 1, 2015 actuarial valuation would have increased to 51.75% of compensation.

The recommended assumption changes would have increased the overall plan cost by 9.0% of compensation. The change to the 7.25% investment return assumption alone would increase costs by about 5.7% of compensation. The recommended change to the generational mortality table alone would increase costs by about 4.8% of compensation. The change to the salary increase assumption alone would decrease costs by about 1.3% of compensation. All the other recommended changes would decrease costs by about 0.2% of compensation.

Chart 12 shows the details of the cost increase due to the recommended assumption changes.

## Chart 12

## Recommended Department Contributions

|  | Current Assumptions | | Recommended Assumptions | |
|---|---|---|---|---|
| 1. Actuarial accrued liability | | | | |
| Active members | $5,122,447,766 | | $5,452,666,802 | |
| Terminated vested members | 200,526,239 | | 207,797,803 | |
| Retired members and beneficiaries | 5,895,471,562 | | 6,237,574,726 | |
| Total | $11,218,445,567 | | $11,898,039,331 | |
| 2. Net actuarial value of assets | $9,750,343,300 | | $9,750,343,300 | |
| 3. Unfunded actuarial accrued liability (UAAL) (1) – (2) | $1,468,102,267 | | $2,147,696,031 | |

|  | Dollar Amount | % of pay | Dollar Amount | % of pay |
|---|---|---|---|---|
| 4. Total normal cost | $209,832,859 | 22.79% | $217,920,070 | 23.71% |
| 5. Expected member contributions | 60,278,794 | 6.55 | 57,866,058 | 6.30 |
| 6. Net normal cost: (4) – (5) | 149,554,065 | 16.24 | 160,054,012 | 17.41 |
| 7. Amortization of UAAL | 229,995,914 | 24.98 | 298,958,293 | 32.53 |
| 8. Required employer contribution, at beginning of the year | 379,549,979 | 41.22 | 459,012,305 | 49.94 |
| 9. Required employer contribution, with mid-year interest adjustment | 393,783,103 | 42.77 | 475,651,501 | 51.75 |
| 10. Projected compensation | 920,781,074 | | 919,066,467 | |

# APPENDIX A

## CURRENT ACTUARIAL ASSUMPTIONS

**Demographic Assumptions:**

**Mortality Rates:**

*After Service Retirement and Pre-retirement*:    RP-2000 Combined Healthy Mortality Table with ages set back one year, projected to 2030 with Scale AA.

*After Disability Retirement*    RP-2000 Combined Healthy Mortality Table with ages set back one year, projected to 2030 with Scale AA.

**Termination Rates Before Retirement:**

| | Rate (%) | | | |
|---|---|---|---|---|
| | **Mortality*** | | **Disability** | |
| **Age** | **Male** | **Female** | **Male** | **Female** |
| 25 | 0.028 | 0.013 | 0.006 | 0.000 |
| 30 | 0.036 | 0.018 | 0.012 | 0.006 |
| 35 | 0.060 | 0.031 | 0.012 | 0.036 |
| 40 | 0.080 | 0.041 | 0.018 | 0.072 |
| 45 | 0.094 | 0.063 | 0.030 | 0.102 |
| 50 | 0.116 | 0.093 | 0.054 | 0.138 |
| 55 | 0.180 | 0.191 | 0.126 | 0.168 |
| 60 | 0.367 | 0.382 | 0.240 | 0.000 |
| 65 | 0.739 | 0.742 | 0.000 | 0.000 |

\*    *5% of pre-retirement deaths are assumed to be duty related, with the remaining being non-duty related.*

**Withdrawal Rates:**

| Years of Service | Total Withdrawal* |
|:---:|:---:|
| Less than 1 | 9.00% |
| 1 | 4.00% |
| 2 | 3.50% |
| 3 | 3.00% |
| 4 | 2.75% |
| 5 | 2.50% |
| 6 | 2.25% |
| 7 | 2.00% |
| 8 | 1.75% |
| 9 | 1.50% |
| 10 | 1.25% |
| 11 & over | 1.00% |

\* No withdrawal is assumed after a member is first eligible to retire. Ordinary withdrawal members are assumed to receive their account balance at termination. Vested termination members are assumed to receive a deferred retirement benefit. For Tier 1 members terminating with less than one year of service and Tier 2 members terminating with less than 15 years of service, 100% are assumed to be ordinary withdrawals. For members terminating with more than one year of service (15 years of service for Tier 2), 15% are assumed to be ordinary withdrawals, with the remaining 85% being vested terminations.

# CURRENT ACTUARIAL ASSUMPTIONS

## (Continued)

**Retirement Rates:**

| | Rate (%) | | | |
|---|---|---|---|---|
| | Tier 1 | | Tier 2 | |
| **Age** | **Under 30 Years of Service** | **30 or More Years of Service** | **Under 30 Years of Service** | **30 or More Years of Service** |
| 55 | 5.0% | 25.0% | 0.0% | 25.0% |
| 56 | 3.0 | 18.0 | 0.0 | 12.5 |
| 57 | 3.0 | 15.0 | 0.0 | 10.0 |
| 58 | 3.0 | 15.0 | 0.0 | 10.0 |
| 59 | 3.0 | 15.0 | 0.0 | 10.0 |
| 60 | 5.0 | 20.0 | 5.0 | 17.5 |
| 61 | 6.0 | 15.0 | 2.5 | 5.0 |
| 62 | 6.0 | 15.0 | 0.0 | 5.0 |
| 63 | 6.0 | 25.0 | 20.0 | 25.0 |
| 64 | 7.0 | 20.0 | 15.0 | 20.0 |
| 65 | 12.0 | 25.0 | 15.0 | 25.0 |
| 66 | 12.0 | 25.0 | 15.0 | 25.0 |
| 67 | 12.0 | 25.0 | 15.0 | 25.0 |
| 68 | 12.0 | 25.0 | 15.0 | 25.0 |
| 69 | 15.0 | 25.0 | 15.0 | 25.0 |
| 70 | 30.0 | 30.0 | 100.0 | 100.0 |
| 71 | 30.0 | 30.0 | 100.0 | 100.0 |
| 72 | 30.0 | 30.0 | 100.0 | 100.0 |
| 73 | 30.0 | 30.0 | 100.0 | 100.0 |
| 74 | 30.0 | 30.0 | 100.0 | 100.0 |
| 75 | 100.0 | 100.0 | 100.0 | 100.0 |

**Benefit for Inactive Vested Members:**

For Tier 1, inactive vested members are assumed to retire at age 60 with a Money Purchase Annuity. Members receiving Permanent Total Disability benefits are assumed to retire at the earlier of age 60 or age 55 with 30 years of service. For Tier 2, inactive vested members are assumed to retire at age 63.

# CURRENT ACTUARIAL ASSUMPTIONS

## (Continued)

**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:**  Females are 3 years younger than their spouses.

**Future Benefit Accruals:**  1.0 year of service per year.

**Other Government Service:**  Tier 1 members are assumed to purchase an additional 0.15 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.

## Economic Assumptions:

**Net Investment Return:**  7.50%, net of investment expenses.

**Consumer Price Index:**  Increase of 3.25% per year; benefit increases due to CPI subject to 3.00% maximum for Tier 1 and 2.00% for Tier 2.

**Employee Contribution, Additional Annuity and Matching Account Crediting Rate:**  7.50%, based on Plan provisions.

**Administration Expenses:**    Offset by additional employer contributions.

**Salary Increases:**    <u>Annual Rate of Compensation Increase</u>

Inflation: 3.25% per year, plus "across the board" salary increases of 0.75% per year, plus the following merit and promotional increases.

| Years of Service | Increase |
|---|---|
| Less than 1 | 6.00% |
| 1 | 5.50% |
| 2 | 5.00% |
| 3 | 4.00% |
| 4 | 2.50% |
| 5 | 1.50% |
| 6 | 1.10% |
| 7 | 1.00% |
| 8 | 0.90% |
| 9 | 0.80% |
| 10 & over | 0.75% |

The merit and promotional increases are added to the sum of the inflationary and "across the board" salary increases.

# APPENDIX B

## PROPOSED ACTUARIAL ASSUMPTIONS

**<u>Demographic Assumptions:</u>**

**Mortality Rates:**

| | |
|---|---|
| *Pre-retirement:* | Head count-weighted RP-2014 Employee Mortality Table times 80%, projected generationally with the two-dimensional MP-2015 projection scale. |
| *After Service Retirement:* | Head count-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 MP-2015 projection scale. |
| *After Disability Retirement:* | Head count-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 MP-2015 projection scale. |

**Termination Rates Before Retirement:**

| Rate (%) | | |
|---|---|---|
| **Male** | | |
| **Age** | **Mortality*** | **Disability** |
| 25 | .049 | 0.006 |
| 30 | .048 | 0.012 |
| 35 | .053 | 0.012 |
| 40 | .064 | 0.018 |
| 45 | .098 | 0.030 |
| 50 | .167 | 0.054 |
| 55 | .273 | 0.126 |
| 60 | .452 | 0.240 |
| 65 | .779 | 0.000 |
| **Female** | | |
| **Age** | **Mortality*** | **Disability** |
| 25 | .017 | 0.000 |
| 30 | .022 | 0.006 |
| 35 | .029 | 0.036 |
| 40 | .039 | 0.072 |
| 45 | .058 | 0.102 |
| 50 | .100 | 0.138 |
| 55 | .168 | 0.168 |
| 60 | .241 | 0.000 |
| 65 | .356 | 0.000 |

*   *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.*

# PROPOSED ACTUARIAL ASSUMPTIONS

## (Continued)

**Withdrawal Rates:**

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

\*   *No withdrawal is assumed after a member is first eligible to retire. Ordinary withdrawal members are assumed to receive their account balance at termination. Vested termination members are assumed to receive a deferred retirement benefit. For Tier 1 members terminating with less than one year of service, and Tier 2 members terminating with less than 15 years of service, 100% or assumed to be ordinary withdrawals. For Tier 1 members terminating with at least one year of service but less than eleven years of service, 30% are assumed to be ordinary withdrawals with the remaining 70% being vested terminations. For Tier 1 members terminating with 11 or more years of service and Tier 2 members terminating with 15 or more years of service, 15% are assumed to be ordinary withdrawals, with the remaining 85% being vested terminations.*

# PROPOSED ACTUARIAL ASSUMPTIONS

(Continued)

**Retirement Rates:**

| | Rate (%) | | | |
|---|---|---|---|---|
| | Tier 1 | | Tier 2 | |
| Age | 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% | 0.0% | 25.0% |
| 56 | 2.00 | 20.00 | 0.0 | 14.0 |
| 57 | 2.50 | 17.00 | 0.0 | 12.0 |
| 58 | 3.00 | 17.00 | 0.0 | 12.0 |
| 59 | 3.00 | 17.00 | 0.0 | 12.0 |
| 60 | 5.00 | 20.00 | 5.0 | 17.5 |
| 61 | 6.00 | 20.00 | 2.5 | 5.0 |
| 62 | 6.00 | 20.00 | 0.0 | 5.0 |
| 63 | 6.00 | 25.00 | 20.0 | 25.0 |
| 64 | 7.00 | 25.00 | 15.0 | 25.0 |
| 65 | 11.00 | 28.00 | 14.0 | 28.0 |
| 66 | 11.00 | 28.00 | 14.0 | 28.0 |
| 67 | 11.00 | 28.00 | 14.0 | 28.0 |
| 68 | 11.00 | 28.00 | 14.0 | 28.0 |
| 69 | 13.00 | 28.00 | 13.0 | 28.0 |
| 70 | 25.00 | 25.00 | 100.0 | 100.0 |
| 71 | 25.00 | 25.00 | 100.0 | 100.0 |
| 72 | 25.00 | 25.00 | 100.0 | 100.0 |
| 73 | 25.00 | 25.00 | 100.0 | 100.0 |
| 74 | 25.00 | 25.00 | 100.0 | 100.0 |
| 75 | 100.00 | 100.00 | 100.0 | 100.0 |

**PROPOSED ACTUARIAL ASSUMPTIONS**

(Continued)

**Benefit for Inactive Vested Members:**      For Tier 1, inactive vested members are assumed to retire at age 60 with a Money Purchase Annuity. 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. For Tier 2, inactive vested members are assumed to retire at age 63.

**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:**      Females are 3 years younger than their spouses.

**Future Benefit Accruals:**      1.0 year of service per year.

**Other Government Service:**      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.

**Economic Assumptions:**

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

**Consumer Price Index:**      Increase of 3.00% per year; benefit increases due to CPI subject to 3.00% maximum for Tier 1 and 2.00% for Tier 2.

**Employee Contribution, Additional Annuity and Matching Account Crediting Rate:**      7.50%, based on Plan provisions

# PROPOSED ACTUARIAL ASSUMPTIONS

### (Continued)

**Administration Expenses:**     Offset by additional employer contributions.

**Salary Increases:**

<u>Annual Rate of Compensation Increase</u>

Inflation: 3.00% per year, plus "across the board" salary increases of 0.50% per year, plus the following merit and promotional increases.

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

The merit and promotional increases are added to the sum of the inflationary and "across the board" salary increases.