

# Austin Police Retirement System

Actuarial Experience Study

As of December 31, 2017



May 15, 2019

Board of Trustees  
Austin Police Retirement System  
252 South IH 35, Suite 100  
Austin, TX 78704

**Subject: Results of 2018 Actuarial Experience Study**

Members of the Board:

We are pleased to present our report on the results of the 2018 Actuarial Experience Study for the Austin Police Retirement System (APRS). This report includes our recommendations for updated actuarial assumptions and methods to be effective for the December 31, 2018 actuarial valuation.

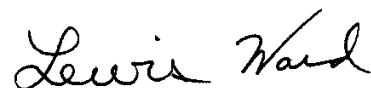
With the Board's approval of the recommendations in this report, we believe the actuarial condition of APRS will be more accurately portrayed. The Board's decisions should be based on the appropriateness of each recommendation, not on the collective effect on the contribution rate or the unfunded liability.

This study was conducted in accordance with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. The signing actuaries are independent of the plan sponsor. Ryan Falls is an Enrolled Actuary, a Fellow of the Society of Actuaries, and a Member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries. Finally, both of the undersigned are experienced in performing valuations for large public retirement systems. We wish to thank the APRS staff for their assistance in providing data for this study.

Respectfully submitted,  
**Gabriel, Roeder, Smith & Company**



R. Ryan Falls, FSA, EA, MAAA  
Senior Consultant & Actuary



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## **SECTION A**

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### **EXECUTIVE SUMMARY**

## Summary of Recommendations

Our recommended changes to the current actuarial assumptions may be summarized as follows:

### *Economic Assumptions*

1. We recommend decreasing the price inflation assumption from 3.00% to 2.50%.
2. We recommend decreasing the nominal investment return assumption from 7.70% to 7.25%. This assumption is comprised of 2.50% inflation and 4.75% real return and is stated net of investment-related expenses.
3. We recommend an ultimate salary scale assumption used to project individual salary increases of 3.00%, made up of price inflation, general productivity, and a minor component for merit. In addition, we recommend updated service-based rates consistent with current step schedules.
4. We recommend decreasing the payroll growth assumption from 4.00% to 3.00% to be more consistent with anticipated inflation, and excluding population growth. This is the rate amortization payments are anticipated to grow in the future.
5. We recommend adding an explicit assumption for administrative expenses of 0.90% of payroll into the ADEC. Included in this assumption would be any administrative expenses associated with the proportionate retirement program, which is currently assumed to be 0.017% of payroll.

### *Mortality Assumptions*

6. We recommend the healthy retiree mortality tables published in the Pub-2010 Public Retirement Plans Mortality Tables Report, for public safety personnel (PubS-2010) with future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.
7. Similarly, we recommend updating the mortality tables for disabled retirees and employees to the appropriate (disabled lives and employee) Pub-2010 mortality table for public safety personnel with future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.

### *Other Demographic Assumptions*

8. We recommend adjustments in the overall termination rates consistent with APRS member experience and future expectations.
9. We recommend adjustments in the overall retirement rates consistent with APRS member experience and future expectations. Retirement rates will reflect the member's expected departure from active service.

10. We recommend the DROP assumption be simplified to assume that members eligible for the Back DROP and the 5-year Forward DROP will select the DROP entry and duration length that provides the greatest economic value. Members only eligible for the 7-year Forward DROP are assumed not to participate in DROP.

*Actuarial Methods and Policies*

11. We recommend continuing to use the asset smoothing method that recognizes each year's gain or loss over a closed five-year period. However, we recommend a small modification to the method to allow for direct offsetting of unrecognized gains and losses.

## **SECTION B**

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### **INTRODUCTION**

# Introduction

A periodic review and selection of the actuarial assumptions is one of many important components of understanding and managing the financial aspects of the Austin Police Retirement System (APRS). Use of outdated or inappropriate assumptions can result in: (1) understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due; or, (2) overstated costs which place an unnecessarily large burden on the current generation of members, employers, and taxpayers.

A single set of assumptions is typically not expected to be suitable forever. As the actual experience unfolds or the future expectations change, the assumptions should be reviewed and adjusted accordingly.

It is important to recognize that the impact from various outcomes and the ability to adjust from experience deviating from the assumption are not symmetric. Due to compounding economic forces, legal limitations, and moral obligations, outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates. That asymmetric risk should be considered when the assumption set, investment policy and funding policy are created. As such, the assumption set used in the valuation process needs to represent the best estimate of the future experience of a retirement plan and be at least as likely, if not more than likely, to overestimate the future liabilities versus underestimate them.

Using this strategic mindset, each assumption was analyzed and compared to the actual experience of APRS and the general experience of other large public employee retirement systems. Changes in certain assumptions and methods are suggested, based upon this comparison, to remove any bias that may exist and to perhaps add in a slight margin for future adverse experience where appropriate. Next, the assumption set, as a whole, was analyzed for consistency and to ensure that the projection of liabilities was reasonable and consistent with historical trends.

The following report provides our recommended changes to the current actuarial assumptions.

## Summary of Process

In determining liabilities and contribution rates for retirement plans, actuaries must make assumptions about the future. Among the assumptions that must be made include:

- Retirement rates
- Mortality rates
- Turnover rates
- Disability rates
- Investment return rate
- Salary increase rates
- Inflation rate

For some of these assumptions, such as the mortality rates, past experience provides important evidence about the future. For others, such as the investment return assumption, the link between past experience and future expectation is much weaker. In either case, actuaries should review the retirement plan's assumptions periodically and determine whether these assumptions are consistent with actual past experience and with future expectation.



While there have been changes to the APRS actuarial assumptions over the years, the analysis appears to be piecemeal in nature and not a comprehensive study of all of the actuarial assumptions. For this experience study, we have reviewed APRS's experience for the five-year period from January 1, 2013 through December 31, 2017.

In conducting experience studies, actuaries generally use data over a period of several years. This is necessary in order to gather enough data so that the results are statistically significant. In addition, if the study period is too short, the impact of the current economic conditions may lead to misleading results. It is known, for example, that the health of the general economy can impact salary increase rates and withdrawal rates. Using results gathered during a short-term boom or bust will not be representative of the long-term trends in these assumptions. Also, the adoption of legislation, such as plan improvements or changes in salary schedules, will sometimes cause a short-term distortion in the experience. For example, if an early retirement window was opened during the study period, we would usually see a short-term spike in the number of retirements followed by a dearth of retirements for the following two-to-four years. Using a longer period prevents giving too much weight to such short-term effects. On the other hand, using a much longer period could obscure real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire.

In an experience study, we first determine the number of deaths, retirements, etc. that occurred during the period. Then we determine the number expected to occur, based on the current actuarial assumptions. The number of "expected" decrements is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. For example, let's look at a rate of retirement of 15% at age 55. The number of exposures can only be those members who are age 55 and eligible for retirement at that time. Thus they are considered "exposed" to that assumption. Finally, we calculate the A/E ratio, where "A" is the actual number (of retirements, for example) and "E" is the expected number. If the current assumptions were "perfect", the A/E ratio would be 100%. When it varies much from this figure, it is a sign that new assumptions may be needed. (However, in some cases we prefer to set our assumptions to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Of course we not only look at the assumptions as a whole, but we also review how well they fit the actual results by gender, by age, and by service.

If the data leads the actuary to conclude that new tables are needed, the actuary may "graduate" or smooth the results, since the raw results can be quite uneven from age to age or from service to service.

Please bear in mind that, while the recommended assumption set represents our best estimate, there are other reasonable assumption sets that could be supported. Some reasonable assumption sets would show higher or lower liabilities or costs.

## Section E Exhibits

The exhibits in Section E should generally be self-explanatory. For example, on page E-1, we show an exhibit analyzing the termination rates by years of service. The second column shows the total number of members who terminated during the study period. This excludes members who died, became disabled or retired. Column (3), labeled "Total Count" shows the total exposures of this group. This is the number of members who meet the criteria who could have terminated during any of the years. On this exhibit, the exposures exclude anyone eligible for retirement. A member is counted in each year they could have terminated, so the total shown is the total exposures for the experience period. Column (4) shows the probability of termination based on the raw data. That is, it is the result of dividing the actual number of terminations (col. 2) by the number exposed (col. 3). Column (6) shows the new recommended termination rates. Column (8)

shows the expected number of terminations based on the proposed termination assumptions. Column (10) shows the Actual-to-Expected ratios under the proposed termination assumptions.

## SECTION C

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### **ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS**

# Analysis of Experience and Recommendations

We will begin by discussing the economic assumptions: inflation, the investment return rate, the general wage increase assumption, the salary increase assumption for individuals, cost-of-living increases if applicable, and the payroll growth rate used for projecting total contributions. Then we will discuss the demographic assumptions: mortality, disability, termination and retirement. Finally we will discuss the actuarial methods used.

## Actuarial Standards of Practice for Setting Economic Assumptions

Actuarial Standards of Practice (ASOP) No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries on giving advice on selecting economic assumptions for measuring obligations for defined benefit plans. ASOP No. 27 was revised and adopted by the Actuarial Standards Board (ASB) in September 2013.

As no one knows what the future holds, it is necessary for an actuary to estimate possible future economic outcomes. Recognizing that there is not one right answer, the current standard calls for an actuary to develop a reasonable economic assumption. A reasonable assumption is one that is:

1. appropriate for the purpose of the measurement,
2. reflects the actuary's professional judgment,
3. takes into account historical and current economic data that is relevant as of the measurement date,
4. an estimate of future experience; an observation of market data; or a combination thereof, and
5. has no significant bias except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

However, the standard explicitly advises an actuary not to give undue weight to recent experience.

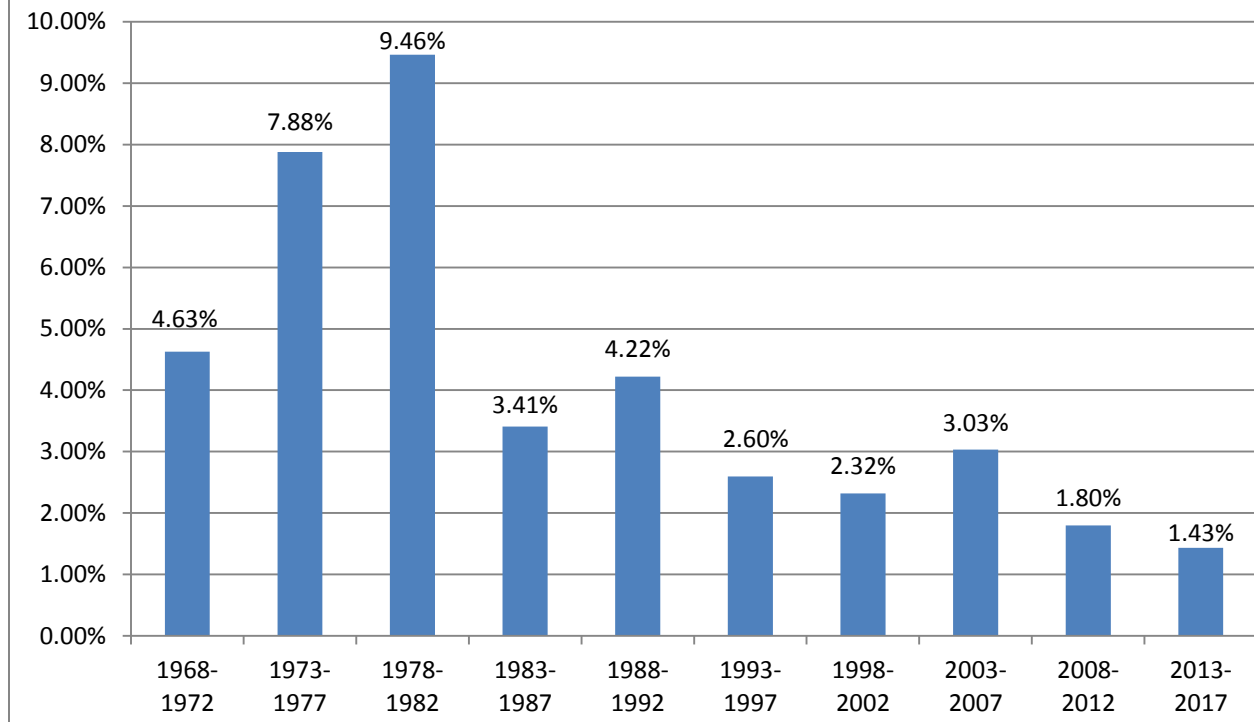
Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. Generally, the economic assumptions are much more subjective in nature than the demographic assumptions.

## Inflation Assumption

By "inflation," we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies most of the other economic assumptions. It can impact investment return, salary increases, and overall payroll growth. The current annual inflation assumption is 3.00%.

The following chart shows the average annual inflation, as measured by the increase in the Consumer Price Index (CPI-U), in each of the ten consecutive five-year periods over the last fifty years.

## Average Annual Inflation CPI-U, Five-Year Averages (December 31),



Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted, Calendar Years

The table below shows the average inflation over various periods, ending December 2017.

Periods Ending Dec. 2018	Average Annual Increase in CPI-U
Last five (5) years	1.43%
Last ten (10) years	1.61%
Last fifteen (15) years	2.08%
Last twenty (20) years	2.14%
Last twenty-five (25) years	2.23%
Last thirty (30) years	2.56%
Since 1913 (first available year)	3.13%

Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted

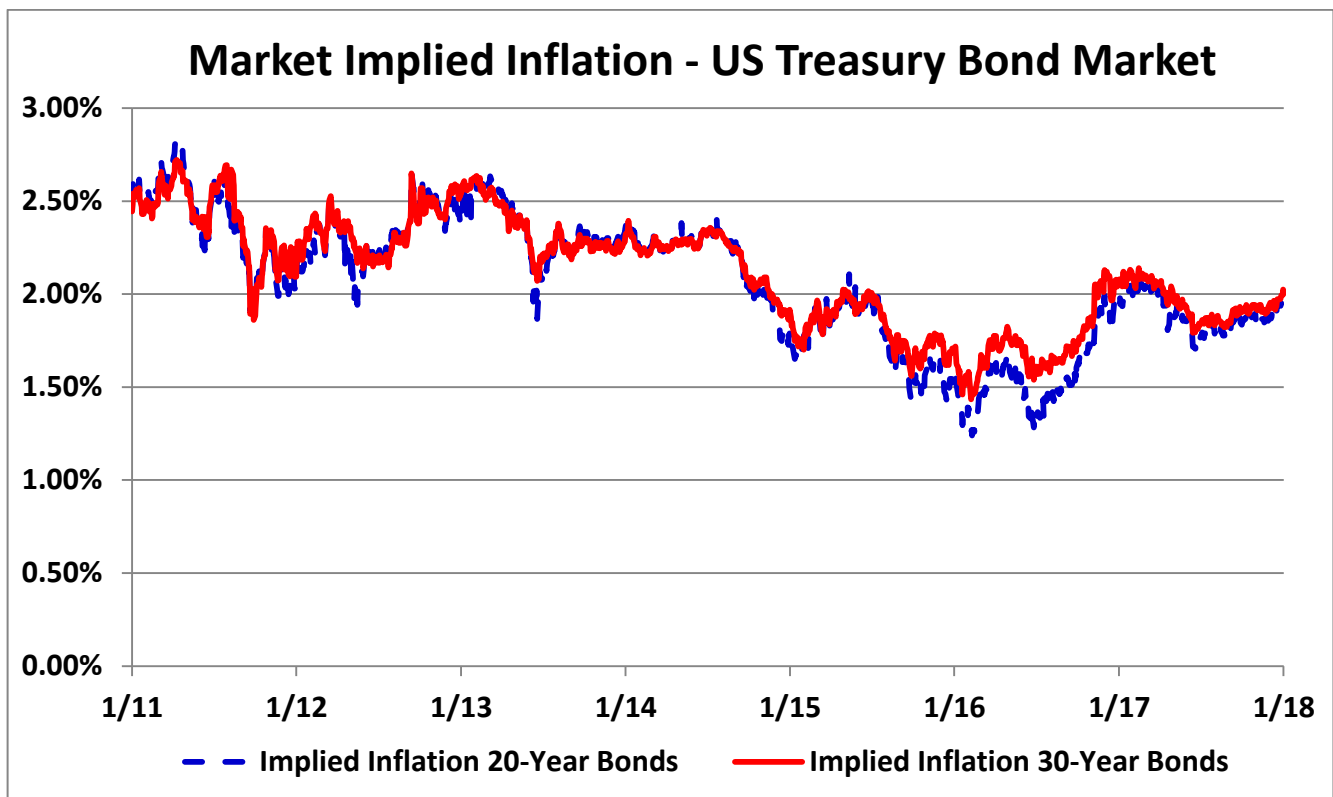
As you can see, inflation has been relatively low over the last twenty-five years and historically low over the past 10 years.

## Forecasts from Investment Consulting Firms

We examined the 2018 capital market assumption sets for twelve investment consulting firms with short-term (approximately 10-year) forecasts and the average assumption for inflation was 2.20%, with a range of 1.95% to 2.50%. Similarly, we examined the 2018 capital market assumption sets for three investment consulting firms with long-term (approximately 20-year) forecasts and the average assumption for inflation was 2.42%, with a range of 2.20% to 2.75%. All but one of the investment consulting firms in our survey, in setting their capital market assumptions, currently assumes that inflation will be 2.50% or less.

## Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. Simplistically, the difference in yield between non-indexed and indexed treasury bonds should be a reasonable estimate of what the bond market expects on a forward looking basis for inflation. As of the end of December 2017, the difference for 20-year bonds implies that inflation over the next twenty years would average 1.95%. The difference in yield for 30-year bonds implies 2.00% inflation over the next 30 years. The chart below shows the historical market implied inflation from January 1, 2011 through December 31, 2017.



However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS.

## Forecasts from Social Security Administration

In the Social Security Administration's 2018 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.6% under the intermediate cost assumption. This remained

unchanged from 2017 but three years prior, the Chief Actuary for the Social Security Administration reduced this assumption by 0.10% from the prior year and also narrowed the low cost and high cost scenarios to 2.0% and 3.2%, respectively.

### Survey of Professional Forecasters and Fed Policy

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. A recent forecast (third quarter of 2018) was for inflation over the next ten years (2019 to 2028) to average 2.20%.

Additionally, the Fed has openly stated that they have a target 2.00% inflation rate.

### Recommendation

As a result, we are recommending lowering the assumption to 2.50%. This change will bring the assumption closer to recent inflation levels and closer to the levels expected in the financial markets. As you will see, this change also affects the expectation for all other economic assumptions.

## **Investment and Administrative Expenses**

Since the trust fund pays expenses in addition to member benefits and refunds, we must develop an assumption about the level of future expenses. Almost all actuaries treat investment-related expenses as an offset to the investment return assumption. That is, the investment return assumption represents the expected return after payment of investment-related expenses.

In regards to investment-related expenses, investment consulting firms periodically issue reports that describe their capital market assumptions. The estimates for core investments (i.e., fixed income, equities, and real estate) are generally based on anticipated returns produced by passive index funds that are net of investment-related fees. The investment return expectations for an alternative asset class such as private equity and hedge funds are also net of investment expenses. Therefore, we did not make any explicit adjustments to account for investment-related expenses. Some of the retirement plans may also employ active management investment strategies that result in higher investment expenses compared to strategies that invest in passive index funds. We have assumed that active management strategies would result in the same returns, net of investment-related expenses, as passive management strategies.

On the other hand, there are a variety of acceptable approaches used to incorporate administrative expenses into the annual cost of a retirement plan. Some actuaries make an assumption that administrative expenses will be some fixed or increasing dollar amount. Others assume that the administrative expenses will be some percentage of the plan's actuarial liabilities or normal cost. And others treat administrative expenses like investment expenses, as an offset to the investment return assumption. For APRS, the practice has been to net the anticipated administrative expenses out of the anticipated investment return for the year. In other words the investment return assumption is net both of administrative expenses and investment expenses.

The table below shows the dollar amount of the administrative expenses for the past five years, the administrative expenses as a percentage of the average assets for the year, as well as a percentage of the payroll for the year.

Year ending December 31 <sup>st</sup>	2017	2016	2015	2014	2013
Average invested assets	727,747,503	665,097,200	641,096,602	616,564,735	567,004,026
Prior year valuation payroll	163,894,324	155,832,755	152,544,227	147,138,718	141,561,047
Administrative Expenses (AE)	1,562,685	1,396,736	1,465,939	1,327,071	1,114,856
AE as percentage of average invested assets	0.21%	0.21%	0.23%	0.22%	0.20%
AE as percentage of payroll	0.95%	0.90%	0.96%	0.90%	0.79%

The administrative expenses have reduced the rate of return by an average 0.21% over the past five years. Over the same five year period the administrative expenses have average 0.90% as a percentage of payroll.

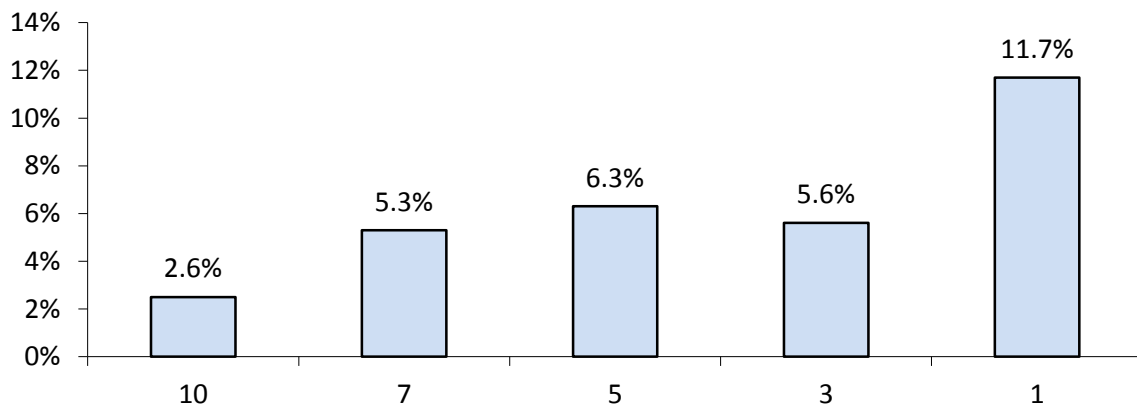
It is our preferred approach to add in an explicit assumption for administrative expenses into the Actuarially Determined Employer Contribution (ADEC) rate for the upcoming year. Including the administrative expenses as an explicit element of the ADEC maximizes transparency, aligns better with the standards of the Governmental Accounting Standards Board, and maintains a parallel between the actual investment returns used by the investment consultant and the actuary.

Our recommendation is to add an explicit assumption for administrative expenses of 0.90% of payroll into the ADEC. Included in this assumption would be any administrative expenses associated with the proportionate retirement program, which currently add 0.017% of payroll to the ADEC.

## Investment Return Rate

The investment return assumption is one of the principal assumptions used in any actuarial valuation of a retirement plan. It is used to discount future expected benefit payments to the valuation date in order to determine the liabilities of the plans. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates. Currently, it is assumed that future investment returns will average 7.70% per year, net of investment-related expenses and administrative expenses.

The chart below shows the annualized history of APRS market returns for rolling periods ending December 31, 2017.



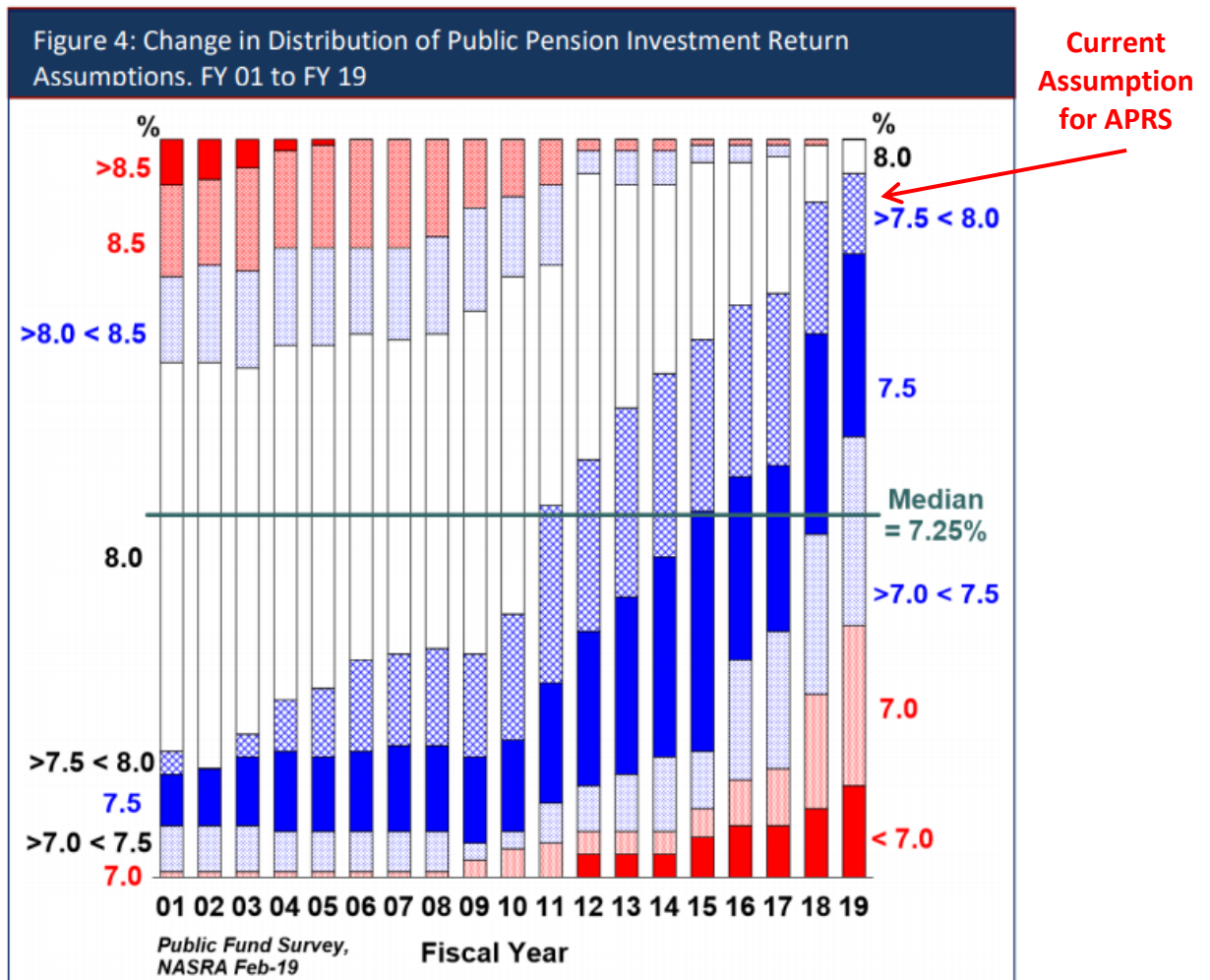
For this assumption, past performance, even averaged over a twenty-five year period, is not a reliable indicator of future performance. The current asset allocation of the trust fund will significantly impact the overall performance, so returns achieved under a different allocation are not as meaningful.



More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a twenty-five year period is not long enough to provide reasonable guidance. There are strong reasons to believe the next twenty-five years will be different than the last twenty-five, in large part because current bond yields are significantly lower than they were twenty-five years ago.

Assumption Comparison to Peers

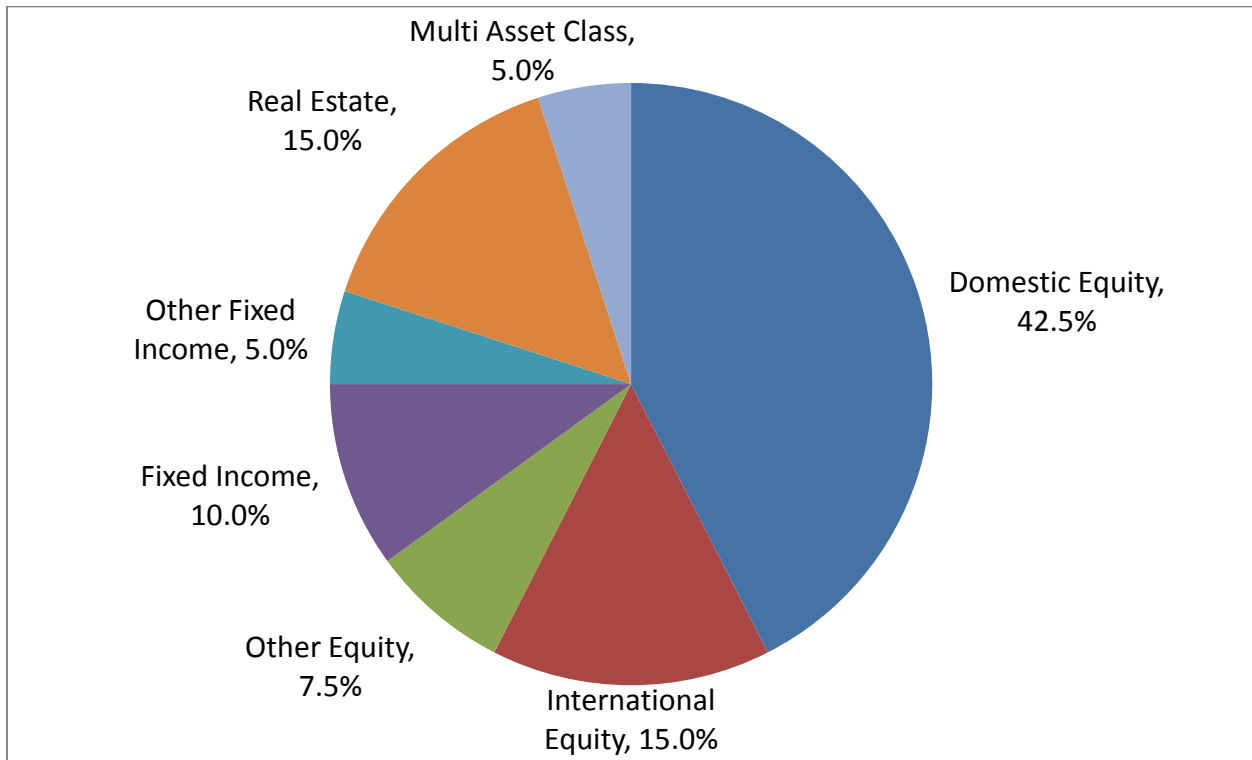
We do not recommend the selection of an investment return assumption based on prevalence information. However, it is still informative to identify where the investment return assumption for APRS is compared to its peers. The chart below shows the distribution of the investment return assumptions in the National Association of State Retirement Administrators (NASRA) survey as of February 2019. It is important to note that variation among survey responses may result from differences in portfolio structures, investment policies, funding policies, and risk tolerance.



As indicated in the table, the most recent survey results indicate that the median investment return assumption is now 7.25%. The chart also indicates that the median investment return assumption was 8.00% just nine years earlier. The national trend has clearly been a shift to lower investment return assumptions over the past 10 years, consistent with the decline in the capital market expectations from investment professionals and economists.

## Asset Allocation

We believe the most appropriate approach to selecting an investment return assumption is to identify expected returns given the funds' target asset allocation mapped to forward-looking capital market assumptions. Below is a summary of the current target asset allocations for APRS.



We have applied the APRS target asset allocation to the forward-looking return expectations developed by several investment consulting firms and industry surveys.

Most investment consultants provide return expectations with a 7 to 10 year time horizon, which we would describe as a "shorter time horizon" when discussing investing of pension plan assets. The first table below shows 12 sets of "shorter time horizon" expectations based on the APRS target asset allocation and our recommended 2.50% inflation assumption. As shown in the table, the average expected arithmetic return for the portfolio is 6.9%, with a range of outcomes from 5.9% to 8.3%.

We did receive return expectations based on a "longer time horizon" of 20-30 years from three investment consultants. The second table shows the "longer time horizon" expectations based on the APRS target asset allocation and our recommended 2.50% inflation assumption. As shown in the table, the average expected arithmetic return for the portfolio is 7.5%, with a range of outcomes from 7.2% to 7.8%.

**Shorter Time Horizon**

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)-(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)
(1)	(2)	(3)	(4)	(5)	(6)
1	5.58%	2.20%	3.38%	2.50%	5.88%
2	6.10%	2.26%	3.84%	2.50%	6.34%
3	6.18%	2.21%	3.97%	2.50%	6.47%
4	6.50%	2.50%	4.00%	2.50%	6.50%
5	6.51%	2.50%	4.01%	2.50%	6.51%
6	6.17%	2.00%	4.17%	2.50%	6.67%
7	6.41%	2.00%	4.41%	2.50%	6.91%
8	6.76%	2.31%	4.45%	2.50%	6.95%
9	6.82%	2.25%	4.57%	2.50%	7.07%
10	7.14%	2.26%	4.88%	2.50%	7.38%
11	6.91%	1.95%	4.96%	2.50%	7.46%
12	7.78%	2.00%	5.78%	2.50%	8.28%
<b>Average</b>	<b>6.57%</b>	<b>2.20%</b>	<b>4.37%</b>	<b>2.50%</b>	<b>6.87%</b>

**Longer Time Horizon**

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)-(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)
(1)	(2)	(3)	(4)	(5)	(6)
1	7.01%	2.31%	4.70%	2.50%	7.20%
2	7.11%	2.20%	4.91%	2.50%	7.41%
3	8.07%	2.75%	5.32%	2.50%	7.82%
<b>Average</b>	<b>7.40%</b>	<b>2.42%</b>	<b>4.98%</b>	<b>2.50%</b>	<b>7.48%</b>

However, both of these tables show the one-year expectation which ignores the impact of volatility. As a simple example of volatility we can use a two-year period where in the first case the rate of return over each one-year period is 7.50%. Then the arithmetic return is 7.50%  $[(7.50\% + 7.50\%)/2 = 7.50\%]$  as is the compound return  $[(1.075 \times 1.075)^{(1/2)} - 1 = 7.50\%]$ . In the second case we will subtract 7.50% from the first year and add 7.50% to the second year so that we still have a 7.50% arithmetic return  $[(0.00\% + 15.00\%)/2 = 7.50\%]$ . However, now the compound return changes to 7.24%  $[(1.00 \times 1.15)^{(1/2)} - 1 = 7.24\%]$ .

One must only look at the last ten years of actual returns of APRS to see that returns on investments are not smooth from year to year and therefore volatility must be considered when selecting the assumption. So if we use the same capital market expectations that produce the arithmetic return of 7.50% shown above for the “longer term horizon”, and determine a compounded return over a 20-year time horizon, the average expected compound return is only 6.7%.

We have also compared these outcomes to a larger collection of expectations by other investment consulting firms by utilizing a report issued by Horizon Actuarial Services, LLC (2018 Edition), which compiles and averages the return and risk forecasts of 34 major investment consulting firms. Based on the information, the survey produces an average expected compound return over a 20-year period of 7.1%.

### Recommendation

Based on this analysis, we recommend the Board reduce the investment return assumption to 7.25%. This would be closer to levels currently expected by a broad survey of investment professionals and the current APRS portfolio. This would be comprised of a 4.75% real return, net of investment-related expenses, and a 2.50% inflation assumption.

## **Salary Increase Rates for Individuals**

In order to project future benefits, the actuary must project future salary increases. Salaries may increase for a variety of reasons:

- Across-the-board increases for all employees;
- Across-the-board increases for a given group of employees;
- Increases to a minimum salary schedule;
- Additional pay for additional duties;
- Step or service-related increases;
- Increases for acquisition of advanced degrees or specialized training;
- Promotions;
- Overtime;
- Bonuses, if available; or
- Merit increases, if available.

Our salary increase assumption is meant to reflect all of these kinds of increases to the extent that they are included in the pay used to determine contributions or plan benefits.

The actuary should not look at the overall increases in payroll in setting this assumption, because payroll can grow at a rate different from the average pay increase for individual members. There are two reasons for this. First, when older, longer-service employees terminate, retire or die, they are generally replaced with new employees who have a lower salary. Because of this, in most populations that are not growing in size, the growth in total payroll is smaller than the average pay increase for members. Second, payroll can change due to an increase or decrease in the size of the group. Therefore, to analyze salary increases, we examine the actual increase in salary for each year and for each member who is active in two consecutive fiscal years.

We looked at the salaries provided for all members who were active at the start and the end of an experience year, for the experience study period.

Most actuaries recommend salary increase assumptions that include an element that depends on the member's age or service, especially for large retirement systems. They assume larger pay increases for younger or shorter-service employees. This is done in order to reflect pay increases that accompany changes in job responsibility, promotions, demonstrated merit, steps, etc. As would be expected with the service based step-rate salary schedules, the experience shows salaries continue to be more closely correlated to service (rather than age). For APRS, the salary increase rates are currently a one-dimensional table based on APRS service.

The salary scale is composed of four pieces: price inflation, a general productivity component, a merit piece, and a service-based step-rate. Our recommended price inflation assumption is 2.50%, as discussed earlier. The productivity component represents the real wage growth over time in the general economy. The merit component is any additional salary increase of the longer-service employees (which could come from individual merit and promotions). The service-based component is the expected salary increase of the shorter-service members that is above this level. All four pieces are assessed independently and then added together to develop the ultimate salary schedule.

### Productivity and Merit

The productivity component represents the real wage growth over time in the general economy, or, is the assumption on how much the payroll schedules themselves will change year to year, not necessarily how much the pay increases received by individuals are, or even necessarily how the payroll in total may change, which can be impacted by population changes, etc. This assumption should be applicable to a local economy, not necessarily one group inside a retirement plan. Nominally, the sum of price inflation and general productivity would be considered a General Wage Inflation (GWI).

Historically, GWI has almost always exceeded price inflation. This is because wage inflation is in theory the result of (a) price inflation, and (b) productivity gains being passed through to wages. Since 1951, for the national economy as a whole, wage inflation has been about 1.00% larger than price inflation each year. For the last 10 years, for the national economy as a whole, wage inflation has been 2.67%, outpacing price inflation by about 0.61%. The current real productivity growth assumption for APRS is 0.25% in addition to the current price inflation assumption of 3.0%, or a nominal 3.25% GWI assumption.

To determine the merit component, we first calculated the average increase over the study period for members grouped by service. Members with approximately 20 or more years of service were selected because after that point the salary increase did not vary significantly with additional service.

The current assumption for pay increases for members with 20+ years of service is currently 3.25%, meaning no allowance for merit. Using data from 2012-2017, the average actual increase for APRS members with 20+ years of service is summarized in the table below. With the understanding that actual inflation during that period has been 1.43%, the actual productivity and merit for this group was closer to 0.50%, approximately double the current assumption.

	<b>Increases for 20+ Years of Service</b>	<b>Inflation</b>	<b>Net Productivity and Merit</b>
Police Officers	1.92%	1.43%	0.49%

Based on this experience, we are recommending a nominal ultimate 3.00% salary scale, made up of the 2.50% inflation component, the 0.50% general productivity component.

The next step is to add in the actual service-based step-rate increases. We are recommending using the step-rate increases from the recently adopted bargaining agreement. While the bargaining agreement is not a long-term agreement, the step-rates in this agreement are consistent with the step-rates in prior agreements and therefore we believe the proposed step-rates are a reasonable estimation for future agreements. Page E-3 includes a detailed summary of the salary increase experience.

Finally, as you are aware, there are two types of academy classes, the “Regular Academy” class and the “Modified Academy” class. Depending upon which type of class a cadet participated in, the amount of the pay increase for graduating from cadet to officer and the timing of the first step two step increases can be significantly different. We are recommending that the salary increase assumption reflect the type of academy in determining the pay increase for graduating and the timing of the first two step increases.

Recommendation

In addition to the nominal 3.00% ultimate salary scale assumption noted above, we recommend the use of the most recently adopted service based step-rates and reflecting the academy type in determining the size and timing of pay increases during the first few years of service. The full schedule is shown in Section D of this report.

**Payroll Growth Rate**

The salary increase rates discussed above are assumptions applied to individuals. They are used in projecting future benefits. There also may be an overall payroll growth assumption, currently 4.00%, in projecting aggregate payroll growth for a specific retirement system. In theory, payroll growth in the absence of membership growth should approximate the GWI assumption. However, adjustments may be made based on the demographics of the individual population.

The payroll growth rate is used in determining the contributions needed to amortize the unfunded actuarial accrued liability. The amortization payments may be calculated to be a level percentage of payroll, so as payroll increases over time, these contributions also increase. Thus, the amortization percentage is dependent on the rate at which payroll is assumed to increase.

Total payroll for APRS has grown on average 1.0% over the last 9 years, net of population growth, during a time when inflation was 1.8%. Thus, payroll has grown slower than inflation if population growth is factored out.

Period	Total Payroll Growth	Membership Growth	Net Growth	Actual Inflation
Last 15 Years	N/A	2.6%	N/A	N/A
Last 9 Years	3.2%	2.2%	1.0%	1.8%
Last 5 Years	3.0%	1.8%	1.2%	1.4%

While we do not expect that trend to continue long term it does give us pause when selecting this assumption. Therefore, we are recommending that APRS select a payroll growth assumption of 3.00%, which is equal to the salary increase assumption for long service employees. This assumption does not include a provision for membership growth.

## Actuarial Standards of Practice for Setting Demographic Assumptions

Actuaries are guided by the Actuarial Standards of Practice (ASOP) adopted by the Actuarial Standards Board (ASB). One of these standards is ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting noneconomic assumptions for measuring obligations under defined benefit plans. We believe the recommended assumptions in this report were developed in compliance with this standard.

### Post-Retirement Mortality Rates

APRS' actuarial liabilities and necessary contribution rates depend in large part on how long retirees live. If members live longer than expected, benefits will be paid for a longer period of time and the liability and necessary contribution rates will be larger than expected.

The mortality table currently being used for healthy retirees is based on the RP-2000 Combined Healthy Mortality Table without mortality improvement projection.

### Credibility

When choosing an appropriate mortality assumption, actuaries typically use standard mortality tables, unlike when choosing other demographic assumptions. They may choose to adjust these standard mortality tables, however, to reflect various characteristics of the covered group, and to provide for expectations of future mortality improvement (both up to and after the measurement date). If the plan population has sufficient credibility to justify its own mortality table, then the use of such a table also could be appropriate. Factors that may be considered in selecting and/or adjusting a mortality table include the demographics of the covered group, the size of the group, the statistical credibility of its experience, and the anticipated rate of future mortality improvement.

We first measured the credibility of the dataset to determine whether standard, unadjusted tables should be used or if statistical analysis of APRS specific data was warranted. Based on a practice note issued by the American Academy of Actuaries in the Fall of 2011, a dataset needs 96 expected deaths for each gender to be within +/- 20% of the actual pattern with 95% confidence. We believe +/- 20% is a rather large range to be considered fully credible. Other sources state higher requirements, such as 1,000 deaths per gender which is generally our rule-of-thumb.

The following table gives the number of deaths needed by gender to have a given level of confidence that the data is +/- X% of the actual pattern.

Number of Deaths Needed for a Given Confidence Level					
Confidence	99%-101%	97-103%	95%-105%	90%-110%	80%-120%
75%	4,543	505	182	45	11
80%	16,435	1,826	657	164	41
90%	27,060	3,007	1,082	271	68
95%	38,416	4,268	1,537	384	96
99%	66,358	7,373	2,654	664	166

Using this information, 1,082 deaths are needed by gender to have 90% confidence that the data is within +/- 5% of the actual pattern. For the period January 1, 2013 through December 31, 2017, APRS experienced 36 male and 3 female healthy retiree deaths. As a result, the mortality experience for APRS has no credibility for setting a plan-specific mortality assumption. Even though we will not base our assumption on plan experience it is worth noting that the current assumption anticipated approximately 47 deaths during the period which is almost 25% higher than the actual number of deaths. Industry best practice is to use a benefit weighted approach as analysis has shown that longevity is strongly correlated with income and a benefit-weighted approach is a much better predictor of how liabilities will run off over time. It is also a best practice to assume future mortality improvement. Our recommended assumption will reflect both of these best practices.

### **Recommended Base Mortality Assumption**

In January, 2019, the Society of Actuaries (SOA) published a report titled Pub-2010 Public Retirement Plans Mortality Tables. With this report, the SOA published a new set of mortality tables for U.S. public pension plans, referred to as the Pub-2010 Mortality Tables, which marked the first time the SOA has studied public retirement plan mortality separately from the private sector. These new tables include the individual mortality experience for teachers, public safety professionals and general employees.

While there is no requirement for APRS to update to these new tables, best practice is to give serious consideration to the newest published tables unless there is a compelling reason to not do so. Consideration of the new Pub-2010 tables is further reinforced by the fact that these new tables were specifically constructed for public employee pension plans.

Although not fully credible, applying the Pub-2010 Mortality Tables for public safety professionals produces a benefit-weighted A/E ratio of 1.05 for APRS over the experience period studied, a much better match than the current assumption.

We recommend the healthy retiree mortality tables published in the Pub-2010 Public Retirement Plans Mortality Tables Report for public safety personnel (PubS-2010) with future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.

### **Recommended Mortality Improvement Assumption**

The current mortality assumption uses a static mortality approach. In other words, no improvement in mortality is assumed. However, current best practice is to build in mortality improvement on a fully generational approach. Because of this strategy of building in continuous improvement, life expectancies for today's younger active members are expected to be materially longer than those of today's retirees, and this has a significant impact on costs and liabilities. Further, this fully generational projection approach provides a gradual and consistent improvement over time which is incorporated into the valuation process.

In October 2014, RPEC issued final reports of the mortality study that was originally initiated in 2010. These final reports included the release of another mortality improvement assumption, Scale MP-2014. A significant difference between the MP-2014 improvement scales and the prior improvement scales is that the MP tables are a two-dimensional improvement assumption that is a function of the age and calendar year, whereas prior scales were only a function of age.



Each year from 2015 through 2018, the RPEC issued updates to the mortality improvement assumption called Scale MP-2015, Scale MP-2016, etc. MP-2015 reflected an additional two years of mortality experience, MP-2016 reflected an additional three years of mortality experience, and so on. In each update, rates of projection were decreased (materially decreased in certain years), meaning the original MP-2014 table was found to be too conservative. In addition, it has been stated that new projection scales are going to be published each year.

After approximately 15 years into the projection of the mortality rates, all five MP mortality projection tables reflect the same improvement rate at each future calendar year (the ultimate mortality improvement rates). In order to balance the two objectives of reflecting the most recent data available, while maintaining stability of results from year to year, GRS is recommending the use of the ultimate mortality improvement rates in the MP tables for all years.

## Disabled Mortality Rates

There are even fewer disable retiree deaths than healthy retiree deaths. For the period January 1, 2013 through December 31, 2017, APRS experienced one disabled retiree death. As a result, the mortality experience for APRS has no credibility for setting a plan-specific mortality assumption.

The current assumption is the same as the healthy mortality assumption. While using a healthy mortality assumption for disabled mortality is a conservative approach, we recommend the adoption of the disability mortality tables published in the Pub-2010 Public Retirement Plans Mortality Tables Report for public safety officers (PubS-2010) with future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.

## Active Mortality Rates

For the period January 1, 2013 through December 31, 2017, APRS experienced six total active member deaths. As a result, the mortality experience for APRS has no credibility for setting a plan-specific mortality assumption.

We recommend the employee mortality tables published in the Pub-2010 Public Retirement Plans Mortality Tables Report for public safety officers (PubS-2010) with future mortality improvements modeled using the ultimate mortality improvement rates in the MP tables.

## Disability Rates

Disability incidence is a minor assumption with a relatively small impact on the actuarial valuation as the occurrence of disability is significantly less frequent than termination and retirement. Even though the occurrence is somewhat infrequent, many times the value of the benefit for the disabled member can be significant. However, in the history of APRS there have been very few disabilities. There are a total of two current disabled retirees and there have been no new disabilities during the five year study period. Without actual experience to evaluate the assumption, it is difficult to develop disability rates to accurately predict the experience.

We did review the disability rates recently adopted by the Texas Municipal Retirement System (TMRS) whose data set is large enough to provide credible disability rates. The projected number of disabilities based on the TMRS assumptions is not significantly different than the current APRS assumptions. However,

the TMRS disability rates are based on a broad study of a population relevant to APRS. As a result, we recommend their adoption for APRS. With no experience to suggest otherwise, we will continue to assume that 55% of disabilities are duty related.

## Retirement Rates

The valuation currently assumes that retirement rates for members eligible for Normal Retirement vary by age and the member's age at entry into APRS. For this experience study, retirement rates were studied based on the rate that members left active service, regardless of whether the member participated in DROP prior to retirement. This approach results in retirement rates that most accurately reflect the working career of the members.

As indicated by the following table, members eligible for Normal Retirement retired faster and earlier than predicted by the current assumptions.

Period Studied	Expected Retirements	Actual Retirements	A/E Ratio
2013-2017	167	238	1.42

The current assumption is overly complicated and is not predicting accurate outcomes. Therefore, we are recommending changes. First, we recommend condensing the retirement rates into two sets. The first set will be based on service and will apply to members who first become eligible to retire at age 55 or earlier. The second set of rates will be age based and will apply to members who first became eligible to retire after age 55. Further, we recommend increasing both sets of retirement rates to produce a number of expected retirements considerably closer to the number of actual retirements during the period. In order to provide a reasonable margin for conservatism, we generally recommend retirement rates that would result in an A/E ratio of around 90%. However, we also want to provide some credibility to the current retirement rate assumption, which are based on past plan experience. Therefore, we recommend moving the rates significantly but not all the way to where the experience might have indicated. The proposed rates produce an A/E ratio of 1.02.

Page E-2 includes a detailed summary of the retirement rate experience. The final schedules are shown in Section D of this report.

## Termination Rates

Termination rates reflect members who leave for any reason other than death, disability or service retirement. They apply whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit in APRS. The current termination rates are based on years of service.

The current assumptions produce an A/E ratio of 140%. In other words, the number of actual terminations is 40% greater than the number of expected terminations.

In order to provide a reasonable margin for conservatism, we generally recommend termination rates that would result in an A/E ratio of 105% to 110%. Therefore, we are recommending increasing the rates of termination to bring the A/E ratio more in line with that level. Page E-1 includes a detailed summary of the termination rate experience. The final schedules are shown in Section D of this report.

## **DROP Participation**

Active members who have completed 23 years of service may elect to participate in the Deferred Retirement Option Plan (DROP). Members electing DROP essentially receive a smaller monthly benefit and a lump sum at retirement in lieu of a larger monthly benefit (and no lump sum). There were significant changes made to the DROP during the study period. The Back DROP has been closed except for a small number of grandfathered members. The 5-year Forward DROP is also only available for a small number of grandfathered members. All members are eligible for the new 7-year forward DROP. However, this DROP was designed to be cost neutral to APRS and is much less generous than the grandfathered DROP programs.

The current assumption for the grandfathered members eligible for both the Back DROP and the 5-year Forward DROP is that 25% of the members will not participate in DROP and that different percentages of the remaining members will elect to participate in the Back DROP or the 5-year Forward DROP based on their years of service at retirement. If a member participates in DROP it is assumed they will elect the maximum DROP period they are eligible for. Members eligible for the new 7-year Forward DROP are valued assuming they did not participate in DROP. We have analyzed the alternative DROP programs and have concluded that the Back DROP and 5-year Forward DROP provide members with a benefit that is more valuable than the standard annuity. We have also determined that in most cases the 7-year Forward DROP provides less value than the standard annuity (a member would need to participate in all 7 years of DROP and have approximately 90+ years combined of age and service for the 7-year Forward DROP to provide more value).

Given the small number of members eligible for the grandfathered DROP programs we are recommending that we use a greatest economic value approach. In other words, the decision on whether a member will participate in DROP and the length of time they participate will be based on which ever option provides them the greatest economic value (based on the actuarial assumptions). For members only eligible for the new 7-year Forward DROP, we recommend continuing the current assumption that no one will participate. Member participation in the 7-year Forward DROP should most often provide actuarial gains to APRS. We will continue to monitor future experience of the 7-year Forward DROP to make sure that this assumption is reasonable.

## **Other Assumptions**

There are other assumptions made in the course of a valuation, such as the percentage of members who are married, the age difference between husbands and wives, the likelihood that a terminating employee will take a refund, etc. We have recommended what we believe to be the most reasonable assumption and have noted if these are a new recommendation or a continuation of the current assumption.

### **Withdrawal of Employee Contributions**

Members that terminate with a vested benefit are assumed to choose the most valuable option available to them at the time of termination: withdrawal of contributions or deferred annuity. Non-vested members are assumed to receive an immediate refund of their contributions. We recommend continuing these assumptions.

### **In Line of Duty Disability**

55% of disablements are assumed to be line of Duty. Given the lack of experience, we believe this is a reasonable assumption and we recommend maintaining this assumption.

## **Marital Assumptions**

We recommend maintaining the current assumption for percent married and age differences.

## **Decrement Timing**

Currently all decrements – mortality, service retirement, disability, and termination of employment for reasons other than death disability or retirement – are assumed to occur at the beginning of the valuation year. While there can be plan design features that result in retirement (and sometimes) termination occurring during specific times of the year, it does not appear to be the case with APRS. While December and January are the most common months of retirement the average calendar month of retirement occurs in July. Furthermore, disability and death are almost always random in nature which is best represented by middle of the year decrement timing. Therefore, we are recommending changing the decrement timing to middle of the year.

## **Actuarial Methods**

### **Actuarial Cost Method**

We recommend continuing the use of the Individual Entry Age Normal (IEAN) actuarial cost method. IEAN will generally produce level contribution amounts for each member as a percentage of salary from year to year and allocate costs among various generations of taxpayers in a reasonable manner. It is by far the most commonly used actuarial cost method for large public retirement systems and the method used for accounting disclosures under GASB Statement No. 67.

### **Asset Valuation (Smoothing) Method**

The purpose of asset smoothing is to reduce short-term volatility in actuarial valuation results which are intended for long-term decision making and funding. Periods of poor returns are often followed by some amount of recovery or vice versa, and a market value (unsmoothed) approach, may result in overreaction to short-term market volatility.

Currently, the actuarial value of assets is equal to the market value of assets less a five-year phase-in of the Excess (Shortfall) between expected investment return and actual income on the market value of assets. We continue to believe this method is appropriate. It does not distinguish between types of return (interest, dividends, realized gains/losses, and unrealized gains/losses) like some other methods. It treats different asset classes and different investment styles the same. We do not believe the method has a bias relative to market. In other words, we expect the ratio of the AVA to MVA to average about 100% over the long term. We believe this method does a good job of smoothing asset gains and losses, and reduces fluctuations in the actuarial metrics.

We recommend one enhancement to the current five-year smoothing method. Specifically, if an offsetting gain or loss occurs in a future valuation, the proposed method would accelerate the recognition of offsetting gains or losses so that all offsetting gains and losses are immediately recognized. This method has the benefit of ensuring that any individual gain or loss is recognized in a reasonable timeframe, while eliminating the artificial volatility that is introduced from the more traditional asset smoothing methods.

## **SECTION D**

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### **SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS**

# Summary of Actuarial Assumptions and Methods Incorporating the Recommended Assumptions

## I. Valuation Date

The valuation date is December 31 of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

## II. Actuarial Cost Method

The actuarial valuation is used to determine the adequacy of the current City contribution rate, describe the current financial condition of APRS, analyze changes in the condition of APRS, and provide various summaries of the data.

The actuarial valuation uses the Entry Age Normal (EAN) actuarial cost method. Under this method, the first step is to determine the contribution rate (level as a percentage of pay) required to provide the benefits to each member, or the normal cost rate. The normal cost rate consists of two pieces: (i) the member's contribution rate, and (ii) the remaining portion of the normal cost rate which is the employer's normal cost rate. The total normal cost rate is based on the benefits payable to each individual active member.

The Unfunded Actuarial Accrued Liability (UAAL) is the liability for future benefits which is in excess of (i) the actuarial value of assets, and (ii) the present value of future normal costs. The employer contribution provided in excess of the employer normal cost is applied to amortize the UAAL.

The funding period is calculated as the number of years required to fully amortize the UAAL, and is calculated assuming: (a) future earnings on actuarial value of assets, net of investment-related expenses, will equal 7.25% per year, (b) there will be no changes in assumptions, (c) the number of active members will remain unchanged, (d) payroll for covered employees will grow at 3.00% each year, and (e) City contributions will remain the same percentage of payroll as described in Section D of the valuation report.

The Entry Age actuarial cost method is an "immediate gain" method (i.e., experience gains and losses are separately identified as part of the UAAL). However, they are amortized over the same period applied to all other components of the UAAL.

## Summary of Actuarial Assumptions and Methods (continued)

### III. Actuarial Value of Assets

The actuarial value of assets is based on the market value of assets with a five-year phase-in of actual investment returns in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first and the net remaining bases continuing to be recognized on their original timeframe. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year).

### IV. Actuarial Assumptions

**Investment Return:** 7.25% per year, net of investment-related expenses (composed of an assumed 2.50% inflation rate and a 4.75% real rate of return)

#### **Mortality Decrements:**

##### Pre-retirement

PubS-2010 Employee Mortality Table for males and females. Generational mortality improvements projected from the year 2010 using the ultimate mortality improvement rates in the MP tables.

##### Healthy Annuitants

PubS-2010 Healthy Retiree Mortality Table for males and females. Generational mortality improvements projected from the year 2010 using the ultimate mortality improvement rates in the MP tables.

##### Disabled Annuitants

PubS-2010 Disability Mortality Table for males and females. Generational mortality improvements projected from the year 2010 using the ultimate mortality improvement rates in the MP tables.

# Summary of Actuarial Assumptions and Methods (continued)

## Service Retirement Decrements:

### Members Who Have 23 Years of Service by Age 55

The following rates reflect the members expected departure from active service and are applied based on years of service:

Years of Service	Probability of Retirement
23	28%
24	18
25	18
26	18
27	25
28	25
29	25
30+	35

100% probability of retirement at age 62.

### Members Who Do Not Have 23 Years of Service by Age 55

The following rates reflect the members expected departure from active service and are applied based on the member's age:

Age	Probability of Retirement
55	50%
56	25
57	25
58	25
59	25
60	25
61	25
62+	100

### Deferred Retirement Option Program (DROP)

Members eligible for either the Back DROP or 5-year Forward DROP (or both) are assumed to select the most valuable option based on their individual situation at each possible retirement age. Members eligible for only the 7-year Forward DROP are assumed to not participate in DROP.

### Post-Retirement Option Plan (PROP) Investment Accounts

75% of members with a PROP account at the valuation date will elect to leave their lump sum in APRS until age 60 and 25% of members will elect to receive their PROP balance at the



valuation date. No future PROP deferrals are assumed and current active members are not assumed to enter PROP. Average annual rate credited to the PROP accounts will be 2.25%.

Withdrawal of Employee Contributions

Members that terminate with a vested benefit are assumed to choose the most valuable option available to them at the time of termination: withdrawal of contributions or deferred annuity. Non-vested members are assumed to receive an immediate refund of accumulated contributions.

**Disability Retirement Decrements:**

Disability Rates

Rates for males and females at selected ages are shown below:

Age	Rate
20	0.0004%
25	0.0025
30	0.0099
35	0.0259
40	0.0494
45	0.0804
50	0.1188
55	0.1647
60	0.2180

Disability rates are set to zero when members become eligible for retirement

In Line of Duty Disability

55% of disability retirements assumed to be in the line of duty.

**Termination Decrements for Reasons Other Than Death or Retirement:**

Withdrawal Rates

The following service-based rates apply:

Years of Service	Probability of Termination
0	12.00%
1	6.00
2-5	2.00
6-22	0.75
23+	0.00

Termination rates are set to zero when members become eligible for retirement

## Summary of Actuarial Assumptions and Methods (continued)

**Salary Increases:** Increases are assumed to vary by years of service. Salary increases include an underlying inflation component of 2.50% and a productivity component of 0.50%.

Anniversary of Academy Graduation	Percentage Increase
1*	15.20%
2	3.00
3	3.00
4	3.00
5	3.00
6	10.00
7	3.00
8	3.00
9	3.00
10	10.00
11	3.00
12	3.00
13	3.00
14	10.00
15	3.00
16	10.00
17+	3.00

\*Rate of Increase for 1<sup>st</sup> Anniversary of Graduation is for an Officer Position. If member is still a cadet on the valuation date then the increase in the upcoming year will be, either: (1) 46.70% for a regular Academy graduate, or (2) 17.40% plus the 15.20% Step Rate for a Modified Academy graduate.

**Cost-of-Living Adjustments (COLA):** Cost of living adjustments are granted on an ad hoc basis. No future COLAs are assumed.

**Administrative Expenses:** 0.90% of payroll. Included in this assumption would be any administrative expenses associated with the proportionate retirement program, which is currently assumed to be 0.017% of payroll.

**Payroll Growth:** Member Payroll is assumed to grow at 3.00% per year.

## Summary of Actuarial Assumptions and Methods (continued)

**Marital Assumptions:** 85% of active members are assumed to be married. Male spouses are assumed to be three years older than female spouses.

**Decrement Timing:** All decrements – mortality, service retirement, disability retirement, and termination of employment for reasons other than death or retirement – are assumed to occur at the middle of the valuation year.

### Census Data and Assets

- The valuation was based on members of APRS as of December 31, 2018 and does not take into account future members.
- All census data was supplied by APRS and was subject to reasonable consistency checks.
- There were data elements that were modified for some members as part of the valuation in order to make the data complete. However, the number of missing data items was immaterial.
- Asset data was supplied by APRS.

### Other Actuarial Valuation Procedures

- No provision was made in this actuarial valuation for the limitations of Internal Revenue Code Sections 415 or 401(a)17.
- Annualized Payroll on Valuation Date is the annualized payroll of active members on the valuation date. Projected Contributory Payroll for the upcoming fiscal year (used in determining the amortization period) is the estimated pensionable earnings received by all plan members for the just completed calendar year (including earnings for members who are no longer active employees on the valuation date) increased by the assumed payroll growth rate.

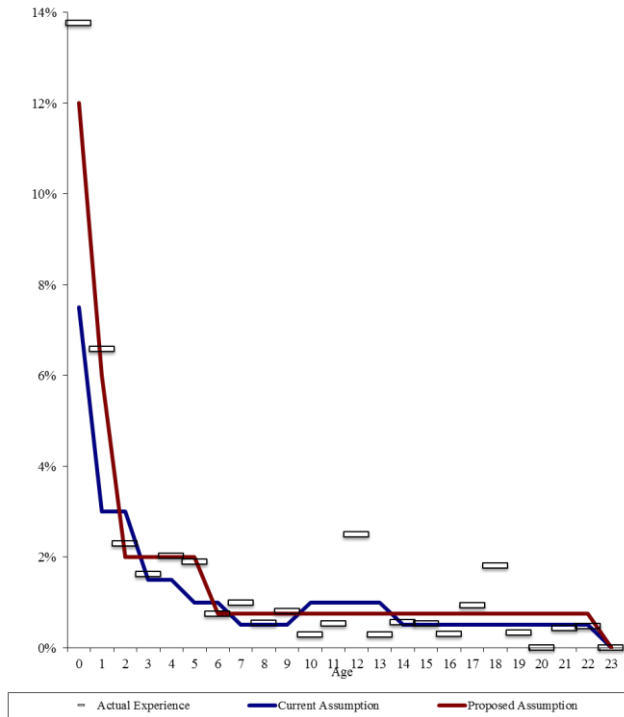
## **SECTION E**

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### **SUMMARY OF DATA AND EXPERIENCE**

**Austin Police Retirement System  
Termination Experience**

Service (1)	Actual Terminations (2)	Total Count (3)	Actual Rate (4)	Assumed Rate		Expected Terminations		Actual/Expected	
				Current (5)	Proposed (6)	Current (7)	Proposed (8)	Current (2) / (7) (9)	Proposed (2) / (8) (10)
0	37	269	0.1375	0.0750	0.1200	20.2	32.3	183%	115%
1	27	410	0.0659	0.0300	0.0600	12.3	24.6	219%	110%
2	8	349	0.0229	0.0300	0.0200	10.7	7.0	75%	115%
3	6	370	0.0162	0.0150	0.0200	6.1	7.4	98%	81%
4	8	397	0.0202	0.0150	0.0200	6.8	7.9	118%	101%
5	8	423	0.0189	0.0100	0.0200	4.6	8.5	175%	95%
6	3	405	0.0074	0.0100	0.0075	4.3	3.0	69%	99%
7	4	405	0.0099	0.0050	0.0075	2.3	3.0	175%	132%
8	2	370	0.0054	0.0050	0.0075	2.1	2.8	96%	72%
9	3	375	0.0080	0.0050	0.0075	2.0	2.8	154%	107%
10	1	353	0.0028	0.0100	0.0075	3.3	2.7	30%	38%
11	2	379	0.0053	0.0100	0.0075	3.5	2.8	57%	70%
12	9	362	0.0249	0.0100	0.0075	3.6	2.7	249%	331%
13	1	348	0.0029	0.0100	0.0075	3.5	2.6	29%	38%
14	2	361	0.0055	0.0050	0.0075	2.0	2.7	100%	74%
15	2	378	0.0053	0.0050	0.0075	2.2	2.8	93%	70%
16	1	333	0.0030	0.0050	0.0075	1.7	2.5	60%	40%
17	3	325	0.0092	0.0050	0.0075	1.6	2.4	185%	123%
18	6	332	0.0181	0.0050	0.0075	1.7	2.5	361%	241%
19	1	300	0.0033	0.0050	0.0075	1.5	2.3	67%	44%
20	0	252	0.0000	0.0050	0.0075	1.3	1.9	0%	0%
21	1	232	0.0043	0.0050	0.0075	1.2	1.7	86%	57%
22	1	212	0.0047	0.0050	0.0075	1.1	1.6	94%	63%
23+	3	0	0.0000	0.0000	0.0000	0.0	0.0	0%	0%
<b>Totals</b>	<b>139</b>	<b>7940</b>	<b>0.0175</b>	<b>0.0122</b>	<b>0.0164</b>	<b>99.3</b>	<b>130.6</b>	<b>140%</b>	<b>106%</b>



**Austin Police Retirement System**  
**Retirement Experience for Employees with 23 or More Years of Service at Age 55**

Service	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
23	52	182	0.2857	N/A*	0.2800	N/A*	51.0	159%	102%
24	22	150	0.1467	N/A*	0.1800	N/A*	27.0	161%	110%
25	29	127	0.2283	N/A*	0.1800	N/A*	22.9	197%	115%
26	19	114	0.1667	N/A*	0.1800	N/A*	20.5	100%	81%
27	26	88	0.2955	N/A*	0.2500	N/A*	22.0	214%	101%
28	17	73	0.2329	N/A*	0.2500	N/A*	18.3	130%	95%
29	15	60	0.2500	N/A*	0.2500	N/A*	15.0	142%	99%
30+	39	111	0.3514	N/A*	0.3500	N/A*	38.9	171%	0%
<b>Totals</b>	<b>219</b>	<b>905</b>	<b>0.2420</b>	<b>N/A*</b>	<b>0.2381</b>	<b>N/A*</b>	<b>215.4</b>	<b>159%</b>	<b>102%</b>

\*Due to change in type of service used for determining applicable retirement rates, these numbers are not comparable to the exposures shown.

**Austin Police Retirement System**  
**Retirement Experience for Employees with 23 or More Years of Service at Age 55**

Age	Actual Retirements	Total Exposures	Actual Rate	Assumed Rate		Expected Retirements		Actual/Expected	
				Current	Proposed	Current	Proposed	Current (2) / (7)	Proposed (2) / (8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
55	5	9	0.5556	N/A*	0.5000	N/A*	4.5	108%	111%
56	2	12	0.1667	N/A*	0.2500	N/A*	3.0	43%	67%
57	2	11	0.1818	N/A*	0.2500	N/A*	2.8	109%	73%
58	3	9	0.3333	N/A*	0.2500	N/A*	2.3	119%	133%
59	2	7	0.2857	N/A*	0.2500	N/A*	1.8	95%	114%
60	0	6	0.0000	N/A*	0.2500	N/A*	1.5	29%	0%
61	3	3	1.0000	N/A*	0.2500	N/A*	0.8	211%	400%
62+	2	2	1.0000	N/A*	1.0000	N/A*	2.0	118%	100%
<b>Totals</b>	<b>19</b>	<b>59</b>	<b>0.3220</b>	<b>N/A*</b>	<b>0.3136</b>	<b>N/A*</b>	<b>18.5</b>	<b>100%</b>	<b>103%</b>

\*Due to change in type of service used for determining applicable retirement rates, these numbers are not comparable to the exposures shown.

## AUSTIN POLICE RETIREMENT SYSTEM SALARY EXPERIENCE

Current Salary Scale			Actual Experience (5 Years)			Proposed Salary Scale	
Years of Service	Total	Step Rate/ Promotional	Total	Above Inflation	Step Rate/ Promotional	Total	Step Rate/ Promotional
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	25.75%	22.50%	<b>15.83%</b>	14.40%	13.91%	<b>15.20%</b>	12.20%
2	12.75%	9.50%	<b>9.87%</b>	8.44%	7.96%	<b>13.40%</b>	10.40%
3	7.75%	4.50%	<b>1.40%</b>	-0.04%	-0.52%	<b>3.00%</b>	0.00%
4	3.75%	0.50%	<b>2.33%</b>	0.90%	0.42%	<b>3.00%</b>	0.00%
5	3.75%	0.50%	<b>2.68%</b>	1.25%	0.77%	<b>3.00%</b>	0.00%
6	8.25%	5.00%	<b>5.23%</b>	3.80%	3.32%	<b>10.00%</b>	7.00%
7	5.25%	2.00%	<b>3.11%</b>	1.67%	1.19%	<b>3.00%</b>	0.00%
8	3.55%	0.30%	<b>2.22%</b>	0.79%	0.30%	<b>3.00%</b>	0.00%
9	3.55%	0.30%	<b>1.85%</b>	0.41%	-0.07%	<b>3.00%</b>	0.00%
10	9.25%	6.00%	<b>8.06%</b>	6.63%	6.15%	<b>10.00%</b>	7.00%
11	3.45%	0.20%	<b>2.19%</b>	0.76%	0.28%	<b>3.00%</b>	0.00%
12	3.45%	0.20%	<b>2.00%</b>	0.57%	0.08%	<b>3.00%</b>	0.00%
13	3.45%	0.20%	<b>2.41%</b>	0.97%	0.49%	<b>3.00%</b>	0.00%
14	9.75%	6.50%	<b>8.43%</b>	7.00%	6.52%	<b>10.00%</b>	7.00%
15	3.95%	0.70%	<b>2.79%</b>	1.36%	0.87%	<b>3.00%</b>	0.00%
16	9.75%	6.50%	<b>8.28%</b>	6.85%	6.36%	<b>10.00%</b>	7.00%
17	3.25%	0.00%	<b>2.35%</b>	0.91%	0.43%	<b>3.00%</b>	0.00%
18	3.25%	0.00%	<b>2.32%</b>	0.89%	0.40%	<b>3.00%</b>	0.00%
19	3.25%	0.00%	<b>1.95%</b>	0.51%	0.03%	<b>3.00%</b>	0.00%
20	3.25%	0.00%	<b>1.92%</b>	0.48%	0.00%	<b>3.00%</b>	0.00%

Current Inflation Assumption	3.00%	Proposed Inflation Assumption	2.50%
Current Productivity Component	0.25%	Proposed Productivity Component	0.50%
Actual CPI-U Inflation for Dec/12 - Dec/17	1.43%		
Apparent Productivity Component	0.48%		

