Wyoming Retirement System

Actuarial Experience Study
As of December 31, 2020

GRS

April 29, 2022

Board of Trustees
Wyoming Retirement System
6101 Yellowstone Road
Cheyenne, Wyoming 82002

Subject: **Results of 2021 Actuarial Experience Study**

Members of the Board:

We are pleased to present our report on the results of the 2021 Actuarial Experience Study for the Wyoming Retirement System (WRS). These proposed assumption and method changes apply to all plans under WRS with the exception of Fire A. This report includes recommendations for new actuarial assumptions and methods to be effective for the January 1, 2022 actuarial valuation. The actuarial impacts shown in this report are presented as though the recommended new assumptions and methods had been effective for the January 1, 2021 actuarial valuation.

With the Board's approval of the recommendations in this report, the actuarial condition of WRS will be more accurately portrayed. The Board's decisions should be based on the appropriateness of each recommendation individually, not on their collective effect on the funding period 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. They are all Members of the American Academy of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries. Finally, each of the undersigned is experienced in performing valuations for large public retirement systems. We wish to thank the WRS staff for their assistance in providing data for this study.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Paul Wood, ASA, FCA, MAAA
Team Leader

Thomas Lyle, FSA, FCA, EA, MAAA
Consultant

Table of Contents

SECTION A

EXECUTIVE SUMMARY

Summary of Recommendations - All Plans

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

Economic Assumptions

1. **Inflation**: Maintain the current inflation assumption of 2.25%.

2. **Real rate of return**: The current assumption of 4.75% is reasonable but if the Board would prefer to increase the probability of achieving its expected return, they should consider a move to 4.55% or lower

3. **Nominal rate of return**: The current nominal investment return assumption (the sum of inflation and the real rate of return) of 7.00% is reasonable but if the Board would prefer to increase the probability of achieving its expected return, they should consider a move to 6.80% or lower.

4. **Wage inflation**: Maintain the current wage inflation assumption of 2.50%. The general wage inflation assumption should be 0.25% above the inflation assumption.

5. **Payroll growth**: Maintain total payroll growth assumption of 2.50%.

6. **Cost of living increases**: None are assumed (except for Fire A).

7. **Asset valuation method**: Maintain the current smoothing method.

Demographic Assumptions

8. **Post-retirement mortality**, **disabled lives mortality, active life mortality**: Update to the Pub-2010 tables, projected generationally using the ultimate MP-2020 scale.

Specific Recommendations - by Plan

Public Employees Retirement System

9. **Salary increase**: Observed experience shows salary increases lower than assumed. The recommendation is to decrease the assumed merit and promotion salary increases.

10. **Retirement (unreduced retirement):** Experience shows slightly higher retirement rates, recommend making modifications to the retirement rates to reflect this experience.

11. **Early (reduced) retirement**: Actual experience showed fewer early retirements, recommend decreasing rates at all ages to reflect this experience.

12. **Termination (withdrawal)**: We recommend changing the termination tables to be based solely on service for males and females and update the assumption of the benefit the member chooses upon termination.

13. **Disability**: No change recommended

Air Guard Firefighters Retirement System

14. Make the same changes as for the Public employee Plan

Law Enforcement Plan

15. **Salary increase**: Experience shows total increases were close to expected, no change is recommended

16. **Retirement (unreduced retirement):** Experience shows that members are retiring earlier in their careers. Increase retirements rates for ages 57 and lower.

17. **Early (reduced) retirement**: No change recommended

18. **Termination (withdrawal)**: We recommend changing the termination tables to be based solely on service.

19. **Disability**: Experience indicated fewer disabilities than expected. Recommend changes to reflect observed experience.

State Highway Patrol, Game & Fish Warden and Criminal Investigator Retirement Plan (Wardens)

20. **Salary increase**: Experience does not indicate any change required

21. **Retirement (unreduced retirement):** No change recommended

22. **Termination (withdrawal)**: We recommend changing the termination tables to be based solely on age.

23. **Disability**: No change recommended

Judicial Retirement System

24. **Salary increase**: Experience shows the salary increases are lower than assumed. Recommend decreasing salary increase rates to 1.50% above wage inflation (2.25%) for all years. The current salary increase assumption of 4.00% per year will decrease to 3.75% per year.

25. **Retirement (unreduced retirement):** Slight increase in retirement rates and move the age at which 100% retirement occurs from 72 to 70.

26. **Early (reduced) retirement**: No change recommended

27. **Termination (withdrawal)**: Remove termination rate assumption.

28. **Disability**: No change recommended

Paid Firemen's Retirement Fund Plan A

29. No changes recommended.

Paid Firemen's Retirement Fund Plan B

30. **Salary increase**: Experience shows the merit and promotion increases were lower than assumed. Recommend slightly decreasing the age-based salary increase rates for merit and promotion.

31. **Retirement (unreduced retirement):** Experience shows higher retirement rates. Recommend slightly increasing retirement rates to reflect this experience.

32. **Termination (withdrawal)**: Experience shows that terminations are occurring at a lower rate than assumed. Recommend lowering termination rates and update to an age-based rate table.

33. **Disability**: No change recommended

Summary of Results

The following tables provide the summary of the key actuarial values for the current assumptions and the proposed assumptions.

Current Assumptions January 1, 2021 with 7.00% Assumed Return (Fire A with 1.00% Assumed Return)

	Public Employee	Law Enforcement	Wardens	Judges	Fire B	Guard Firefighters	Volunteer	Fire A
Actuarial accrued liability (AAL)	$ 10,469.79	$ 840.81	$ 198.66	$ 36.35	$ 183.46	$ 10.30	$ 117.99	$ 478.77
Actuarial value of assets (AVA)	7,827.63	722.31	157.00	35.46	175.95	8.89	90.07	84.97
Market value of assets (MVA)	8,294.24	765.01	166.21	37.47	186.11	9.37	94.89	90.08
Unfunded actuarial accrued liability (UAAL)	$ 2,642.16	$ 118.50	$ 41.67	$ 0.89	$ 7.52	$ 1.41	$ 27.92	$ 393.81
Funded status								
- Actuarial value	74.76%	85.91%	79.03%	97.56%	95.90%	86.26%	76.33%	17.75%
- Market value	79.22%	90.98%	83.67%	103.07%	101.44%	91.01%	80.43%	18.82%

Proposed Assumptions January 1, 2021 with 7.00% Assumed Return

	Public Employee	Law Enforcement	Wardens	Judges	Fire B	Guard Firefighters	Volunteer
Actuarial accrued liability (AAL)	$ 10,416.14	$ 876.49	$ 198.21	$ 37.39	$ 185.68	$ 10.45	$ 116.08
Actuarial value of assets (AVA)	7,827.63	722.31	157.00	35.46	175.95	8.89	90.07
Market value of assets (MVA)	8,294.24	765.01	166.21	37.47	186.11	9.37	94.89
Unfunded actuarial accrued liability (UAAL)	$ 2,588.51	$ 154.18	$ 41.21	$ 1.92	$ 9.73	$ 1.56	$ 26.01
Funded status							
- Actuarial value	75.15%	82.41%	79.21%	94.85%	94.76%	85.04%	77.59%
- Market value	79.63%	87.28%	83.86%	100.22%	100.23%	89.72%	81.75%

Proposed Assumptions January 1, 2021 with 6.80% Assumed Return

	Public Employee	Law Enforcement	Wardens	Judges	Fire B	Guard Firefighters	Volunteer
Actuarial accrued liability (AAL)	$ 10,643.21	$ 898.15	$ 202.72	$ 38.09	$ 190.43	$ 10.69	$ 118.63
Actuarial value of assets (AVA)	7,827.63	722.31	157.00	35.46	175.95	8.89	90.07
Market value of assets (MVA)	8,294.24	765.01	166.21	37.47	186.11	9.37	94.89
Unfunded actuarial accrued liability (UAAL)	$ 2,815.58	$ 175.84	$ 45.72	$ 2.63	$ 14.48	$ 1.81	$ 28.57
Funded status							
- Actuarial value	73.55%	80.42%	77.45%	93.09%	92.39%	83.11%	75.92%
- Market value	77.93%	85.18%	81.99%	98.36%	97.73%	87.68%	79.99%

SECTION B

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 Wyoming Retirement System (WRS). Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due; or, on the other hand, produce 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.

The economic 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 other obligations, outcomes from underestimating future liabilities are much more difficult to manage than outcomes of overestimates. It is easier to decrease a contribution requirement than it is to increase the contribution requirement. That asymmetric risk should be considered when the assumption set, investment policy and funding policy are created. The assumption set used in the valuation process represents the best estimate of the future experience of the System and may even provide a margin against adverse experience.

Using this strategic mindset, each assumption was analyzed compared to the actual experience of WRS and general experience of other large public employee retirement systems. Changes in certain assumptions and methods are suggested upon this comparison to remove any bias that may exist and to 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 and future results is

much weaker. In either case, actuaries should review the plan's assumptions periodically and determine whether these assumptions are consistent with actual past experience and with anticipated future experience.

The last such actuarial experience investigation was performed as of December 31, 2016 and effective with the January 1, 2018 actuarial valuation. For this experience study, we have reviewed WRS' experience for the five-year period from January 1, 2016 through December 31, 2020. The new assumptions will be effective with the January 1, 2022, actuarial valuation.

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 affect 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. In addition, 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 were 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 water down real changes that may be occurring, such as mortality improvement or a change in the ages at which members retire.

In an experience study, the first step is to determine the number of deaths, retirements, etc. that occurred during the period. The next step is to use the assumptions in order to determine the number expected to occur. The number of "expected" decrements (death, termination, retirement, disability) is determined by multiplying the probability of the occurrence at the given age, by the "exposures" at that same age. An "exposure" is a member who is susceptible to the given decrement.

For example, consider 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, the A/E ratio is calculated, 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%. Variance from this calculation is an indication that new assumptions may be needed. (However, in some cases the assumptions may be set to produce an A/E ratio a little above or below 100%, in order to introduce some conservatism.) Assumptions are reviewed in the aggregate and also by 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.

While the recommended assumption set represent a best estimate, there are other reasonable assumptions that could be supported. Some reasonable assumption sets would show higher or lower liabilities or costs.

SECTION C

ANALYSIS OF EXPERIENCE AND RECOMMENDATIONS

Analysis of Experience and Recommendations

This section begins by discussing the economic assumptions and recommendations that apply to all WRS plans. These assumptions are the inflation rate, the real rate of return, the investment return rate and the assumed rate of growth in payroll.

Actuarial Standards

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 June 2020.

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.   is an estimate of future experience; an observation of market data; or a combination thereof;
5.   and has no significant bias.

The standard explicitly advises an actuary not to give undue weight to recent experience.

Each economic assumption should individually satisfy this standard. Each economic assumption should be consistent with every other economic assumption over the measurement period.

Inflation Assumption

By "inflation," this analysis is referring to price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies most of the other economic assumptions. It impacts investment return, salary increases, and overall payroll growth. The current annual inflation assumption is 2.25%. A history of the changes in the inflation assumption for WRS is shown in the following table:

Valuation Date: January 1,	Inflation Assumption
1990	4.50%
1998	4.00%
2003	3.00%
2009	3.50%
2014	3.25%
2018	2.25%

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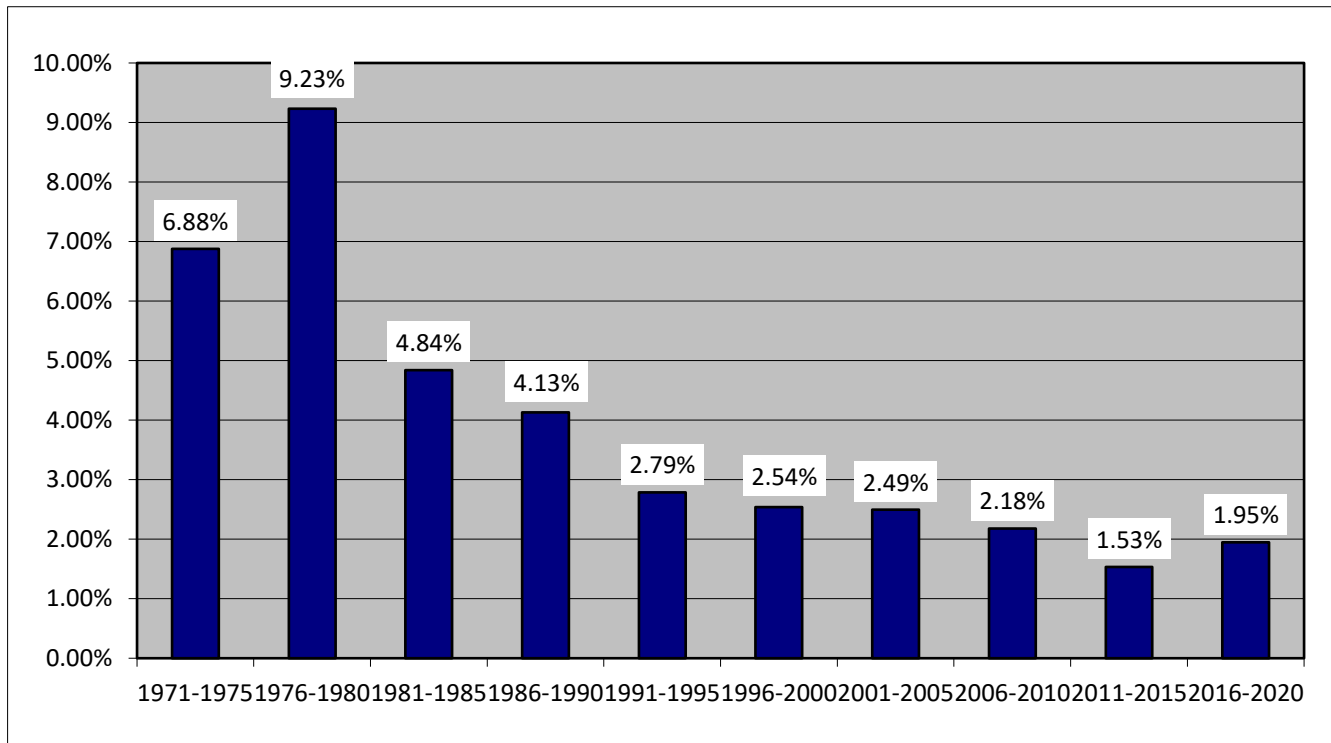
Source: Bureau of Labor Statistics, CPI-U, all items, not seasonally adjusted, Calendar Years

The table below shows the average inflation over various periods, ending December 2020.

Periods Ending December 2020	Average Annual Increase in CPI-U
Last five (5) years	1.95%
Last ten (10) years	1.74%
Last fifteen (15) years	1.89%
Last twenty (20) years	2.04%
Last thirty (30) years	2.25%
Since 1913 (first available year)	3.90%

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

Inflation has been relatively low over the last thirty years, and historically so over the past 10 years.

This CPI-U measurement is based on the national CPI-U. The measurement is relevant to assessing the long-term growth on assets. Inflation is also a component for salary increases and the payroll growth assumption. It is interesting to review the inflation that has occurred in the State of Wyoming. While the Wyoming rate of inflation is not used directly in setting assumptions, it may be useful in understanding some of the impacts on salary and population growth.

Annual Rates of Inflation		
Quarter:	US CPI	State of Wyoming CPI
2Q16	1.0%	-0.6%
4Q16	2.1%	0.6%
2Q17	1.6%	1.1%
4Q17	2.1%	2.3%
2Q18	2.9%	3.3%
4Q18	1.9%	2.5%
2Q19	1.6%	2.0%
4Q19	2.3%	2.2%
2Q20	0.6%	1.1%
4Q20	1.4%	2.0%
Mean	1.8%	1.8%

Source: Wyoming Department of Administration & Information, Economic Analysis Division, April 16, 2021; **Wyoming Cost of Living Index for the Fourth Quarter of 2020**, *Table 3-Annual Inflation Rates by Region.*

Forecasts from the Investment Consultant

WRS has retained the investment consulting services of Meketa. Meketa is using 2.10% as their inflation assumption over the next 20 years beginning in 2021. This assumption is down from 2.60% from the prior year.

Forecasts from Other Investment Consulting Firms

The 2021 capital market assumption sets for eight investment-consulting firms showed the average assumption for inflation was 2.19%, with a range of 2.00% to 3.00%.

Expectations Implied in the Bond Market

Another source of information about future inflation is the market for US Treasury bonds. The difference in yield between non-indexed and indexed (TIPS) treasury bonds should be a reasonable estimate of what the bond market expects on a forward-looking basis for inflation. Conventional Treasury securities compensate its holders by providing a nominal yield with two components; the real rate of interest and inflation. Since the TIPS (Treasury Inflation-Protected Securities) already adjust for inflation, the yield only includes the real rate of interest. Therefore, the difference roughly reflects the inflation expectation for that maturity horizon.

As of the end of May, the difference for 20-year bonds implies that inflation over the next twenty years would average 2.47%. The difference in yield for 30-year bonds implies 2.32% inflation over the next 30 years. The chart below shows the historical market implied inflation from January 1, 2010 through May 28, 2021.

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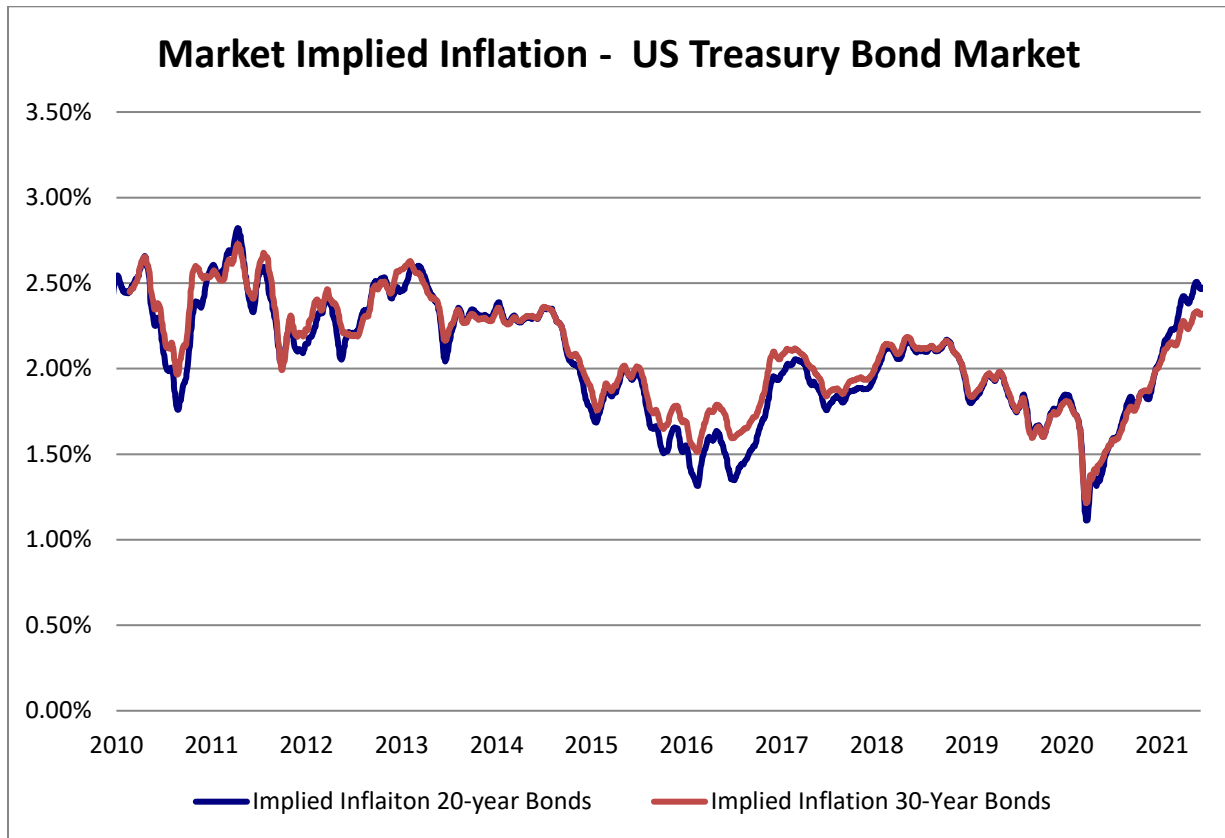
However, this analysis is known to be imperfect as it ignores the inflation risk premium that buyers of US Treasury bonds often demand as well as possible differences in liquidity between US Treasury bonds and TIPS.

Other Sources of Inflation

In the Social Security Administration's 2020 Trustees Report, the Office of the Chief Actuary is projecting a long-term average annual inflation rate of 2.40% under the intermediate cost assumption. (The inflation assumptions are 3.00% and 1.80% respectively in the low cost and high cost projection scenarios.)

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Its most recent forecast (first quarter of 2021) was for inflation over the next ten years to average 2.20%.

Recommendation

While there is short term pressure on inflation, we recommend maintaining the current inflation rate of 2.25%.

Investment Return Rate Assumption

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 7.00% per year, net of investment expenses.

The chart below shows the historical annualized history of WRS market returns through FY 2020.

Plan Year	Market Value	Actuarial Value
(1)	(2)	(3)
2000	-0.99%	16.37%
2001	-4.47%	10.54%
2002	-9.29%	-1.47%
2003	21.00%	8.72%
2004	11.54%	2.77%
2005	8.22%	5.13%
2006	12.63%	8.55%
2007	7.44%	11.41%
2008	-29.63%	-12.85%
2009	23.72%	17.89%
2010	13.80%	3.00%
2011	-0.90%	1.25%
2012	14.05%	2.22%
2013	13.53%	11.55%
2014	4.70%	8.70%
2015	-0.26%	5.87%
2016	7.60%	6.74%
2017	14.20%	7.14%
2018	-3.52%	3.88%
2019	18.72%	6.05%
2020	11.03%	9.17%
Average returns:		
Last five years:	9.34%	6.58%
Last ten years:	7.67%	6.21%
Last fifteen years:	6.33%	5.83%
Last twenty years:	5.95%	5.63%

The returns in the chart above are market returns, gross of investment expenses, as reported in the actuarial valuations. Past performance, even averaged over a ten-year period, is not a reliable indicator of future performance.

More importantly, the real rates of return for many asset classes, especially equities, vary so dramatically from year to year that even a fifteen-year period is not long enough to provide reasonable guidance. There are strong reasons to believe the next ten years will be different from the last, in large part because current bond yields are significantly lower than they were 25 years ago.

Assumption Comparison to Peers

The chart below shows the distribution of the investment return assumptions in the Public Fund Data as of May 2021. The median rate of return is 7.00% and there appears to be a downward trend.

Distribution of Nominal Investment Return Assumptions, FY 01 to present

Public Fund Survey, NASRA May-21
Fiscal Year
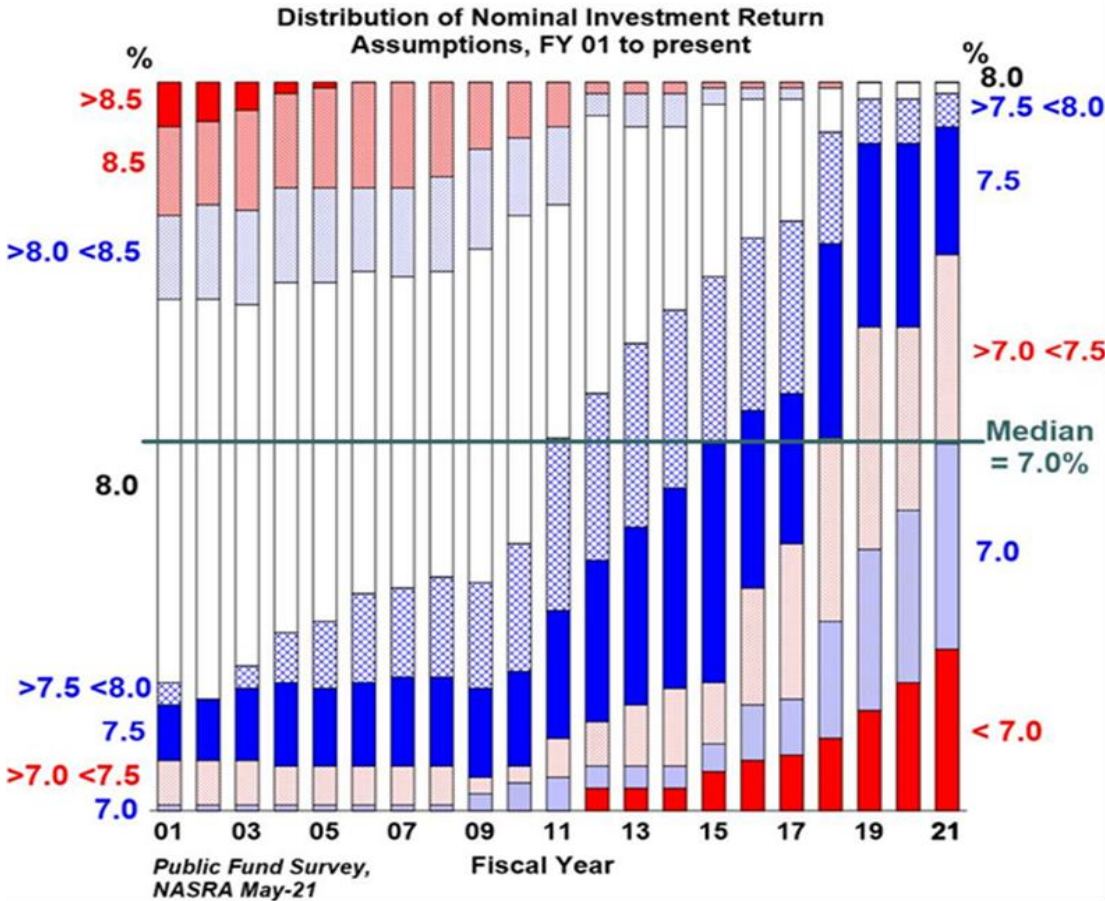
As shown, for recent experience studies, the median assumption has been 7.00%.

Asset Allocation

We believe the most appropriate approach to selecting an investment return assumption is to identify expected returns given the funds' asset allocation mapped to forward-looking capital market assumptions. Because GRS is a benefit consulting firm and does not provide investment consulting advice, we do not develop or maintain our own forecasts of capital market expectations. Instead, we utilized the forward-looking return expectations developed by nationally recognized investment consulting firms, including Meketa, which is the WRS investment consultant.

The following is an excerpt from ASOP 27 on the topic of using experts:

> **Section 3.5.6 Views of Experts** – *Economic data and analyses are available from a variety of sources, including representatives of the plan sponsor and administrator, investment advisors, economists, and other professionals. When the actuary is responsible for selecting or giving advice on selecting economic assumptions within the scope of this standard, the actuary may incorporate the views of experts but the selection or advice should reflect the actuary's professional judgement.*

In our professional judgement, it is appropriate to rely on Meketa's input as part of our consideration in making a recommendation as they are the experts and have specialized knowledge in this subject matter. This is the same data being used for investment decision making, and thus is a reasonable set of data for use in decisions on funding as well.

Meketa develops two sets of capital market assumptions, a "short-term" based on a 10-year investment horizon and a "long-term" based on a 20-year investment horizon, and the table below provides the expected forward-looking return (geometric) over each time period.

WRS Expectations with 2021 Assumptions

Asset Classes	Allocation as of March 31, 2021 (%)	Current Policy (%)	Adjusted Policy Mix (%)
Tactical Cash	4.9	2.0	2.0
Total Fixed Income	20.0	21.0	21.0
Marketable Fixed Income	16.0	18.0	18.0
Core Plus	4.5	5.0	5.0
US Government Debt	8.1	9.0	8.5
Opportunistic Credit	3.4	4.0	3.5
Private Debt	4.1	3.0	3.0
Total Equity	47.7	48.5	48.5
Marketable Equity	39.7	44.0	39.5
US Equity	15.3	21.2	19.0
Developed Market Equity (non-US)	17.0	14.2	13.0
Emerging Markets Equity	7.3	8.6	7.5
Private Equity	8.0	4.5	9.0
Marketable Alternatives¹	17.8	19.0	19.0
Private Real Assets²	9.6	9.5	9.5
Expected Return (20 years) (%)	6.7%	6.6%	6.8%
Expected Return (10 years) (%)	5.9%	5.8%	5.9%
Standard Deviation (annual) (%)	13.0%	12.9%	13.2%
Sharpe Ratio (20 years)	0.43	0.43	0.43

The expected return for the System based on Meketa's assumptions is approximately 90 basis points higher over the next 20 years compared to the next 10 years. For comparison, the same values based on Meketa's 2020 capital market expectations were 6.40% over the 10-year period and 7.20% over a 20-year time period. Furthermore, the same values based on Meketa's 2019 capital market expectations were 7.30% over the 10-year period and 7.90% over a 20-year time period. Clearly there were significant changes from year to year, and this was heavily based on the strong returns during 2019 and 2020. Likewise, the 2019 numbers were higher than the 2018 expectations because of a weak 2018 returns. Thus, there is significant volatility in these numbers from year to year.

For time horizon, the duration of the current liabilities of WRS are much longer than the 10 year time horizon in the short term expectations and more likely in line with the 20 year horizon.

Adjustments should be made for differences in inflation expectations. For example, Meketa's inflation assumption in 2019 and 2020 was 2.60% and the assumption in 2021 was 2.10% while the valuation is assuming 2.25%. Thus, 0.35% can be subtracted from the 2019 and 2020 values while 0.15% can be added to the 2021 values. Performing this exercise on all six data points would produce the following expectations:

Meketa's 2019, 2020, and 2021 median expectations for the current Target Portfolio, adjusted for inflation differences			
	10 Year	20 Year	Average
2019	6.95%	7.55%	7.25%
2020	6.05%	6.85%	6.45%
2021	6.05%	6.95%	6.50%
Average	6.35%	7.12%	6.73%

It is valuable to have stability in this assumption and which year a System had an experience study performed should not yield significant differences in the assumption.

Recommendation

The current nominal investment return assumption (the sum of inflation and the real rate of return) of 7.00% is reasonable but if the Board would prefer to increase the probability of achieving its expected return, they should consider a move to 6.80% or lower.

Salary Increase Rates

The current salary increase rates assumed for the valuation vary by age, with the exception of the Judges plan., which assumes a constant salary increase rate of 4.00% per year.

Wage Inflation

The salary increase assumption consists of the sum of the wage inflation assumption and a "merit and promotion" assumption. The merit and promotion increases are assumed only to apply in the earlier years of a member's career.

Historically wage inflation usually exceeds price inflation. The amount of wage inflation in excess of price inflation is referred to as the "productivity" component of the salary increase. This productivity component reflects economic gains occurring to the organization and being passed on to the members through increases in their compensation.

Wage inflation is currently assumed 2.50%. This wage inflation assumption is comprised of a core inflation assumption component of 2.25% and a productivity assumption component of 0.25%. Individual merit and promotion assumptions are age-based ranging from 4.00% in the younger years to 0.00% in later years.

Productivity in the pay raises is defined as the amount of the pay raise above inflation that is generally given to all members. As discussed previously, inflation for the study period was 1.95%. In order to determine the productivity component that occurred over the study period the pay raises for the members at the older service periods is examined. Pay raises for this group generally do not include merit and promotion amounts. The pay raises for these longer-service members includes inflation and productivity.

Over the five-year experience period, actual core inflation was 1.95% (versus the assumed rate of 2.25%). Over this same five-year period, the productivity component has been 0.25%. The recommendation for all plans (except Fire A, Judges and the Volunteer plans) is to maintain the current wage inflation assumption of 2.50%. This wage inflation assumption will be comprised of a 2.25% inflation assumption and a .25% productivity assumption. The recommendation for the merit and promotion assumption on the State plan is to correlate those increases to years of service rather than age.

Merit and promotion is the final piece of the assumed salary increase assumption. In order to determine the merit and promotion increases that occurred during the study period the total increases are prepared (by service group) and then the inflation (1.95%) and productivity (.25%) are subtracted.

The following exhibits illustrate the expected versus actual merit and promotion increases as well as the total salary increase rates to be assumed.

Wyoming Retirement System Experience Study							
Public Employee		Merit/Promotion % Increase			Total % Increase		
Years of			Expected			Expected	
Service	Number	Actual[1]	Old	New	Actual	Old	New[2]
1	8,223	(1.41)%	4.00 %	4.00 %	1.09 %	6.50 %	6.50 %
2	13,607	4.67 %	4.00 %	4.00 %	7.17 %	6.50 %	6.50 %
3	11,490	3.70 %	4.00 %	4.00 %	6.20 %	6.50 %	6.50 %
4	10,299	2.75 %	3.50 %	3.50 %	5.25 %	6.00 %	6.00 %
5	9,447	2.56 %	2.75 %	2.75 %	5.06 %	5.25 %	5.25 %
6	8,617	2.33 %	2.25 %	2.25 %	4.83 %	4.75 %	4.75 %
7	7,551	1.79 %	1.75 %	1.75 %	4.29 %	4.25 %	4.25 %
8	6,903	1.44 %	1.50 %	1.50 %	3.94 %	4.00 %	4.00 %
9	6,552	1.29 %	1.50 %	1.50 %	3.79 %	4.00 %	4.00 %
10	6,146	1.02 %	1.50 %	1.00 %	3.52 %	4.00 %	3.50 %
11	5,969	1.01 %	1.25 %	1.00 %	3.51 %	3.75 %	3.50 %
12	5,697	0.81 %	1.00 %	1.00 %	3.31 %	3.50 %	3.50 %
13	5,292	0.62 %	1.00 %	1.00 %	3.12 %	3.50 %	3.50 %
14	4,813	0.44 %	1.00 %	0.75 %	2.94 %	3.50 %	3.25 %
15	4,323	0.57 %	0.75 %	0.50 %	3.07 %	3.25 %	3.00 %
16	3,988	0.34 %	0.75 %	0.50 %	2.84 %	3.25 %	3.00 %
17	3,747	0.13 %	0.75 %	0.25 %	2.63 %	3.25 %	2.75 %
18	3,510	0.17 %	0.75 %	0.25 %	2.67 %	3.25 %	2.75 %
19	3,282	(0.05)%	0.50 %	0.25 %	2.45 %	3.00 %	2.75 %
20	2,945	(0.09)%	0.50 %	0.25 %	2.41 %	3.00 %	2.75 %
21	2,622	(0.00)%	0.25 %	0.00 %	2.50 %	2.75 %	2.50 %
22	2,372	(0.32)%	0.25 %	0.00 %	2.18 %	2.75 %	2.50 %
23	2,117	(0.45)%	0.25 %	0.00 %	2.05 %	2.75 %	2.50 %
24	1,973	(0.33)%	0.25 %	0.00 %	2.17 %	2.75 %	2.50 %
25+	14,186	(0.64)%	0.00 %	0.00 %	1.86 %	2.50 %	2.50 %

1. *The Actual Merit/Promotion rate increase is determined by taking the total salary increase, subtracting inflation (1.95%) for the same period.*
2. *The new Total % increase is the recommended total assumed salary increase, which is the sum of the inflation assumption of 2.25%, productivity of 0.25% and the relevant merit/promotion increase. The assumed merit/promotion increases were lowered for all years of service.*

Wyoming Retirement System Experience Study							
		Merit/Promotion % Increase			Total % Increase		
			Expected			Expected	
Fire B	Number	Actual	Old	New	Actual	Old	New
<25	37	5.41%	5.00%	5.00%	7.36%	7.50%	7.50%
25-29	163	4.77%	4.50%	4.50%	6.72%	7.00%	7.00%
30-34	287	3.46%	4.50%	3.00%	5.41%	7.00%	5.50%
35-39	391	1.75%	4.00%	2.00%	3.70%	6.50%	4.50%
40-44	334	0.79%	3.00%	2.00%	2.74%	5.50%	4.50%
45-49	299	1.06%	2.50%	2.00%	3.01%	5.00%	4.50%
50-54	134	1.51%	2.50%	2.00%	3.46%	5.00%	4.50%
55-59	72	1.69%	2.25%	2.00%	3.64%	4.75%	4.50%
60-64	24	2.40%	2.00%	2.00%	4.35%	4.50%	4.50%
65+	-	2.34%	2.00%	2.00%	4.29%	4.50%	4.50%

Wyoming Retirement System Experience Study							
		Merit/Promotion % Increase			Total % Increase		
			Expected			Expected	
Judges	Number	Actual	Old	New	Actual	Old	New
<25	-	0.00%	1.50%	1.25%	0.00%	4.00%	3.75%
25-29	-	0.00%	1.50%	1.25%	0.00%	4.00%	3.75%
30-34	-	0.00%	1.50%	1.25%	0.00%	4.00%	3.75%
35-39	1	-5.28%	1.50%	1.25%	-2.78%	4.00%	3.75%
40-44	14	1.76%	1.50%	1.25%	4.26%	4.00%	3.75%
45-49	33	0.07%	1.50%	1.25%	2.57%	4.00%	3.75%
50-54	22	1.22%	1.50%	1.25%	3.72%	4.00%	3.75%
55-59	39	0.53%	1.50%	1.25%	3.03%	4.00%	3.75%
60-64	71	0.52%	1.50%	1.25%	3.02%	4.00%	3.75%
65+	42	0.35%	1.50%	1.25%	2.85%	4.00%	3.75%

➢ *Judges- Increase the total assumed pay rate to 3.75%*
➢ *Guard Fire- There is not enough data to develop unique assumptions, therefore Guard Fire was included in the analysis for the Public Employee plan.*

Payroll Growth Rate

The salary increase rates discussed above are assumptions applied to individuals. These assumed individual pay increases are used in projecting future benefits for each member of the system. There is also an overall payroll growth assumption, currently 2.50%, in projecting aggregate payroll. This separate payroll growth assumption is used in determining the annual amortization payment needed to pay off the unfunded actuarial accrued liability for six plans: State, Law Enforcement, Fire B, Wardens, Judges and Guard Firefighters (the Fire A plan calculates its amortization payment as a flat dollar amount). The amortization payments are calculated to be a level percentage of payroll. As total payroll increases over time, these charges also increase. The annual amortization payment is dependent on the rate as which payroll is assumed to increase. Higher payroll total growth means a lower payment can be made today since more dollars will be contributed in the future. A decrease in the payroll growth assumption will increase the required amortization payment.

Wyoming Retirement System Experience Study											
	Annual Payroll Increase						Population Adjusted[1] Annual Payroll Increase				
Valuation Year	State	Law Enforcement	Wardens	Fire B	Judges	Guard FireFighters	State	Law Enforcement	Wardens	Fire B	Judges	Guard FireFighters
2011	1.74%	3.46%	1.50%	1.38%	4.35%		1.07%	0.66%	0.87%	2.62%	1.74%	
2012	1.64%	0.54%	2.72%	0.72%	-0.10%	1.60%	0.96%	1.67%	4.01%	0.41%	-0.10%	1.60%
2013	1.44%	1.47%	0.14%	6.76%	11.29%	22.52%	0.39%	1.93%	-1.10%	-1.64%	8.58%	-5.14%
2014	0.00%	-2.34%	-6.88%	5.72%	14.84%	-3.27%	0.25%	-1.44%	-1.04%	2.27%	7.01%	-3.27%
2015	2.02%	1.77%	1.74%	5.84%	6.24%	22.71%	1.64%	3.72%	1.40%	5.55%	1.62%	0.11%
2016	2.23%	2.91%	6.49%	1.55%	0.33%	1.26%	1.99%	2.69%	2.12%	0.74%	0.33%	6.89%
2017	-0.37%	-0.80%	0.02%	6.90%	0.02%	-8.16%	1.54%	0.74%	0.66%	7.18%	0.02%	-5.53%
2018	-3.62%	-2.73%	-4.08%	-6.55%	2.95%	7.20%	-1.20%	-0.61%	-0.61%	-4.50%	0.76%	-1.26%
2019	-0.18%	2.60%	0.24%	4.54%	0.68%	8.67%	0.22%	2.56%	0.24%	3.97%	0.68%	0.72%
2020	2.43%	3.14%	4.13%	1.89%	12.24%	-1.08%	1.46%	3.21%	1.46%	-0.56%	5.51%	-1.08%
2021	2.22%	3.35%	0.53%	4.96%	6.42%	-6.84%	2.50%	3.90%	-0.43%	4.40%	4.33%	0.52%
Five year average	0.07%	1.08%	0.13%	2.23%	4.37%	-0.28%	0.90%	1.95%	0.26%	2.01%	2.23%	-1.35%
Ten year average	0.77%	0.97%	0.44%	3.16%	5.36%	NA	0.97%	1.82%	0.66%	1.73%	2.83%	NA

1. *The annual increase in payroll growth is adjusted to smooth out the effects of large swings in the population.*

Recent history has shown somewhat depressed total payroll growth so this is certainly an assumption that will need monitoring. Open group projections assuming a stable population indicate the assumption of 2.5% is still reasonable but further population contraction or slower payroll growth may lead to lowering this assumption in future studies. It is recommended that the payroll growth assumption of 2.50% be maintained. For the Judges plan, a flat salary growth assumption in all years (4.00%) should be lowered to 3.75% per year.

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 making recommendations on selecting noneconomic assumptions for measuring obligations under defined benefit plans. The recommended assumptions in this report were developed in compliance with this standard.

Mortality Rates

WRS' actuarial liabilities and contribution rates depend in 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 ultimate contribution rates will be larger than expected.

The mortality tables currently being used for active employees, retirees and beneficiaries receiving benefits are the RP-2014 Fully Generational mortality tables. Generational mortality improvements are projected for future generations using the Scale MP-2017. The mortality tables were then calibrated with multipliers to fit with the Wyoming data. The multiplier is 88% for healthy retired females and 100% for all other groups.

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.

The analysis of the mortality rate assumption begins by determining the expected number of deaths in each year at each age for males and females. The actual number of deaths is then compared to the expected number of deaths. The ratio of the actual deaths to the expected deaths (the A/E ratio) indicates the degree to which the assumption is predicting the outcome. When using a generational approach for mortality improvement, an A/E of 100% is targeted. However, we will also focus on the pattern across all ages and life expectancy created at individual ages when determining whether the assumption is appropriate.

A ratio of actual deaths to expected deaths (A/E ratio) of 100% would be considered appropriate for a fully generation mortality table. Assumptions regarding mortality improvements for future generations will follow, through the use of a projection scale.

In January 2019, the Society of Actuaries (SOA) issued the final version of Pub-2010 Public Retirement Plans Mortality Tables. This is the first set of mortality rates published based on U.S. public sector experience. In this study, the SOA examined mortality for Teachers, Public Safety, and General employment categories. The SOA also studied mortality rates by gender, income (in total and separated into above and below median), and status (active employees, retirees, disabled retirees, and contingent survivors). As a consequence, there are over 90 Pub-2010 tables to select from.

In this analysis, we look at a subset of the tables: PubG-2010 for healthy general retirees, PubG-2010 for healthy retired teachers, and PubS-2010 for the safety members. In certain cases, the Pub-2010 tables do not have rates below or above certain ages. In cases where rates are absent, we have extended the published tables with cubic splines or exponentials in a manner similar to the way the tables were created. The new tables are based specifically on public sector data and appear to have a better fit across the spectrum of ages.

The data was grouped into either Safety or General for analyzing the mortality. The Safety group includes Fire A, Fire B, Law Enforcement, Guard Fire, and Wardens and the General group includes Public Employee, Judges, and Volunteer. In analyzing the fit of the Base Table to the data, the deaths were "weighted" by the member's associated liability. In general, members with higher benefit amounts (higher liabilities) tend to live longer than those with lower benefit amounts.

For the general group, the general retiree table was a better fit than the teachers table.

Post-Retirement Mortality Rates

General

POST-RETIREMENT MORTALITY - MALE - GENERAL					
		Current Assumptions		Proposed Assumptions	
	Actual	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
Age	Deaths	Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
50-54	0	0	97%	0	97%
55-59	1	3	25%	2	35%
60-64	14	18	79%	13	111%
65-69	30	43	70%	34	89%
70-74	45	53	85%	47	97%
75-79	42	52	81%	51	83%
80-84	51	50	102%	52	98%
85-89	50	44	112%	48	104%
90+	42	33	129%	34	123%
Other	0	0	0%	0	0%
Totals	**275**	**297**	**93%**	**280**	**98%**

POST-RETIREMENT MORTALITY - FEMALE - GENERAL				
	Actual Deaths	Current Assumptions RP-2014 with Scale MP-2017		Proposed Assumptions Pub-2010 with Scale MP-2020	
Age		Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
50-54	0	0	35%	0	35%
55-59	3	3	107%	2	139%
60-64	12	16	73%	12	95%
65-69	24	36	67%	31	78%
70-74	27	37	74%	35	78%
75-79	34	31	110%	31	107%
80-84	29	27	108%	30	99%
85-89	33	25	131%	30	111%
90+	44	27	159%	33	131%
Other	0	0	0%	0	0%
Totals	**205**	**202**	**102%**	**204**	**101%**

Based on the current tables, the mortality experience for healthy retirees in the general group produced A/E ratios of 93% for males and 102% for females. The proposed tables provide a better fit for both males and females with A/E ratios of 98% and 101% respectively. We recommend changing to the Pub-2010 General Healthy Annuitant mortality tables for both males and females.

Safety

POST-RETIREMENT MORTALITY - MALE - SAFETY				
	Actual Deaths	Current Assumptions RP-2014 with Scale MP-2017		Proposed Assumptions Pub-2010 with Scale MP-2020	
Age		Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
50-54	0	1	40%	0	69%
55-59	1	2	42%	1	70%
60-64	5	5	98%	3	148%
65-69	7	6	111%	5	146%
70-74	6	6	101%	5	115%
75-79	3	5	63%	5	66%
80-84	2	4	67%	4	65%
85-89	5	4	104%	5	97%
90+	6	4	137%	4	131%
Other	0	0	0%	0	0%
Totals	**35**	**38**	**93%**	**33**	**106%**

POST-RETIREMENT MORTALITY - FEMALE - SAFETY					
		Current Assumptions		Proposed Assumptions	
	Actual	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
Age	Deaths	Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
50-54	0	0	0%	0	0%
55-59	0	0	121%	0	241%
60-64	0	0	21%	0	31%
65-69	0	0	82%	0	82%
70-74	1	0	316%	0	211%
75-79	0	0	252%	0	252%
80-84	0	0	0%	0	0%
85-89	0	0	0%	0	0%
90+	0	0	0%	0	0%
Other	0	0	0%	0	0%
Totals	**2**	**1**	**166%**	**1**	**182%**

Based on the current tables, the mortality experience for healthy retirees in the safety group produced A/E ratios of 93% for males and 166% for females. The proposed table for males provides a better fit than the current tables, so we recommend changing to the Pub-2010 Safety Healthy Annuitant mortality tables for both males and females.

Active Mortality Rates

General

		Current Assumptions		Proposed Assumptions	
PRE-RETIREMENT MORTALITY - MALE - GENERAL					
Age	Actual Deaths	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
		Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
Male	10	7	137%	7	140%
Female	3	5	63%	7	46%
Totals	**13**	**12**	**108%**	**14**	**95%**

Safety

		Current Assumptions		Proposed Assumptions	
PRE-RETIREMENT MORTALITY - MALE - SAFETY					
Age	Actual Deaths	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
		Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
Male	10	7	137%	6	166%
Female	3	5	63%	7	44%
Totals	**13**	**12**	**108%**	**13**	**101%**

Active mortality is an assumption with a minimal impact on valuation results, since so few members die while in active service. Life expectancy is higher for members who are still engaged in active employment and incidence of active deaths is very low in comparison to terminations and retirements. For active mortality rates, we recommendation changing to the Pub-2010 General Healthy Active mortality tables for both males and females in the general group, and the Pub-2010 Safety Healthy Active mortality tables for both males and females in the safety group.

Disabled Retiree Mortality Rates

General

		Current Assumptions		Proposed Assumptions	
PRE-RETIREMENT MORTALITY - MALE - GENERAL					
	Actual	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
Age	Deaths	Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
Male	5	4	113%	3	177%
Female	3	3	106%	2	139%
Totals	**8**	**7**	**110%**	**5**	**160%**

Safety

		Current Assumptions		Proposed Assumptions	
PRE-RETIREMENT MORTALITY - MALE - SAFETY					
	Actual	RP-2014 with Scale MP-2017		Pub-2010 with Scale MP-2020	
Age	Deaths	Expected Deaths	A/E Ratio	Expected Deaths	A/E Ratio
Male	3	11	24%	3	79%
Female	0	1	58%	0	175%
Totals	**3**	**12**	**26%**	**4**	**86%**

The rate of disability incidence is low for the WRS plans and the disabled mortality rates apply to a very small subsection of plan participants. The lack of data does not permit an in-depth study of this assumption. This is a minor assumption that has little impact on the liabilities of WRS. The Pub-2010 General Disabled Retiree mortality table is recommended for the general disabled lives mortality assumption and the Pub-2010 Safety Disabled Retiree mortality table is recommended for the safety disabled lives mortality assumption. Use of the Disabled Mortality tables will still reflect the impairment of life expectancy that occurs with disability and will also reflect some consistency with the general population by utilizing a similar basis as the retiree group.

Mortality Improvement Rates

In 2013, the Board adopted a fully generational mortality assumption. This strategy of building in continuous mortality improvement produces life expectancies of younger members that are materially longer than those of today's retirees. The lengthening of the future retiree's life has a significant impact on actuarial liabilities contribution requirements. Currently mortality is assumed to improve in accordance with Scale MP 2017. Scale MP 2017 was issued in 2017 and is now considered to be an outdated improvement scale.

The mortality improvement scales provide for the rates of improvement in life expectancy that can be expected for each future generation. The tables have rates that vary for earlier generations, but the rates converge after a period of time to their "ultimate" improvement rate. The recommendation for the active, retired, and disabled populations in this report are based on the MP-2020 Ultimate Scale.

Disability Rates

For the disability assumption, A/E ratios under 100% means there are fewer disabilities than expected. WRS experienced fewer disabilities than expected. The disability assumption is an assumption with a minor impact on the liabilities of the plan. Note the following:

- Law Enforcement is the only plan that separates duty from non-duty disability;
  - Non-duty disability requires 10 years of service for eligibility;
  - A breakdown by age is shown to provide insight into the age of members who receive disability benefits.

Wyoming Retirement System Experience Study- Rates of Disability					
		Current Assumptions		**Proposed Assumptions**	
Law Enforcement	**Actual**	**Expected**	**A/E Ratio**	**Expected**	**A/E Ratio**
Non-duty					
<30	0	0	0%	0	0%
30-34	1	0	587%	0	821%
35-39	2	1	273%	1	383%
40-44	4	2	214%	1	299%
45-49	5	4	130%	3	182%
50-54	2	5	39%	4	55%
55-59	1	5	18%	4	26%
60-64	0	8	0%	6	0%
65+	0	1	0%	1	0%
Total	**15**	**27**	**56%**	**19**	**78%**

- *Law Enforcement – Decrease non-duty rates and no change to duty rates*
- *Public Employee – No change recommended*
- *Fire B – No change recommended*
- *Wardens – No change recommended*
- *Judges – No change recommended*
- *Fire A – No change recommended*
- *Guard Fire – No change recommended*
- *Volunteer – No change recommended*

Retirement Rates

This assumption includes only members who retired from active status. It excludes those who were inactive for over a year before retiring. For this assumption, A/E ratios under 100% are conservative (when there are fewer retirements than expected, the Plan usually experiences a gain). The results of this analysis are shown below for each plan independently.

For the Public Employee plan Tier 1 members may retire upon normal retirement on the date he/she attains age 60 with four or more years of service while Tier 2 members may retire upon normal retirement on the date he/she attains age 65 with four or more years of service. All employees may also retire upon normal retirement on the date that the sum of the member's age and service is at least 85. Tier 1 members are eligible for a reduced benefit at age 50 with four or more years of service and Tier 2 members are eligible for a reduced benefit at age 55 with four or more years of service. All members are eligible for a reduced benefit at any age with 25 or more years of service.

The Public Employee plan currently uses two retirement rate tables; one for early retirement eligibility and one for normal retirement eligibility. For reduced retirement benefits (early retirement) members are retiring less than expected. For unreduced retirement the experience is slightly higher than the current assumption. The recommendation for this assumption is to lower the rates for certain ages that members are assumed to retire with a reduced benefit and raise the rates for certain ages that members are assumed to retire with an unreduced benefit.

Wyoming Retirement System Experience Study- Rates of Retirement					
		Current Assumptions		**Proposed Assumptions**	
Public Employee	**Actual**	**Expected**	**A/E Ratio**	**Expected**	**A/E Ratio**
Normal Retirement					
<55	59	53	112%	53	112%
55	65	74	88%	74	88%
56	102	104	98%	104	98%
57	130	116	112%	132	99%
58	159	139	114%	158	101%
59	182	160	114%	181	100%
60	552	524	105%	524	105%
61	420	474	89%	474	89%
62	589	603	98%	603	98%
63	445	430	103%	430	103%
64	414	378	110%	378	110%
65	680	580	117%	695	98%
66	582	495	118%	578	101%
67	324	312	104%	312	104%
68	193	201	96%	201	96%
69	157	151	104%	151	104%
70	139	76	183%	126	110%
71	81	54	149%	72	112%
72	46	40	116%	53	87%
73	37	28	132%	37	99%
74	34	24	141%	24	141%
75	19	19	101%	19	101%
76	16	14	111%	14	111%
77	12	13	92%	13	92%
78	9	10	88%	10	88%
79	15	7	217%	7	217%
80+	19	0	N/A	0	N/A
Total	**5,480**	**5,079**	**108%**	**5,424**	**101%**
Early Retirement					
<50	0	6	0%	1	0%
50	4	16	25%	6	64%
51	6	16	38%	6	95%
52	10	16	61%	10	102%
53	14	16	85%	16	85%
54	24	17	143%	17	143%
55	30	38	80%	38	80%
56	37	38	98%	38	98%
57	42	36	118%	36	118%
58	61	35	173%	53	115%
59	65	85	77%	68	96%
60	3	10	31%	10	31%
61	6	9	69%	9	69%
62	7	8	89%	8	89%
63	11	7	148%	7	148%
64	7	6	115%	6	115%
Total	**327**	**358**	**91%**	**328**	**100%**

Retirement eligibility for the Law Enforcement plan is age 60 with 4 years of service or any age with 20 years of service. Eligibility for early retirement is age 50 with 4 years of service. Under the normal retirement assumption, younger members are retiring at a greater rate than assumed. The recommendation is to raise the normal retirement rates to reflect the experience.

Wyoming Retirement System Experience Study- Rates of Retirement					
		Current Assumptions		Proposed Assumptions	
Law Enforcement	Actual	Expected	A/E Ratio	Expected	A/E Ratio
Normal Retirement					
<45	21	6	344%	12	175%
45	10	4	233%	8	125%
46	5	4	128%	8	63%
47	10	5	213%	9	111%
48	10	6	179%	11	91%
49	13	6	203%	12	108%
50	14	12	119%	12	117%
51	11	7	154%	9	122%
52	10	7	145%	9	111%
53	13	8	172%	10	130%
54	11	7	151%	10	110%
55	10	7	142%	7	143%
56	7	7	106%	7	100%
57	12	7	167%	7	171%
58	12	9	133%	7	171%
59	6	7	81%	6	100%
60	20	24	83%	18	111%
61	19	19	102%	28	68%
62	28	18	155%	27	104%
63	15	16	96%	8	188%
64	11	13	86%	17	65%
65	13	25	53%	25	52%
66	17	17	103%	17	100%
67	8	7	123%	7	114%
68	4	6	73%	6	67%
69	2	4	50%	4	50%
70+	9	23	39%	25	36%
Total	**321**	**278**	**115%**	**326**	**98%**

Retirement eligibility for the Fire B plan is age 50 with 4 years of service. Rate changes are recommended to align the table with experience.

Wyoming Retirement System Experience Study- Rates of Retirement					
		Current Assumptions		Proposed Assumptions	
Fire B	Actual	Expected	A/E Ratio	Expected	A/E Ratio
<50	0	0	0%	0	0%
50	13	12	112%	15	90%
51	5	4	116%	4	116%
52	1	3	36%	3	36%
53	3	2	136%	2	136%
54	0	2	0%	2	0%
55	6	4	136%	6	109%
56	3	4	71%	4	71%
57	4	4	107%	4	107%
58	2	2	111%	2	111%
59	1	2	51%	2	51%
60	3	2	133%	2	133%
61	1	4	29%	4	29%
62+	3	14	21%	14	21%
Total	45	58	77%	62	72%

Retirement eligibility for the Wardens plan is age 60 with 5 years of service. Members are retiring generally less than expected, and data is limited for this group, so recommended changes to fit the A/E ratios for each age are minor.

Wyoming Retirement System Experience Study- Rates of Retirement					
		Current Assumptions		Proposed Assumptions	
Volunteer	Actual	Expected	A/E Ratio	Expected	A/E Ratio
<60	0	0	0%	0	0%
60	213	281	76%	221	97%
61	42	28	151%	47	90%
62	20	20	100%	20	100%
63	15	20	76%	15	101%
64	8	18	44%	11	74%
65	5	12	43%	12	43%
66	9	10	91%	10	91%
67	4	12	34%	6	69%
68	2	10	19%	5	38%
69	3	11	29%	3	107%
70+	9	40	23%	40	23%
Total	330	460	72%	388	85%

Retirement eligibility for the Judges plan is the earliest of: age 60 with 20 years of service, age 65 with 4 years of service, or age 70. Eligibility for early retirement is age 55 with 4 years of service.

Wyoming Retirement System Experience Study- Rates of Retirement					
		Current Assumptions		Proposed Assumptions	
Judges	Actual	Expected	A/E Ratio	Expected	A/E Ratio
<65	1	0	500%	0	500%
65	4	3	157%	4	94%
66	1	1	71%	2	48%
67	3	1	273%	2	182%
68	1	1	111%	1	74%
69	2	0	500%	1	333%
70+	2	0	667%	2	100%
Total	14	7	204%	12	115%

Termination Rates

Termination rates are used to estimate the number of members who leave for any reason other than death, disability or service retirement. Termination rates apply whether the termination is voluntary or involuntary, and whether the member takes a refund or keeps his/her account balance on deposit in the Pension Trust. For this assumption, A/E ratios over 100% are conservative (when there are more terminations than expected, the Plan usually experiences a gain).

Currently, some plans incorporate both age and service in the "select and ultimate" assumption. This means that, for a five year select period, every employee will be assumed to terminate according to the rates in the select table, regardless of age. However, based on the recent data, we are recommending that the all plans be either age based on service based. The patterns for each are well defined by one or the other approach.

Another change this year is that we are now using a liability weighting approach for the termination rates. What this does is considers the value of each termination, opposed to only counting the number of members. This is generally a better approach for termination rates because higher liability members tend to not terminate at the same rate as the lower liability members. Using count-based rates tends to overstate the impact of the terminations.

The public employee plan currently uses the select and ultimate approach. However, using the liability weighted approach showed that the best pattern exists use a service based on tables. The recommendation is to lower terminations in the early years, but increase terminations in the later year.

Wyoming Retirement System Experience Study- Rates of Termination						
			Expected		A/E Ratio	
Public Employee	Actual	Exposure	Current	New	Current	New
Male - Service-Based						
<5	191	1600	246	208	78%	92%
5-9	451	4433	271	441	166%	102%
10-14	462	5903	263	437	176%	106%
15-19	253	5177	213	239	118%	106%
20-24	118	3899	156	117	75%	101%
25+	27	248	10	7	271%	361%
Total	1,501	21,260	1,159	1,450	129%	104%
Female - Service-Based						
<5	306	2,393	416	335	74%	91%
5-9	752	6,962	466	693	162%	109%
10-14	698	8,975	457	663	153%	105%
15-19	482	8,083	404	485	119%	99%
20-24	307	5,143	257	309	119%	99%
25+	20	312	16	19	131%	109%
Total	2,566	31,868	2,015	2,503	127%	102%

The Law Enforcement plan currently employs a select and ultimate assumption with a five year select period. However, based on the data, the best pattern for the groups is uses a service only approach. Additionally, over all, there were fewer than expected termination over the study period.

Therefore, the recommendation is to decrease the rates of termination rates.

Wyoming Retirement System Experience Study- Rates of Termination						
			Expected		A/E Ratio	
Law Enforcement	Actual	Exposure	Current	New	Current	New
Male - Service-Based						
<5	44	414	67	50	66%	89%
5-9	131	1419	114	131	115%	100%
10-14	111	2351	149	117	74%	94%
15-19	49	2216	121	49	41%	101%
20+	5	203	11	2	47%	243%
Total	341	6,603	462	349	74%	98%
Female - Service-Based						
<5	22	153	31	25	71%	87%
5-9	54	421	35	49	152%	110%
10-14	48	720	45	48	107%	100%
15-19	12	620	34	15	34%	76%
20+	0	51	3	1	0%	0%
Total	135	1,966	148	138	91%	98%

The Wardens plan currently employs a termination assumption that is based solely on the member's age. This approach is still be best pattern for this group. The recommendation is to slightly decrease these age-based termination rates to reflect the lower than assumed termination rates.

Wyoming Retirement System Experience Study- Rates of Termination						
			Expected		A/E Ratio	
Wardens	Actual	Exposure	Current	New	Current	New
<20	0	0	0	0	0%	0%
20-24	0	2	0	0	0%	0%
25-29	2	43	3	2	59%	88%
30-34	12	178	10	8	124%	156%
35-39	16	325	16	15	102%	109%
40-44	15	529	22	16	69%	96%
45-49	18	687	27	21	68%	87%
50-54	1	688	0	7	0%	15%
55-59	5	475	0	5	0%	93%
60-62	0	141	0	1	0%	0%
Total	70	3,068	78	75	90%	93%

The Volunteer plan currently employs a termination assumption that is based solely on the member's age. This approach is still be best pattern for this group. The recommendation is to decrease these age-based termination rates to reflect the lower than assumed termination rates.

Wyoming Retirement System Experience Study- Rates of Termination						
			Expected		A/E Ratio	
Volunteer	Actual	Exposure	Current	New	Current	New
<20	0	0	0	0	0%	0%
20-24	0	2	0	0	9%	16%
25-29	0	9	2	1	21%	63%
30-34	1	29	4	1	24%	75%
35-39	3	75	8	3	35%	94%
40-44	5	123	13	5	37%	97%
45-49	4	208	13	6	29%	62%
50-54	9	389	16	10	54%	91%
55-59	12	784	27	12	43%	100%
60-64	0	259	6	3	0%	0%
65-69	0	23	1	0	0%	0%
70+	0	1	0	0	0%	0%
Total	**33**	**1,902**	**91**	**41**	**37%**	**82%**

The Fire B plan currently employs a termination assumption that is based solely on the member's age. There is no "select" period in the Fire B termination assumption. There were more terminations (51) than assumed (40). The recommendation is to slightly increase these age-based termination rates to reflect the higher than assumed termination experience.

Wyoming Retirement System Experience Study- Rates of Termination						
			Expected		A/E Ratio	
Fire B	Actual	Exposure	Current	New	Current	New
<20	0	0	0	0	0%	0%
20-24	0	5	1	0	77%	92%
25-29	3	57	5	3	67%	100%
30-34	8	240	10	10	87%	87%
35-39	9	632	19	16	47%	56%
40-44	25	921	23	18	110%	137%
45-49	15	1068	21	16	70%	93%
50-54	0	4	0	0	0%	519%
55-59	0	6	0	0	0%	0%
60-62	0	2	0	0	0%	0%
Total	**61**	**2,933**	**79**	**64**	**78%**	**96%**

For the Judges plan, over the study period, there were no members who terminated. Therefore, recommend removing this assumption.

Other Assumptions and Refunds

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.

There are additional assumptions made that have a smaller role in determining liabilities.

Percent Married: Currently, the Fire A plan and the Judge's plan assume 100% of members are married at retirement and all other plans assume 85%. No change is recommended.

Spouse Age Difference: The current assumption is that males are three years older than their female spouse. There is no recommended change to this assumption.

Refund: Based on plan experience, we recommend changing the refund assumption for the Public Employee Plan to maximum value. This means the member will elect the maximum of a deferred benefit or a refund of contributions. There is no other recommended changes to this assumption.

Optional Forms of Payment

The optional forms of payment for Service Retirement benefits are all generally considered to be the same value (or "actuarial equivalent"). There is no additional assumption used in valuing optional forms of payment.

Administrative Expenses

The valuation assumes that administrative expenses will increase each year by 2.50% based on the average adjusted expenses paid for the prior two years. There is no change recommend for this assumption.

Retirement Age for Terminated-Vested members

The following chart shows the assumed age for retirement for terminated vested members by plan:

**Assumed Retirement Age for Members
with Deferred Vested Benefits**

Plan	Age
Fire B	50
Guard Fire	60
Judges	65
LE	60
Public Employee	60 (65 for Tier 2)
Vol	60
Wardens	50

We recommend no change for the retirement age assumption for deferred vested members.

Actuarial Methods

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.

We are not recommending a change to the asset valuation method of five year smoothing of asset gains and losses.

Amortization Method

The amortization methodology is important because it establishes a systematic approach to paying off the UAL and determines how the Actuarially Determined Contribution is to be calculated for the valuation report.

WRS uses level percent-of-pay amortization methodology for the plans that provide salary-related benefits and level dollar amortization methodology for plans that are closed to new entrants or provide benefit amounts independent of salary.

The amortization payment is based upon the following assumptions:
- The funding period is based on a 30-year closed period for the initial base as of January 1, 2018 and 20-year closed period layers for future gains and losses
- Amortization payment amounts are calculated in such a way that they will increase as a level percentage of payroll
- Total payroll increases are assumed at 2.50% per year, and
- Future growth in the number of active members is not reflected in the annual valuation

No changes are recommended to this approach.

SECTION D

SUMMARY OF ASSUMPTIONS AND METHODS

Summary of Assumptions and Methods
Incorporating the Recommended Assumptions

Salary Increase Assumptions

% Increases in Salary - Proposed Assumptions	
Service	Public Employee
1	6.5000%
2	6.5000%
3	6.5000%
4	6.0000%
5	5.2500%
6	4.7500%
7	4.2500%
8	4.0000%
9	4.0000%
10	3.5000%
11	3.5000%
12	3.5000%
13	3.5000%
14	3.2500%
15	3.0000%
16	3.0000%
17	2.7500%
18	2.7500%
19	2.7500%
20	2.7500%
21	2.5000%
22	2.5000%
23	2.5000%
24	2.5000%
25	2.5000%

% Increases in Salary - Proposed Assumptions		
Age	Fire B	Judges
<20	7.5000%	3.7500%
20-25	7.5000%	3.7500%
25-29	7.0000%	3.7500%
30-35	5.5000%	3.7500%
35+	4.5000%	3.7500%

Post-Retirement Mortality Rates

General

Base Table - Active - All Plans								
	% Dying Next Year			**% Dying Next Year**			**% Dying Next Year**	
Age	**Male**	**Female**	**Age**	**Male**	**Female**	**Age**	**Male**	**Female**
50	0.2566%	0.1969%	65	0.7897%	0.5461%	80	4.2271%	3.0644%
51	0.2764%	0.2066%	66	0.8695%	0.6089%	81	4.7849%	3.4731%
52	0.2980%	0.2182%	67	0.9616%	0.6794%	82	5.4126%	3.9389%
53	0.3203%	0.2297%	68	1.0678%	0.7597%	83	6.1253%	4.4777%
54	0.3453%	0.2412%	69	1.1912%	0.8520%	84	6.9236%	5.0988%
55	0.3711%	0.2537%	70	1.3303%	0.9545%	85	7.8037%	5.8055%
56	0.3987%	0.2670%	71	1.4862%	1.0706%	86	8.7824%	6.6242%
57	0.4280%	0.2820%	72	1.6654%	1.2027%	87	9.8581%	7.5561%
58	0.4590%	0.2980%	73	1.8642%	1.3501%	88	11.0219%	8.5959%
59	0.4934%	0.3175%	74	2.0922%	1.5177%	89	12.3012%	9.7616%
60	0.5296%	0.3406%	75	2.3467%	1.7039%	90	13.6867%	11.0371%
61	0.5692%	0.3689%	76	2.6342%	1.9124%	91	15.1510%	12.3850%
62	0.6140%	0.4027%	77	2.9628%	2.1500%	92	16.7190%	13.8182%
63	0.6638%	0.4439%	78	3.3314%	2.4161%	93	18.3720%	15.3224%
64	0.7223%	0.4912%	79	3.7527%	2.7202%	94	20.0854%	16.8859%
						95	21.9008%	18.5535%

Safety

Base Table - Active - All Plans								
	% Dying Next Year			**% Dying Next Year**			**% Dying Next Year**	
Age	**Male**	**Female**	**Age**	**Male**	**Female**	**Age**	**Male**	**Female**
50	0.1653%	0.1283%	65	0.7620%	0.6660%	80	4.5184%	3.5081%
51	0.1817%	0.1438%	66	0.8556%	0.7438%	81	5.1134%	3.9355%
52	0.1989%	0.1602%	67	0.9607%	0.8306%	82	5.7775%	4.4091%
53	0.2179%	0.1783%	68	1.0791%	0.9279%	83	6.5282%	4.9454%
54	0.2394%	0.1989%	69	1.2147%	1.0371%	84	7.3694%	5.5472%
55	0.2635%	0.2222%	70	1.3669%	1.1586%	85	8.2978%	6.2150%
56	0.2902%	0.2480%	71	1.5395%	1.2934%	86	9.3414%	6.9711%
57	0.3203%	0.2764%	72	1.7353%	1.4458%	87	10.5020%	7.8191%
58	0.3548%	0.3083%	73	1.9544%	1.6147%	88	11.7784%	8.7607%
59	0.3935%	0.3436%	74	2.2045%	1.8052%	89	13.2085%	9.8261%
60	0.4375%	0.3841%	75	2.4828%	2.0163%	90	14.7949%	11.0215%
61	0.4874%	0.4280%	76	2.7970%	2.2516%	91	16.4168%	12.2960%
62	0.5434%	0.4771%	77	3.1540%	2.5167%	92	18.0512%	13.6559%
63	0.6069%	0.5328%	78	3.5538%	2.8107%	93	19.6605%	15.0817%
64	0.6800%	0.5962%	79	4.0092%	3.1416%	94	21.2264%	16.5607%
						95	22.8194%	18.1394%

Pre-Retirement Mortality Rates

General

Base Table - Active - All Plans								
	% Dying Next Year			% Dying Next Year			% Dying Next Year	
Age	Male	Female	Age	Male	Female	Age	Male	Female
20	0.0319%	0.0112%	35	0.0405%	0.0198%	50	0.1283%	0.0715%
21	0.0310%	0.0103%	36	0.0431%	0.0215%	51	0.1395%	0.0775%
22	0.0284%	0.0095%	37	0.0456%	0.0241%	52	0.1507%	0.0835%
23	0.0267%	0.0086%	38	0.0491%	0.0258%	53	0.1628%	0.0904%
24	0.0250%	0.0078%	39	0.0525%	0.0284%	54	0.1748%	0.0973%
25	0.0241%	0.0078%	40	0.0568%	0.0310%	55	0.1886%	0.1059%
26	0.0258%	0.0086%	41	0.0611%	0.0344%	56	0.2032%	0.1145%
27	0.0267%	0.0095%	42	0.0663%	0.0370%	57	0.2196%	0.1240%
28	0.0284%	0.0103%	43	0.0715%	0.0405%	58	0.2368%	0.1343%
29	0.0293%	0.0112%	44	0.0775%	0.0439%	59	0.2549%	0.1464%
30	0.0310%	0.0129%	45	0.0844%	0.0482%	60	0.2747%	0.1602%
31	0.0327%	0.0138%	46	0.0921%	0.0525%	61	0.2962%	0.1748%
32	0.0344%	0.0155%	47	0.0999%	0.0568%	62	0.3195%	0.1912%
33	0.0362%	0.0164%	48	0.1094%	0.0611%	63	0.3457%	0.2103%
34	0.0379%	0.0181%	49	0.1188%	0.0663%	64	0.3741%	0.2324%
						65	0.4048%	0.2560%

Safety

Base Table - Active - All Plans								
	% Dying Next Year			% Dying Next Year			% Dying Next Year	
Age	Male	Female	Age	Male	Female	Age	Male	Female
20	0.0353%	0.0138%	35	0.0405%	0.0310%	50	0.1033%	0.0784%
21	0.0353%	0.0146%	36	0.0422%	0.0327%	51	0.1111%	0.0835%
22	0.0344%	0.0146%	37	0.0431%	0.0353%	52	0.1206%	0.0887%
23	0.0336%	0.0155%	38	0.0456%	0.0370%	53	0.1300%	0.0939%
24	0.0327%	0.0164%	39	0.0482%	0.0396%	54	0.1395%	0.0999%
25	0.0319%	0.0172%	40	0.0508%	0.0422%	55	0.1507%	0.1059%
26	0.0327%	0.0181%	41	0.0534%	0.0448%	56	0.1636%	0.1128%
27	0.0336%	0.0189%	42	0.0577%	0.0482%	57	0.1765%	0.1206%
28	0.0344%	0.0207%	43	0.0611%	0.0508%	58	0.1920%	0.1274%
29	0.0353%	0.0215%	44	0.0654%	0.0543%	59	0.2093%	0.1361%
30	0.0353%	0.0233%	45	0.0706%	0.0577%	60	0.2273%	0.1447%
31	0.0362%	0.0241%	46	0.0758%	0.0611%	61	0.2480%	0.1533%
32	0.0370%	0.0258%	47	0.0818%	0.0654%	62	0.2713%	0.1636%
33	0.0379%	0.0276%	48	0.0878%	0.0689%	63	0.2966%	0.1741%
34	0.0388%	0.0293%	49	0.0956%	0.0732%	64	0.3240%	0.1858%
						65	0.3546%	0.1972%

Disabled Retirement Mortality Rates

General

Base Table - Active - All Plans								
	% Dying Next Year			% Dying Next Year			% Dying Next Year	
Age	Male	Female	Age	Male	Female	Age	Male	Female
50	1.3821%	1.2771%	65	2.6330%	1.9514%	80	6.5062%	5.3188%
51	1.4743%	1.3218%	66	2.7680%	2.0338%	81	7.0598%	5.8320%
52	1.5655%	1.3666%	67	2.9100%	2.1263%	82	7.6601%	6.3946%
53	1.6542%	1.4123%	68	3.0618%	2.2321%	83	8.3269%	7.0246%
54	1.7395%	1.4570%	69	3.2271%	2.3563%	84	9.0524%	7.7194%
55	1.8204%	1.5001%	70	3.4007%	2.4949%	85	9.8239%	8.4759%
56	1.8953%	1.5406%	71	3.5895%	2.6522%	86	10.6668%	9.2830%
57	1.9634%	1.5784%	72	3.7996%	2.8330%	87	11.5775%	10.1162%
58	2.0280%	1.6138%	73	4.0271%	3.0332%	88	12.5497%	10.9583%
59	2.0908%	1.6482%	74	4.2827%	3.2629%	89	13.7864%	11.8346%
60	2.1554%	1.6844%	75	4.5615%	3.5169%	90	15.1615%	12.7473%
61	2.2252%	1.7223%	76	4.8701%	3.8014%	91	16.5668%	13.6959%
62	2.3052%	1.7662%	77	5.2194%	4.1237%	92	18.0201%	14.7310%
63	2.4009%	1.8190%	78	5.6012%	4.4786%	93	19.5051%	15.8595%
64	2.5126%	1.8818%	79	6.0338%	4.8795%	94	21.0094%	17.0860%
						95	22.5984%	18.4657%

Safety

Base Table - Active - All Plans								
	% Dying Next Year			% Dying Next Year			% Dying Next Year	
Age	Male	Female	Age	Male	Female	Age	Male	Female
50	0.3040%	0.2618%	65	1.0259%	0.9177%	80	4.9567%	3.5081%
51	0.3212%	0.2842%	66	1.1304%	0.9995%	81	5.5016%	3.9355%
52	0.3401%	0.3091%	67	1.2445%	1.0883%	82	6.0932%	4.4091%
53	0.3617%	0.3358%	68	1.3693%	1.1842%	83	6.7593%	4.9454%
54	0.3858%	0.3651%	69	1.5082%	1.2896%	84	7.5132%	5.5472%
55	0.4133%	0.3970%	70	1.6624%	1.4035%	85	8.3687%	6.2150%
56	0.4452%	0.4314%	71	1.8353%	1.5273%	86	9.3414%	6.9711%
57	0.4831%	0.4685%	72	2.0371%	1.6636%	87	10.5020%	7.8191%
58	0.5270%	0.5098%	73	2.2679%	1.8108%	88	11.7784%	8.7607%
59	0.5770%	0.5537%	74	2.5389%	1.9728%	89	13.2085%	9.8261%
60	0.6329%	0.6019%	75	2.8474%	2.1463%	90	14.7949%	11.0215%
61	0.6967%	0.6545%	76	3.1963%	2.3378%	91	16.4168%	12.2960%
62	0.7664%	0.7113%	77	3.5895%	2.5528%	92	18.0512%	13.6559%
63	0.8448%	0.7742%	78	4.0136%	2.8107%	93	19.6605%	15.0817%
64	0.9314%	0.8433%	79	4.4727%	3.1416%	94	21.2264%	16.5607%
						95	22.8194%	18.1394%

Disability Rates

	Public Employee		Law Enforcement				
% Disabled Next Year							
Age	**Male**	**Female**	**Non-Duty**	**Duty**	**Fire B**	**Wardens**	**Judges**
20	0.0080%	0.0080%	0.0330%	0.0198%	0.0240%	0.1040%	0.0100%
25	0.0080%	0.0080%	0.0330%	0.0198%	0.0240%	0.1040%	0.0100%
30	0.0080%	0.0080%	0.0330%	0.0198%	0.0240%	0.2340%	0.0100%
35	0.0080%	0.0080%	0.0390%	0.0234%	0.1520%	0.3900%	0.0100%
40	0.0080%	0.0080%	0.0900%	0.0540%	0.3360%	0.5720%	0.0100%
45	0.0240%	0.0240%	0.1920%	0.1152%	0.5200%	0.7280%	0.0100%
50	0.1200%	0.0480%	0.3330%	0.1998%	0.6560%	0.7540%	0.0300%
55	0.2400%	0.1200%	0.5700%	0.3420%	1.4480%	0.7540%	0.0500%
60	0.2400%	0.2400%	1.1100%	0.6660%	1.6000%	0.7540%	0.0700%
65	0.2400%	0.2400%	1.5300%	0.9180%	1.6640%	0.7540%	0.0900%
70	0.2400%	0.2400%	1.5300%	0.9180%	1.6640%	0.7540%	0.1100%
75	0.2400%	0.2400%	1.5300%	0.9180%	1.6640%	0.7540%	0.1300%

Retirement Rates

	Public Employee		Law Enforcement				Judges		
% Retired Next Year									
Age	**Normal**	**Early**	**Normal**	**Early**	**Fire B**	**Wardens**	**Normal**	**Early**	**Volunteer**
50	15.00%	0.20%	25.00%	2.00%	25.00%	15.00%	2.00%	2.00%	
51	15.00%	0.20%	18.00%	2.00%	10.00%	5.00%	2.00%	2.00%	
52	15.00%	0.20%	18.00%	2.00%	10.00%	5.00%	2.00%	2.00%	
53	15.00%	0.20%	18.00%	2.00%	10.00%	5.00%	2.00%	2.00%	
54	15.00%	0.20%	18.00%	2.00%	10.00%	10.00%	2.00%	2.00%	
55	17.00%	0.20%	18.00%	2.00%	25.00%	10.00%	2.00%	2.00%	
56	17.00%	0.20%	18.00%	2.00%	25.00%	10.00%	2.00%	2.00%	
57	17.00%	0.20%	20.00%	2.00%	25.00%	15.00%	2.00%	2.00%	
58	17.00%	0.20%	20.00%	2.00%	15.00%	15.00%	2.00%	2.00%	
59	17.00%	0.20%	20.00%	2.00%	15.00%	15.00%	2.00%	2.00%	
60	13.00%	0.20%	20.00%	2.00%	25.00%	35.00%	25.00%	15.00%	55.00%
61	13.00%	0.20%	17.00%	2.00%	50.00%	40.00%	15.00%	10.00%	25.00%
62	18.00%	0.30%	17.00%	2.00%	100.00%	100.00%	15.00%	10.00%	15.00%
63	15.00%	0.50%	20.00%	2.00%			15.00%	10.00%	15.00%
64	15.00%	0.50%	20.00%	2.00%			15.00%	10.00%	15.00%
65	30.00%	1.00%	50.00%	2.00%			100.00%	15.00%	25.00%
66	35.00%	1.00%	50.00%	2.00%				15.00%	30.00%
67	28.00%	1.00%	50.00%	2.00%				100.00%	20.00%
68	25.00%	1.50%	50.00%	2.00%					20.00%
69	25.00%	2.00%	50.00%	2.00%					20.00%
70	25.00%	2.50%	100.00%	100.00%					100.00%
71	20.00%	2.50%							
72	20.00%	2.50%							
73	20.00%	2.50%							
74	15.00%	2.50%							
75	15.00%	2.50%							
76	15.00%	2.50%							
77	15.00%	2.50%							
78	15.00%	2.50%							
79	15.00%	2.50%							
80	100.00%	100.00%							

Termination Rates

% Terminated Next Year			
Age	Fire B	Wardens	Volunteer
20	10.00%	4.50%	10.00%
25	6.00%	4.50%	6.00%
30	4.00%	4.50%	5.00%
35	2.50%	4.50%	4.00%
40	2.00%	3.00%	4.00%
45	1.50%	3.00%	3.00%
50	1.50%	1.00%	2.50%
55	0.50%	1.00%	1.50%
60	0.50%	1.00%	1.00%
65	0.50%	1.00%	1.00%

% Terminated Next Year				
	Public Employee		Law Enforcement	
Service	Male	Female	Male	Female
1	13.00%	14.00%	12.00%	18.00%
2	13.00%	14.00%	12.00%	16.00%
3	13.00%	14.00%	12.00%	16.00%
4	13.00%	14.00%	12.00%	16.00%
5	13.00%	13.00%	12.00%	14.00%
6	11.00%	11.00%	10.00%	14.00%
7	10.00%	10.00%	10.00%	12.00%
8	9.00%	9.00%	9.00%	11.00%
9	8.00%	8.00%	7.00%	8.00%
10	8.00%	8.00%	6.00%	8.00%
11	8.00%	8.00%	6.00%	8.00%
12	8.00%	7.00%	5.00%	7.00%
13	7.00%	7.00%	4.00%	6.00%
14	6.00%	7.00%	4.00%	5.00%
15	6.00%	6.00%	3.00%	4.00%
16	5.00%	6.00%	3.00%	3.00%
17	5.00%	6.00%	2.00%	2.00%
18	4.00%	6.00%	2.00%	2.00%
19	3.00%	6.00%	1.00%	1.00%
20	3.00%	6.00%	1.00%	1.00%
21	3.00%	6.00%	0.00%	0.00%
22	3.00%	6.00%	0.00%	0.00%
23	3.00%	6.00%	0.00%	0.00%
24	3.00%	6.00%	0.00%	0.00%
25	3.00%	6.00%	0.00%	0.00%