Public Employees Police and Fire Plan of Minnesota

4-Year Experience Study

July 1, 2019 through June 30, 2023

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July 31, 2024

Public Employees Retirement Association of Minnesota
Public Employees Police and Fire Plan
St. Paul, Minnesota

Dear Trustees of the Public Employees Police and Fire Plan:

The results of the four-year ***actuarial experience study*** of the Public Employees Police and Fire Plan (PEPFP) are presented in this report. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the Public Employees Police and Fire Plan.

The investigation was based upon the statistical data furnished for annual active member and retired life actuarial valuations concerning members who died, withdrew, became disabled or retired during the four-year period of the study by the Public Employees Retirement Association of Minnesota (PERA). We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by PERA.

The investigation covered the four-year period from ***July 1, 2019 to June 30, 2023***, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the Public Employees Police and Fire Plan.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of PERA and is intended for use by the Retirement Association and those designated or approved by the Trustees. This report may be provided to parties other than the Association only in its entirety and only with the permission of the Trustees.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with Minnesota Statutes Section 356.215 and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

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Public Employees Retirement Association of Minnesota
Public Employees Police and Fire Plan
July 31, 2024

Bonita J. Wurst and Sheryl L. Christensen are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, GRS meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Bonita J. Wurst, ASA, EA, FCA, MAAA

Sheryl L. Christensen, FSA, EA, FCA, MAAA

BJW/SLC:sc

Actuarial Experience Study
2019-2023

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2019 to June 30, 2023) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the Public Employees Police and Fire Plan. The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations

- Adjust rates of merit and seniority, resulting in proposed merit and seniority rates that are, in total, approximately 31 basis points lower than that anticipated by the current rates.
- Adjust assumed retirement rates:
  - Increase the rate of assumed unreduced retirements (i.e., Normal Retirement) before age 65.
  - Reduce early retirement rates at ages 50 and 51 and increase early retirement rates at ages 53 and 54.
- Increase the assumed rates of withdrawal (termination of membership before eligible to retire) at most years prior to year 22 with more significant adjustment in the first two years.
- Higher rates of disability.
- Continued use of the Pub-2010 general mortality table, with rates adjusted to better fit observed plan experience and with future improvement projected using scale MP-2021.
- Minor changes to the form of payment assumptions for male and female retirees and to the percent married assumption for female retirees.
- Minor changes to the assumptions made with respect to missing participant data.

The recommendations are summarized on the following pages.

Review of the investment return assumption and actuarial methods is outside the scope of this experience study. Please refer to GRS' General Employees Retirement Plan experience study dated June 29, 2023. This report concluded that the current investment return assumption of 7.0% was within a reasonable range as of the date of the report.

Introduction

Each year as of June 30, the actuarial liabilities of the Association are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Rates of **withdrawal** of active members (leaving before eligible to retire).
- Rates of **disability** among active members.
- Patterns of **pay increases** to active members.
- Rates of **retirement** among active members.
- Rates of **mortality** among active members, retirees, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the System.

Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or gradual increases in required contributions as time progresses; and

- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers.

All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement or the PERA Trustees.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year to year fluctuations. Actuarial assumptions were last revised for the 2021 actuarial valuations based on the results of the most recent experience study and in 2023 to reflect the change to 7.0% interest. Assumptions in effect prior to June 30, 2023 are ignored for purposes of this report.

No single experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and the actual experience, we generally recommend a change in assumptions that produces results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Consequently, temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

We are recommending certain changes in assumptions and methods. The various assumption changes are described on the following pages.

Summary of Decrement Experience
2019-2023

Results presented in this exhibit and in the body of the report are liability weighted for retirement, withdrawal and active mortality and benefit weighted for healthy and disabled retiree mortality.

Decrement Risk Area		Actual Number	Expected		
			Present Assumptions	Proposed Assumptions	Change
Unreduced Retirement ($000s)		876,771	656,794	777,425	120,631
Reduced Retirement ($000s)		420,332	382,588	408,608	26,020
Withdrawal ($000s)		340,537	269,180	309,053	39,873
Disability		810	255	565	310
*Mortality ($000s)***					
Healthy Retired Lives	- Male	43,735	41,213	42,475	1,262
	- Female	1,037	1,029	1,029	0
Disabled Retired Lives	- Male	6,744	4,485	4,998	513
	- Female	304	208	208	0
Active Lives	- Male	16,561	21,979	21,979	0
	- Female	1,232	1,783	1,783	0

* *Normal retirements less than age 70. See Section C for full detail.*

** *Adjustments to fit plan experience are limited due to a lack of credible data (deaths) except for healthy post-retirement males.*

In general, increased incidence of withdrawals and lower future salaries result in lower liability and contribution requirements while increased incidence of unreduced and disability retirements result in higher liabilities and contribution requirements. We will follow up with the impact of the proposed changes.

SECTION B

PAY INCREASES

Pay Increases Due to Merit and Seniority

Pay increases granted to active members typically consist of two pieces:

- Payroll growth is an across-the-board, economic type of increase granted to most or all members of the group. This increase is typically tied to inflation or cost-of-living changes; and

- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

Inflation and Payroll Growth

For the Police and Fire plan, the general inflation assumption is currently 2.25% and the payroll growth assumption is currently 3.00%.

General inflation, as measured by the change in Consumer Price Index, has averaged about 4.5% over the four-year period ending June 30, 2023. During the 2020 to 2022 calendar year period, the increase in the national average earnings have been about 5.7% (the 2023 national average earnings amount was not available at the time this report was published). Actual annual payroll growth for this plan for the four-year period ending June 30, 2023 has averaged approximately 4.9%.

Active membership increased from 11,763 as of July 1, 2019 to 12,025 as of July 1, 2020 but decreased to 11,705 as of July 1, 2021 and 11,629 as of July 1, 2022, presumably due to the impact of the pandemic and civil unrest which began in May, 2020. Active membership as of July 1, 2023 was 11,635, a slight increase from July 1, 2022. Overall, active membership decreased 1.1%, from 11,763 as of July 1, 2019 to 11,635 as of July 1, 2023. We note that, although active membership decreased, payroll continued to increase during this period, more than the assumed annual rate of 3.00%.

A thorough review of general inflation and payroll growth is presented in Section B of the PERA General Employees Retirement Plan experience study report dated June 29, 2023. In that report, we concluded:

> "although current inflation rates are higher than they have been in previous decades, the future outlook … suggest 2.25% continues to be reasonable."
>
> and
>
> "When combined with the 2.25% price inflation assumption, the recommended payroll growth assumption remains at 3.00% ... The recommended payroll growth assumption is appropriate for a stable population."

We recommend maintaining the price inflation assumption of 2.25% and a payroll growth assumption of 3.00% for the Police and Fire plan. These assumptions are supported by experience and are consistent with the assumption used for PERA's General Employees Retirement Plan.

Pay Increases Due to Merit and Seniority

We reviewed the merit and seniority pay increases during the four-year period. For each year, we excluded individual pay increases that were more than 30% and also excluded individual pay increases that were less than -30%. Some occurrences of a negative salary increase are reasonable and expected in a plan that covers part-time employees. While this was a relatively small number of records, the experience distorted the experience of the overall group.

In order to study the merit and seniority portion of the salary increase assumption, it is necessary to separate out the portion attributable to wage inflation. Based on our review of salary experience for PEPFP members for the period July 1, 2019 through June 30, 2023, we observed that members with longer service averaged approximately a 5.0% annual increase for this period. However, we note average salary for this group of members varied and increased each year in the study period, from 3.9% in 2020 to 6.1% in 2023. For our analysis of the merit and seniority portion of total salary increase, we assumed that the salary increase amount in excess of the total salary increase for the longer-service members (i.e., those with 25 or more years of service) was attributable to wage inflation only. This assumes that once members reach a certain length of service, merit and seniority increases are much less common. We also note there were more active members exiting due to retirement, termination and disability than was expected during this period.

Findings

The assumed wage inflation was 3.00% during the study period. During the four years of the study, we estimate the average actual wage inflation component of pay increases was around 5.00% for members of the Public Employees Police and Fire Plan (based on the average increase for members with 25 or more years of service, as described above). This estimated actual wage inflation of 5.0% was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted that the results of the analysis are very sensitive to the estimated wage inflation component.

Gross actual salary increases averaged 5.92% over the four-year period, ranging from 5.04% in 2020 to 7.19% in 2023. After adjusting for the 5.00% average wage inflation for this period, the average net salary increases (i.e., merit and seniority) averaged 0.92%, ranging from 0.04% to 2.19%.

Fiscal Year Ending	Exposures	Gross		Net*	
		Actual	Expected	Actual	Expected
2020	10,369	5.04%	4.51%	0.04%	1.51%
2021	10,136	5.32%	4.53%	0.32%	1.53%
2022	9,810	6.09%	4.55%	1.09%	1.55%
2023	9,522	7.19%	4.54%	2.19%	1.54%
Total	**39,837**	**5.92%**	**4.53%**	**0.92%**	**1.53%**

* *Net Expected increases are equal to Gross Expected increases minus the current assumed wage inflation assumption of 3.00%. Net Actual increases are equal to Gross Actual increases minus the estimated actual wage inflation for the period of 5.00%.*

Pay Increases Due to Merit and Seniority

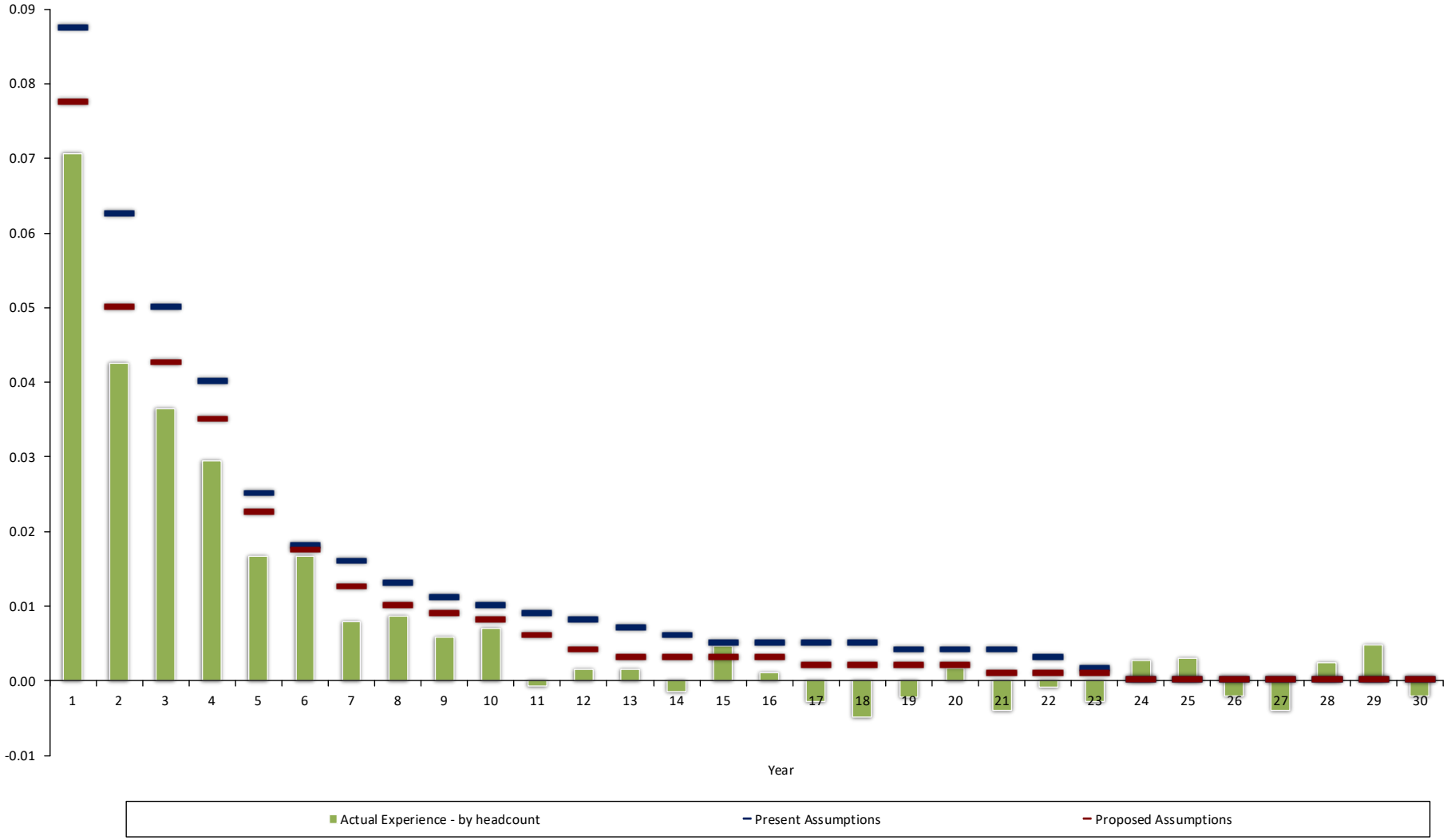
Using the techniques described on the previous page, observed merit and seniority pay increases were lower than the presently assumed increase, especially in the first few years of service. A similar observation was made during the July 1, 2015 to July 1, 2019 experience study, and proposed rates only partially recognized the lower pattern at that time.

Recommendation

We recommend adjustments to the current merit/seniority pay increase assumption as shown below. Overall, the proposed merit/seniority rates are 31 basis points lower than that anticipated by the current assumption, with larger decreases in the first few years of employment.

Service Index	Exposures	Total % Increase			Merit/Seniority % Increase		
		Actual	Rates		Actual	Rates	
		Population Weighted	Current	Proposed	Population Weighted	Current	Proposed
1	1,545	12.06 %	11.75 %	10.75 %	7.06 %	8.75 %	7.75 %
2	2,193	9.25 %	9.25 %	8.00 %	4.25 %	6.25 %	5.00 %
3	2,232	8.64 %	8.00 %	7.25 %	3.64 %	5.00 %	4.25 %
4	2,179	7.94 %	7.00 %	6.50 %	2.94 %	4.00 %	3.50 %
5	2,148	6.67 %	5.50 %	5.25 %	1.67 %	2.50 %	2.25 %
6	2,019	6.67 %	4.80 %	4.75 %	1.67 %	1.80 %	1.75 %
7	1,834	5.79 %	4.60 %	4.25 %	0.79 %	1.60 %	1.25 %
8	1,576	5.87 %	4.30 %	4.00 %	0.87 %	1.30 %	1.00 %
9	1,264	5.59 %	4.10 %	3.90 %	0.59 %	1.10 %	0.90 %
10	1,050	5.70 %	4.00 %	3.80 %	0.70 %	1.00 %	0.80 %
11	1,065	4.93 %	3.90 %	3.60 %	(0.07)%	0.90 %	0.60 %
12	1,192	5.16 %	3.80 %	3.40 %	0.16 %	0.80 %	0.40 %
13	1,377	5.15 %	3.70 %	3.30 %	0.15 %	0.70 %	0.30 %
14	1,575	4.86 %	3.60 %	3.30 %	(0.14)%	0.60 %	0.30 %
15	1,546	5.47 %	3.50 %	3.30 %	0.47 %	0.50 %	0.30 %
16	1,375	5.12 %	3.50 %	3.30 %	0.12 %	0.50 %	0.30 %
17	1,288	4.73 %	3.50 %	3.20 %	(0.27)%	0.50 %	0.20 %
18	1,212	4.52 %	3.50 %	3.20 %	(0.48)%	0.50 %	0.20 %
19	1,228	4.78 %	3.40 %	3.20 %	(0.22)%	0.40 %	0.20 %
20	1,360	5.16 %	3.40 %	3.20 %	0.16 %	0.40 %	0.20 %
21	1,375	4.61 %	3.40 %	3.10 %	(0.39)%	0.40 %	0.10 %
22	1,367	4.92 %	3.30 %	3.10 %	(0.08)%	0.30 %	0.10 %
23	1,268	4.73 %	3.15 %	3.10 %	(0.27)%	0.15 %	0.10 %
24	1,129	5.27 %	3.00 %	3.00 %	0.27 %	0.00 %	0.00 %
25	906	5.31 %	3.00 %	3.00 %	0.31 %	0.00 %	0.00 %
26	722	4.80 %	3.00 %	3.00 %	(0.20)%	0.00 %	0.00 %
27	530	4.61 %	3.00 %	3.00 %	(0.39)%	0.00 %	0.00 %
28	375	5.24 %	3.00 %	3.00 %	0.24 %	0.00 %	0.00 %
29	277	5.47 %	3.00 %	3.00 %	0.47 %	0.00 %	0.00 %
30+	630	4.79 %	3.00 %	3.00 %	(0.21)%	0.00 %	0.00 %
Total	**39,837**	**5.92 %**	**4.53 %**	**4.22 %**	**0.92 %**	**1.53 %**	**1.22 %**

Pay Increases Due to Merit and Seniority



SECTION C

RETIREMENT EXPERIENCE

Liability Weighted Analysis

In most recent experience studies, we have noticed that in order to develop assumptions that reduce the size of the gain or loss in a particular decrement it is necessary to consider the relative magnitude of the liability of the members that decrement, rather than number counts alone. For example, consider a plan with only two members who are both the same age and assume member one has a liability of $10,000 and member two has a liability of $90,000. If one of the members leaves and forfeits all of his or her liability, the net rate of decrement is one out of two for a rate of 50%. However, the net gain or loss to the System will be 10% if member one leaves versus 90% if member two leaves.

As a result, some of our tables include a column entitled 'liability weighted rate' or 'benefit weighted'. This represents the crude rate of decrement on a liability or benefit weighted basis as opposed to strictly a number count basis. The liability weighted rates were found to be most highly correlated with withdrawal and retirement decrements. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability is typically not a decision at all, rather an event that happens to someone. Comments on specific assumptions are provided on the following pages.

While mortality is not a voluntary human behavior, a recent study by the Society of Actuaries found that mortality experience was highly correlated with education and income. That is, people with higher incomes and higher levels of education tended to live longer than others. As such, we also studied mortality rates on a "benefit weighted" basis. This is discussed in more detail in the mortality section of this report.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the Public Employees Police and Fire Plan (PEPFP) establish the minimum age and service requirements for unreduced or normal retirement. However, the actual cost of retirement is determined when members actually retire. The assumption about timing of retirements is a major ingredient in cost calculations. Note that higher rates of retirement with full benefits generally results in higher computed contributions, and vice versa.

Some members terminate employment with eligibility for retirement but elect to defer the benefit. We included these terminations as retirements for the purposes of this study.

The current assumption ends at age 70; in other words, we assume all members currently under the age of 70 will retire by the age of 70. However, for members currently age 70 or older, we assume retirement one year after the valuation date (effectively 18 months due to mid-year decrementing), as required by the Minnesota Standards for Actuarial Work. As such, members over age 69 are not included in our analysis since these members are assumed to work an additional year and then retire. During the four-year period, there were three actual retirements at ages 70 and older. We believe assuming 100% retirement at age 70 is an appropriately conservative approach.

We reviewed the experience during the study period. There was a dramatic increase in unreduced retirements after the first fiscal year, likely due to effects of the pandemic and civil unrest. Overall, on both a population-weighted and liability-weighted basis, the plan experienced more unreduced retirements during fiscal years ending June 30, 2021, 2022 and 2023 than projected by the present assumptions. We recommend increasing the assumed unreduced retirement rates, as shown on the next page.

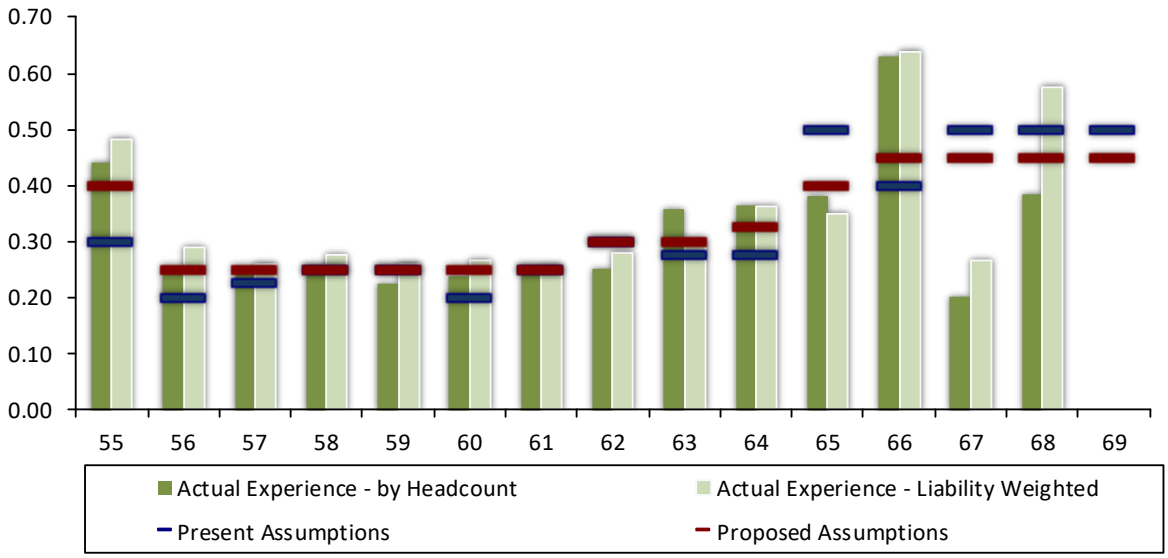
Age and Service Unreduced (Normal) Retirement

Recommendations

We recommend changes to the retirement rates as indicated below, with more weight given to the last three years of experience. The proposed rates will result in an increase in predicted unreduced retirements but not as much as the liability weighted actual experience suggests. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently over age 69 delay retirement one year and instead assume these members retire mid-year, the same as members younger than age 70.

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	395,801	820,226	44.08%	48.26%	30.00%	40.00%	246,068	328,091	160.9%	120.6%
56	129,814	449,049	24.62%	28.91%	20.00%	25.00%	89,810	112,262	144.5%	115.6%
57	90,393	347,271	24.15%	26.03%	22.50%	25.00%	78,136	86,818	115.7%	104.1%
58	72,186	262,409	24.38%	27.51%	25.00%	25.00%	65,602	65,602	110.0%	110.0%
59	48,535	187,967	22.46%	25.82%	25.00%	25.00%	46,992	46,992	103.3%	103.3%
60	37,188	139,211	23.86%	26.71%	20.00%	25.00%	27,842	34,803	133.6%	106.9%
61	24,524	96,304	24.60%	25.46%	25.00%	25.00%	24,076	24,076	101.9%	101.9%
62	22,725	81,543	25.24%	27.87%	30.00%	30.00%	24,463	24,463	92.9%	92.9%
63	17,547	58,418	35.62%	30.04%	27.50%	30.00%	16,065	17,525	109.2%	100.1%
64	14,133	38,816	36.36%	36.41%	27.50%	32.50%	10,674	12,615	132.4%	112.0%
65	8,925	25,503	38.24%	35.00%	50.00%	40.00%	12,751	10,201	70.0%	87.5%
66	7,753	12,155	63.16%	63.79%	40.00%	45.00%	4,862	5,470	159.5%	141.8%
67	2,424	9,081	20.00%	26.70%	50.00%	45.00%	4,540	4,086	53.4%	59.3%
68	4,823	8,369	38.46%	57.63%	50.00%	45.00%	4,185	3,766	115.3%	128.1%
69	-	1,456	0.00%	0.00%	50.00%	45.00%	728	655	0.0%	0.0%
70	*	*	N/A	N/A	*	*	N/A	N/A	N/A	N/A
Totals	876,771	2,537,777	6.89%	34.55%	25.88%	30.63%	656,794	777,425	133.5%	112.8%

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement for one year. Therefore, even though there are members that are over age 69, these members are not included in the analysis above since retirement is assumed to be delayed one year. There were three actual retirements over age 69.*



Reduced Early Retirement

Findings

PEPFP members may retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as early retirements.

Early retirement benefits are equal to the normal retirement benefit with a reduction for early retirement as follows:

> Normal Retirement Benefit based on Allowable Service and Average Salary at retirement date and 0.10% (0.20% for members enrolled in the plan after June 30, 2007) reduction for each month the member is under age 55. If the effective date of retirement is after June 30, 2019, the reduction is 5/12% for each month that the member is under age 55 at the time of retirement.

Generally, higher rates of early retirement result in higher computed contributions due to the enhanced benefit, and vice-versa.

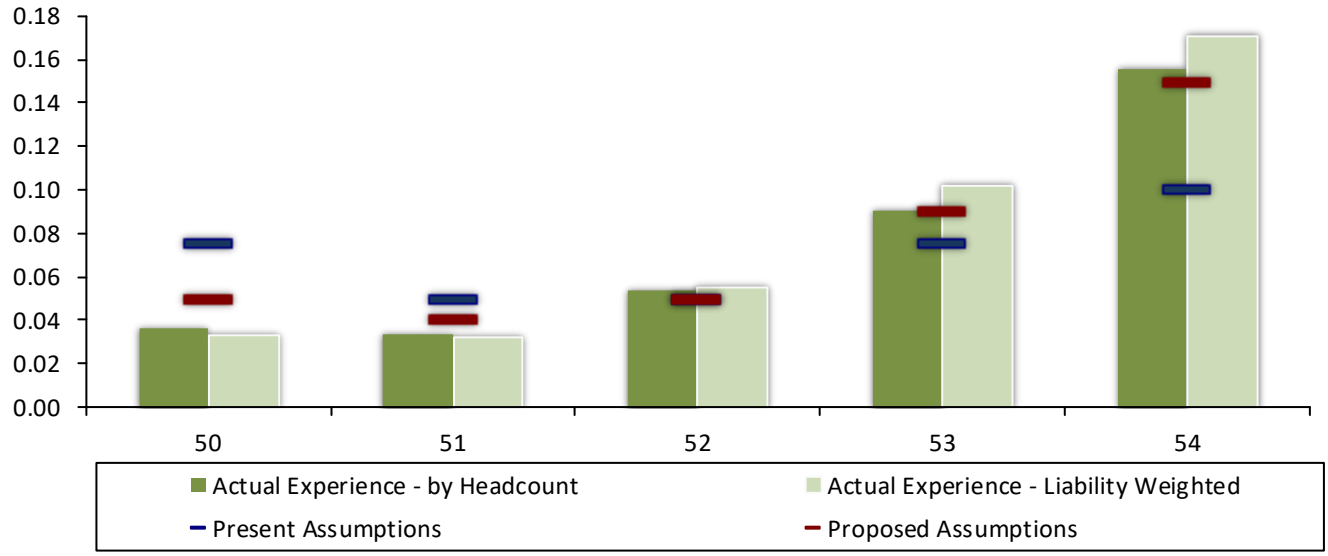
We reviewed the experience during the study period. There was a dramatic increase in early retirements at ages 52+ after the first fiscal year, likely due to effects of the pandemic and civil unrest.

Recommendation

We recommend changes to the Reduced early retirement rates, as indicated on the next page, with more weight given to the last three years of experience.

Reduced Early Retirement

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
50	37,639	1,132,457	3.66%	3.32%	7.50%	5.00%	84,934	56,623	44.3%	66.5%
51	37,806	1,183,940	3.32%	3.19%	5.00%	4.00%	59,197	47,358	63.9%	79.8%
52	63,674	1,152,263	5.36%	5.53%	5.00%	5.00%	57,613	57,613	110.5%	110.5%
53	110,187	1,077,846	9.06%	10.22%	7.50%	9.00%	80,838	97,006	136.3%	113.6%
54	171,025	1,000,056	15.56%	17.10%	10.00%	15.00%	100,006	150,008	171.0%	114.0%
Totals	420,332	5,546,562	6.89%	7.58%	6.90%	7.37%	382,588	408,608	109.9%	102.9%



Retirement from Deferred Status

Members who terminate and meet the following vesting requirements are entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit.

	Vesting if First Hired	
Years of Service	Before 7/1/2010	After 6/30/2010
<3	0%	0%
3 – 4	100	0
5	100	50
6	100	60
7	100	70
8	100	80
9	100	90
10+	100	100

While some members actually elect a refund even if it is less valuable than the deferred annuity, the current valuation assumption is that members will elect a refund only if it is more valuable than the deferred annuity. When a member elects a refund that is less valuable than his or her deferred annuity (or when a member elects the deferred annuity even if the refund is more valuable), the plan experiences a small liability gain. Since the current assumption results in very small gains to the plan, we recommend no change to this assumption.

For those deferred vested members for whom the deferred benefit is more valuable than a refund, the current valuation assumption is that the member will commence benefits at Normal Retirement Age. The benefit is reduced on approximately an actuarially equivalent basis, meaning there is no liability gain or loss to the plan. We recommend no change to this set of assumptions.

SECTION D

WITHDRAWAL EXPERIENCE

Withdrawal Experience

Members who leave active employment, for reasons other than retirement, disability or death, may be eligible for the following payments from the pension trust:

- A refund of employee contributions; or
- A deferred retirement benefit, if they are vested.

Deferred retirement benefits are based on the pay and service credit at the time of withdrawal. The benefit is increased with augmentation (if applicable) from termination until January 1, 2019 and is payable at Normal Retirement (or at Early Retirement with a reduction). Consequently, members who withdraw receive much less from the plan than members who stay in employment until retirement. Higher rates of withdrawal result in lower computed contributions, and vice versa.

Some members are eligible for retirement when they terminate employment but elect to defer the benefit and are consequently reported for the valuation as a termination with a deferred benefit. We included these terminations as retirements for the purposes of this study.

Current valuation termination rates for members are service-based. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Withdrawal Experience

Findings

We observed that the plan experienced more liability decrementing from the plan due to terminations than expected during the four year period. We also note that terminations for members during the 2019-2020 fiscal year were lower than the other years in this study. Due to this volatility, we did not adjust the withdrawal rates as much as we would have otherwise.

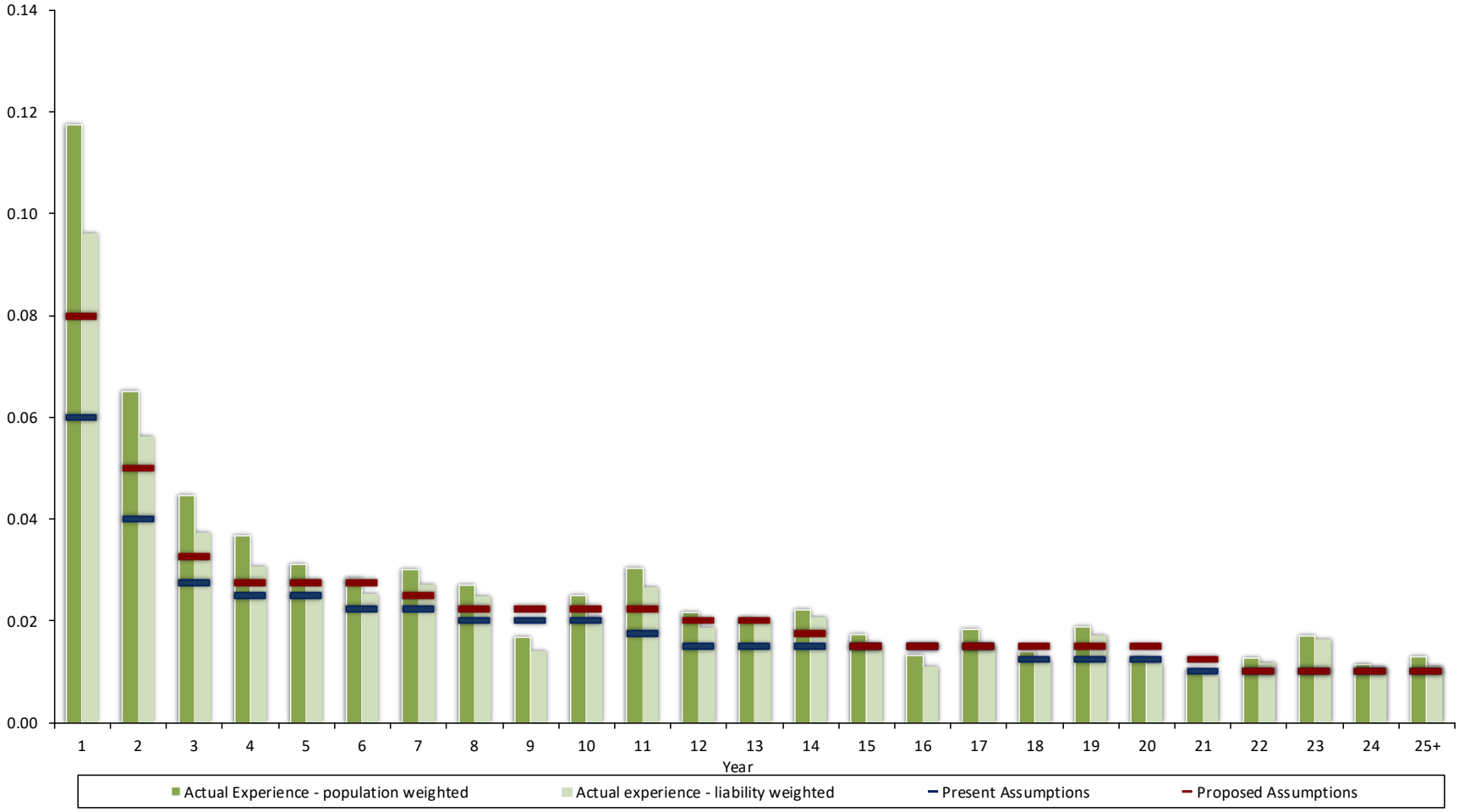
Recommendation

We have recommended proposed rates which are a closer match to actual experience during the period with more weight given to the last three years of experience.

Withdrawal Experience – Males and Females

							Liability Weighted ($000s)			
	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Withdrawals		Ratio of Actuals/Expecteds	
Year	Withdrawal	Exposure	Population Weighted	Liability Weighted	Present	Proposed	Present	Proposed	Present	Proposed
1	17,548	173,955	12.51%	10.09%	6.00%	8.00%	10,438	13,916	168.1%	126.1%
2	32,763	560,571	6.77%	5.84%	4.00%	5.00%	22,423	28,029	146.1%	116.9%
3	23,948	626,291	4.56%	3.82%	2.75%	3.25%	17,224	20,354	139.0%	117.7%
4	19,134	652,704	3.46%	2.93%	2.50%	2.75%	16,317	17,949	117.3%	106.6%
5	21,379	674,348	3.53%	3.17%	2.50%	2.75%	16,858	18,545	126.8%	115.3%
6	20,937	690,842	3.26%	3.03%	2.25%	2.75%	15,543	18,998	134.7%	110.2%
7	18,914	685,744	3.11%	2.76%	2.25%	2.50%	15,429	17,144	122.6%	110.3%
8	16,149	656,083	2.66%	2.46%	2.00%	2.25%	13,122	14,762	123.1%	109.4%
9	9,328	580,908	1.87%	1.61%	2.00%	2.25%	11,618	13,070	80.3%	71.4%
10	11,000	489,411	2.68%	2.25%	2.00%	2.25%	9,788	11,012	112.4%	99.9%
11	12,094	426,712	3.22%	2.83%	1.75%	2.25%	7,467	9,601	162.0%	126.0%
12	8,654	442,084	2.21%	1.96%	1.50%	2.00%	6,631	8,842	130.5%	97.9%
13	12,446	519,450	2.46%	2.40%	1.50%	2.00%	7,792	10,389	159.7%	119.8%
14	11,537	615,018	2.03%	1.88%	1.50%	1.75%	9,226	10,763	125.0%	107.2%
15	11,252	723,963	1.82%	1.55%	1.50%	1.50%	10,860	10,859	103.6%	103.6%
16	9,458	744,132	1.46%	1.27%	1.50%	1.50%	11,162	11,162	84.7%	84.7%
17	10,857	684,107	1.92%	1.59%	1.50%	1.50%	10,261	10,262	105.8%	105.8%
18	8,126	642,733	1.43%	1.26%	1.25%	1.50%	8,034	9,641	101.2%	84.3%
19	12,737	606,595	2.28%	2.10%	1.25%	1.50%	7,583	9,099	168.0%	140.0%
20	8,996	620,388	1.52%	1.45%	1.25%	1.50%	7,755	9,306	116.0%	96.7%
21	9,255	680,464	1.47%	1.36%	1.00%	1.25%	6,805	8,506	136.0%	108.8%
22	7,906	687,431	1.23%	1.15%	1.00%	1.00%	6,875	6,874	115.0%	115.0%
23	10,070	640,582	1.63%	1.57%	1.00%	1.00%	6,406	6,406	157.2%	157.2%
24	5,933	553,577	1.14%	1.07%	1.00%	1.00%	5,535	5,536	107.2%	107.2%
25+	10,115	802,811	1.47%	1.26%	1.00%	1.00%	8,028	8,028	126.0%	126.0%
Totals	**340,537**	**15,180,904**	**3.25%**	**2.24%**	**1.77%**	**2.04%**	**269,180**	**309,053**	**126.5%**	**110.2%**

Withdrawal Experience
Males and Females



SECTION E

DISABILITY EXPERIENCE

Disability Experience

PEPFP members who are physically or mentally unable to perform normal duties as a police officer or fire fighter are eligible to receive a disability retirement benefit. Members must have at least one year of service unless disability is duty-related. Eligibility for disability benefits continues until age 55 or older with 15 or more years of service (20 years if duty-related disability). Effective July 1, 2023, psychological treatment is required prior to approval for a duty disability benefit for a psychological condition relating to the member's occupation. The current disability retirement benefit is equal to 3% of average salary for each year of service, with a minimum benefit equal to 45% of average salary (60% of average salary if disability is duty-related).

Effective July 1, 2023, PEPFP members who are not able to perform any substantial gainful activity as a direct result of a disability (physical or psychological) relating to an act of duty, which is expected to persist for a period of 12 months or more, qualify for a Total and Permanent Duty Disability Benefit equal to 99% of average monthly salary.

All disabilities are assumed to be duty-related since actual disability status (duty or non-duty related) is not reported in the valuation data. There is no assumed incidence of the total and permanent duty disability benefit since this benefit change is newly effective July 1, 2023 and PERA's expectation is that an extremely low number of members will qualify for this benefit. If actual experience differs, we will consider revising this assumption in the future.

In the past, the assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) were considered a minor ingredient in cost calculations, since the incidence of disability has historically been low. However, in recent years, the duty disability incidence has increased substantially. Higher rates of disability generally result in somewhat higher computed contributions, and vice versa.

Findings

Members must apply within 18 months from the date public service is terminated and must provide evidence of the inability to perform job-related duties. As such, there could be a delay in the classification of a member as a disability retirement. In fact, over the course of the four-year period, there were approximately 108 members who were reclassified as a disability retirement after first being reported as a termination. In recognition of this process, we included these members in our analysis and recommend rates including these incidences.

Most members will have 20 years of service by age 55 and will not be eligible for a disability benefit. However, there were 22 members age 55 or older that were reported as disabilities over the four-year period of our study; this suggests there is high utilization among the few members that are eligible. Experience for this group was similar in the prior experience study.

Disability Experience

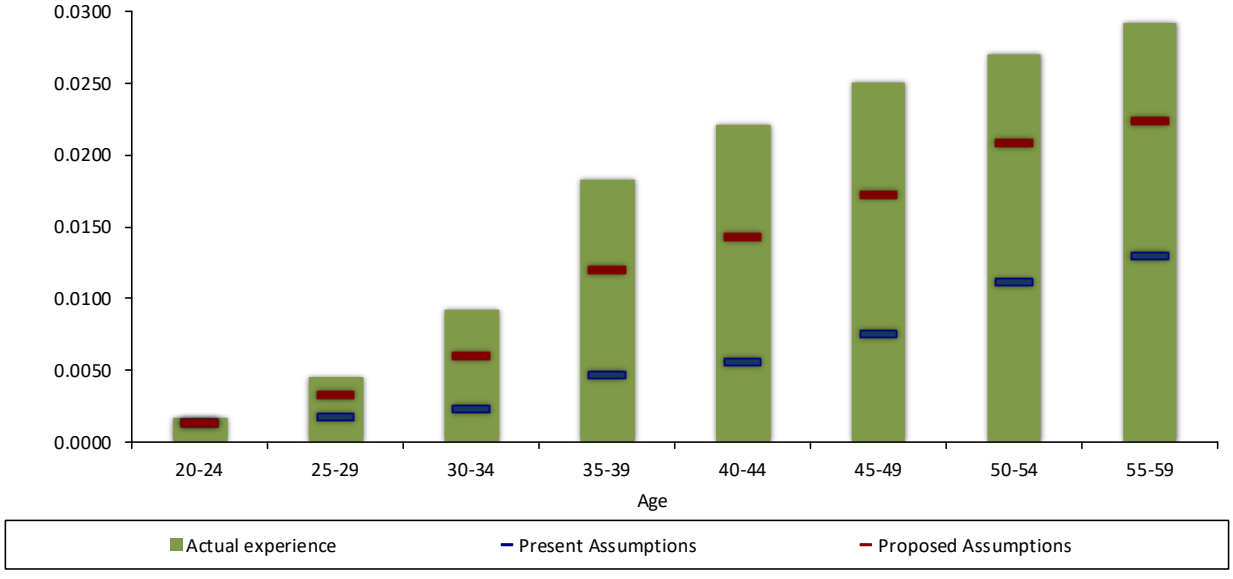
The results of our analysis are shown below. Overall, the actual number of disability retirements (810) was significantly higher than the number projected by the present assumption (255 – see charts below). The number of disabilities increased dramatically in the second and third year of the study period (after the civil unrest that began in May of 2020). The number of disability retirements decreased slightly for the fourth year and PERA indicated this trend is continuing after July 1, 2023, with approximately 132 disability applications from July 1, 2023 through May 31, 2024. In addition, effective July 1, 2023, members seeking a duty disability benefit due to a psychological condition must first undergo treatment. Due to this volatility and the new treatment requirement, we did not adjust rates as much as the experience indicates.

Recommendation

We recommend adopting higher rates of disability at all ages, as shown in the chart below. We also recommend reviewing disability experience in each future valuation, and potentially changing disability assumptions prior to the next regularly scheduled experience study, if needed, to recognize emerging trends.

Males and Females

						Population Weighted			
	Population Weighted		Crude	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
Age	Disabilities	Exposure	Rates	Present	Proposed	Present	Proposed	Present	Proposed
20-24	2	1,191	0.1679%	0.1249%	0.1249%	1.5	1.5	134.5%	134.5%
25-29	24	5,342	0.4493%	0.1766%	0.3283%	9.4	17.5	254.4%	136.8%
30-34	65	7,008	0.9275%	0.2279%	0.6023%	16.0	42.2	407.1%	154.0%
35-39	152	8,291	1.8333%	0.4727%	1.1966%	39.2	99.2	387.8%	153.2%
40-44	169	7,649	2.2094%	0.5554%	1.4292%	42.5	109.3	397.8%	154.6%
45-49	186	7,434	2.5020%	0.7558%	1.7233%	56.2	128.1	331.0%	145.2%
50-54	190	7,042	2.6981%	1.1125%	2.0887%	78.3	147.1	242.5%	129.2%
55-59	19	650	2.9231%	1.3000%	2.2361%	8.5	14.5	224.9%	130.7%
60+	3	232	1.2931%	1.3000%	2.5600%	3.0	5.9	99.5%	50.5%
Totals	**810**	**44,839**	**1.8065%**	**0.5677%**	**1.2610%**	**254.6**	**565.4**	**318.2%**	**143.3%**



SECTION F

MORTALITY EXPERIENCE

Mortality Experience

Post-retirement mortality is an important component in cost calculations and should be updated from time to time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems, if at all.

Actuarial Standards of Practice

Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, "The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement." The current mortality rates used in the valuation include a provision for future mortality improvement.

Mortality Tables and Projection Scales

Prior to the last experience study, the Society of Actuaries published a mortality study that was specific to public sector retirement systems. This is a very comprehensive study and there are numerous mortality tables created for each classification of employee (General members, Public Safety, Teachers, Survivors, Juvenile, headcount-weighted, benefit-weighted, above median, below median).

One of the key findings of the study is that there is a high correlation between longevity and income and education. As such, the SOA highly recommended the use of 'benefit weighted' rates when developing mortality tables. We were able to review PEPFP retiree and disability mortality on a 'benefit weighted' basis and have shown the results in this section of this report. Consistent with the SOA study, PEPFP members with higher benefits generally appear to experience longer lifespans, resulting in lower mortality rates.

Fully generational tables, which are utilized for the PERA valuations, help take into account future improvements in mortality that are expected to occur. Typically, the Society of Actuaries updates the projection scale annually; however, no Scale MP-2022 was issued due to skewed mortality experience during the COVID-19 pandemic. The latest published table is called the MP-2021 Projection Scale.

Credibility

There were 761 male retiree deaths in the four-year period and 1,397 male retiree deaths in the eight-year period ending June 30, 2023. Based on eight years of data, the experience is considered fully credible and there is no credibility constraint when fitting the standard mortality tables to the plan's experience.

For the pre-retirement, disabled retiree and healthy retiree female mortality analysis, we use what is termed "the limited fluctuation credibility procedure" to determine the appropriate scaling factor of the base mortality tables for each gender. In each case, the Credibility Factor is computed based on the experience over the last eight years of the specific group being studied. This Credibility Factor is a measure of the credibility of the pertinent group with a 90% confidence interval.

Mortality Experience

The Best Fit is the ratio of actual to expected deaths using the base table. The Final Scale Factor is then determined as the weighted average of the Best Fit and 100% based on the Credibility Factor. For example, the Credibility Factor for Disabled Male Retirees is 42.43%, suggesting that the data for this group is 42.43% credible (there were not enough deaths among disabled retirees to be completely credible). The Best Fit for this group would be to scale the base tables by 140%. The Final Scale Factor of 117% is the credibility-weighted average (117% = 42.43% x 140% + 57.57% x 100%).

The plan experience is not considered credible for healthy post-retirement females, disabled females and pre-retirement males and females. As such, we recommend adoption of the Pub-2010 Public Safety mortality tables without adjustments.

Findings

We reviewed the mortality experience during the four-year period. The results are shown on the following pages.

Healthy Retirees

Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.

In total, on a benefit weighted basis, the plan experienced more male deaths than expected ($43,735,000 actual versus $41,213,000 expected). Actual experience for males was consistently more than expected during all four years of the study. The actual number of deaths on a benefit weighted basis among retired females ($1,037,000) was also slightly more than the number projected by the present assumptions ($1,029,000).

Disabled Retirees

On a benefit weighted basis, the plan experienced significantly more deaths among disabled males ($6,744,000) than projected by the present assumptions ($4,485,000). The actual number of deaths on a benefit weighted basis among disabled females ($304,000) was also significantly more than the number projected by the present assumptions ($208,000).

Active Members

On a liability weighted basis, the actual amount of liabilities removed due to deaths among active male members ($16,561,000) was lower than the number projected by the present assumption ($21,979,000). The plan also experienced fewer deaths on a liability weighted basis among females ($1,232,000) than projected by the present assumptions ($1,783,000).

Mortality Experience

Recommendations

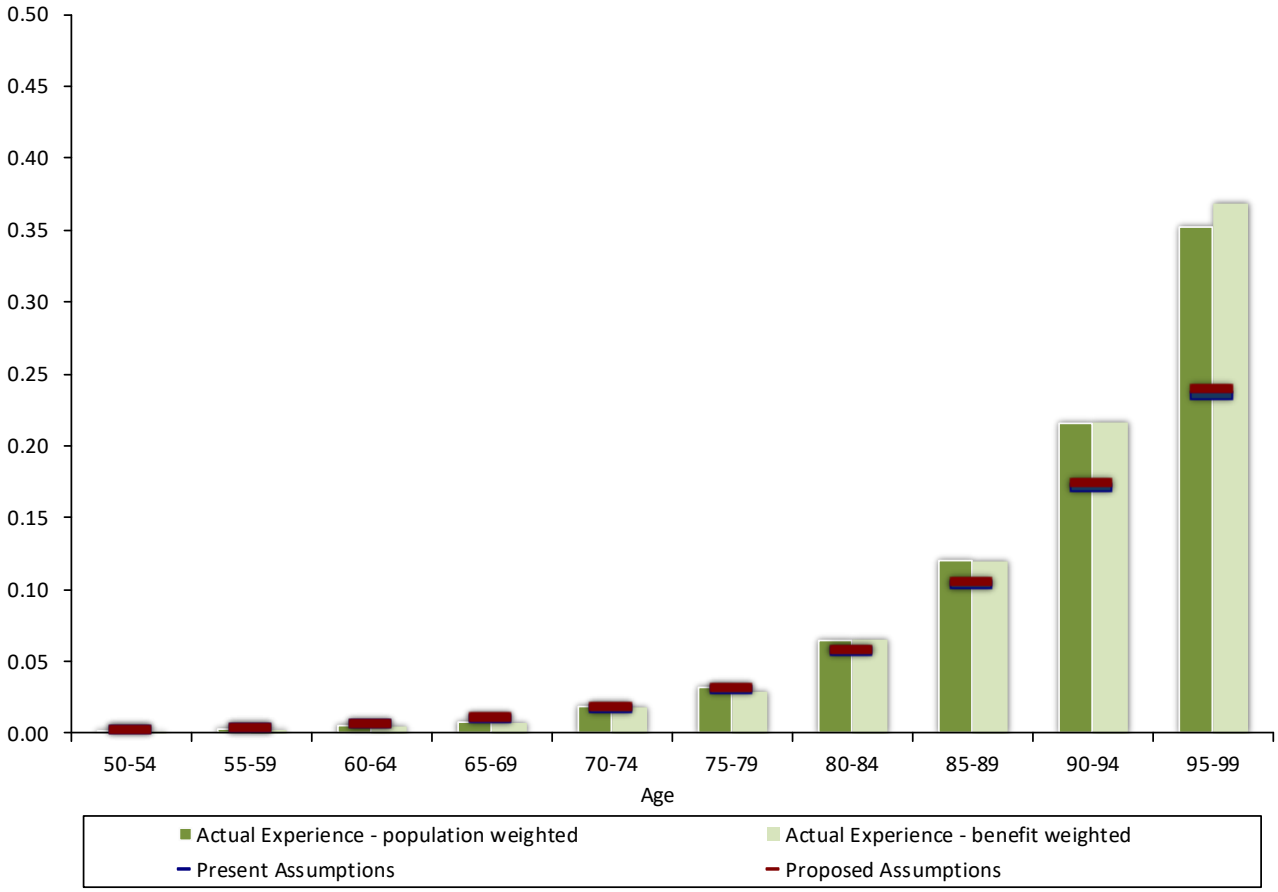
We did not find a published standard table that fit the observed experience at all ages. We recommend continued use of the Pub-2010 mortality tables, with adjustments in some cases, in order to produce a better fit to observed experience when possible. In some cases, even after adjustments, the fit was not uniform and we put more credibility on the rates in the published table than the plan's experience over the past four years. The plan experience is not considered credible for healthy post-retirement females, disabled females and pre-retirement males and females. As such, we recommend adoption of the Pub-2010 Public Safety mortality tables without adjustments. Finally, we did not increase healthy post-retirement mortality rates as much as indicated by the experience as a measure of conservatism and due to potential adverse experience from the COVID-19 pandemic.

We recommend adoption of the following mortality tables (all recommended tables are Benefit Weighted):

Healthy Male Retirees:	Pub-2010 Male Healthy Retired Public Safety Mortality Table adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 1.01.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired Public Safety Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Disabled Male Retirees:	Pub-2010 Male Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021. Rates are multiplied by a factor of 1.17.
Disabled Female Retirees:	Pub-2010 Female Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Male Active Members:	Pub-2010 Male Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021.
Female Active Members:	Pub-2010 Female Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021.

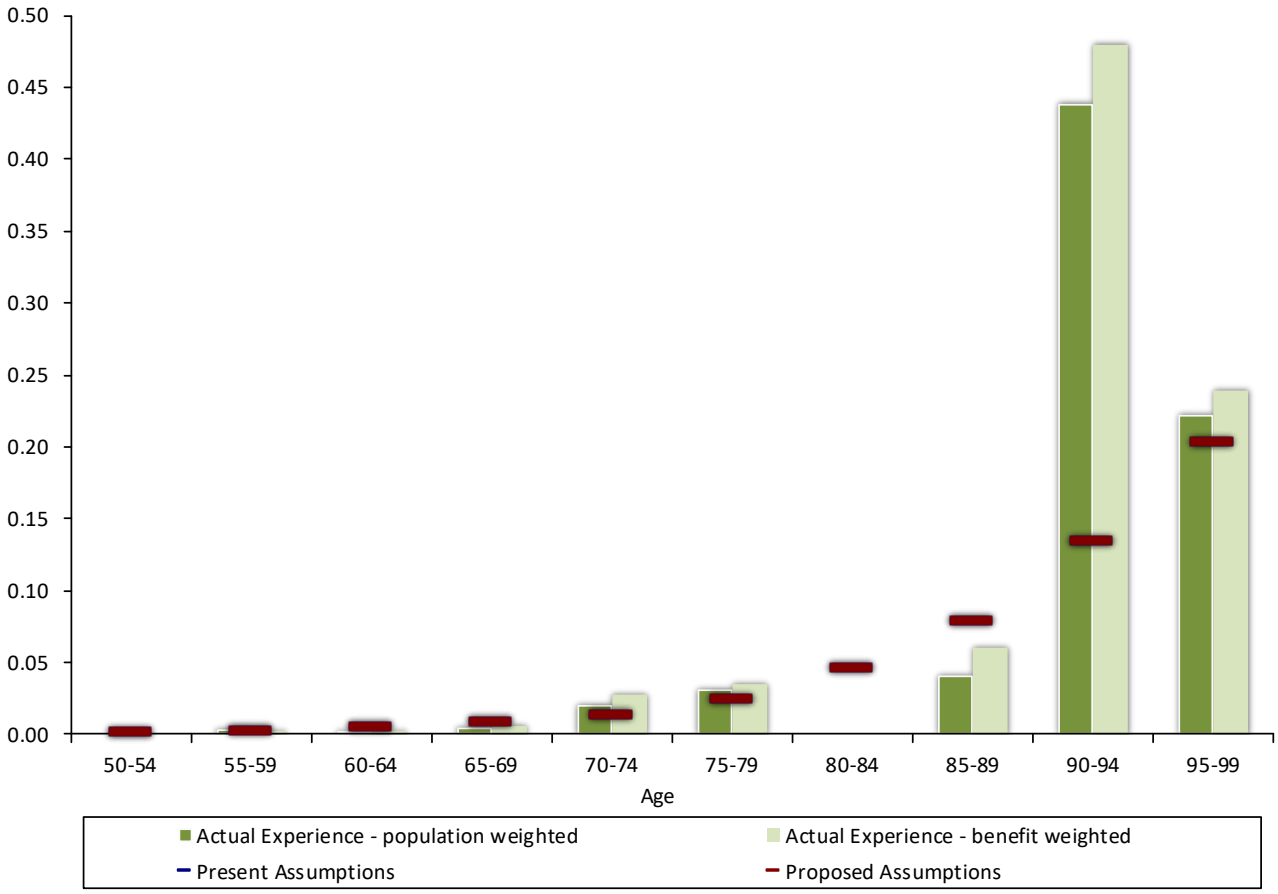
Post-Retirement Mortality Experience
Healthy Males

Age	Benefit Weighted ($000s) Deaths	Benefit Weighted ($000s) Exposure	Crude Rates Benefit Weighted	Crude Rates Population Weighted	Sample Rates Present	Sample Rates Proposed	Benefit Weighted ($000s) Expected Deaths Present	Benefit Weighted ($000s) Expected Deaths Proposed	Ratio of Actuals/Expecteds Present	Ratio of Actuals/Expecteds Proposed
50-54	61	40,608	0.0015	0.0011	0.0024	0.0024	96	99	63.6%	61.7%
55-59	788	276,740	0.0028	0.0027	0.0038	0.0038	1,041	1,073	75.7%	73.5%
60-64	1,508	312,476	0.0048	0.0054	0.0064	0.0066	2,013	2,074	74.9%	72.7%
65-69	2,237	310,794	0.0072	0.0077	0.0107	0.0109	3,320	3,422	67.4%	65.4%
70-74	5,231	290,927	0.0180	0.0185	0.0178	0.0182	5,188	5,347	100.8%	97.8%
75-79	5,929	204,338	0.0290	0.0322	0.0312	0.0319	6,379	6,574	92.9%	90.2%
80-84	9,546	146,205	0.0653	0.0642	0.0568	0.0580	8,304	8,558	115.0%	111.5%
85-89	8,955	75,155	0.1192	0.1202	0.1031	0.1052	7,746	7,983	115.6%	112.2%
90-94	7,033	32,519	0.2163	0.2162	0.1712	0.1747	5,568	5,738	126.3%	122.6%
95-99	2,242	6,091	0.3681	0.3524	0.2355	0.2403	1,435	1,478	156.3%	151.6%
100+	205	393	0.5216	0.5714	0.3168	0.3232	124	128	164.7%	159.8%
Totals	**43,735**	**1,696,246**	**0.0258**	**0.0259**	**0.0243**	**0.0250**	**41,213**	**42,475**	**106.1%**	**103.0%**



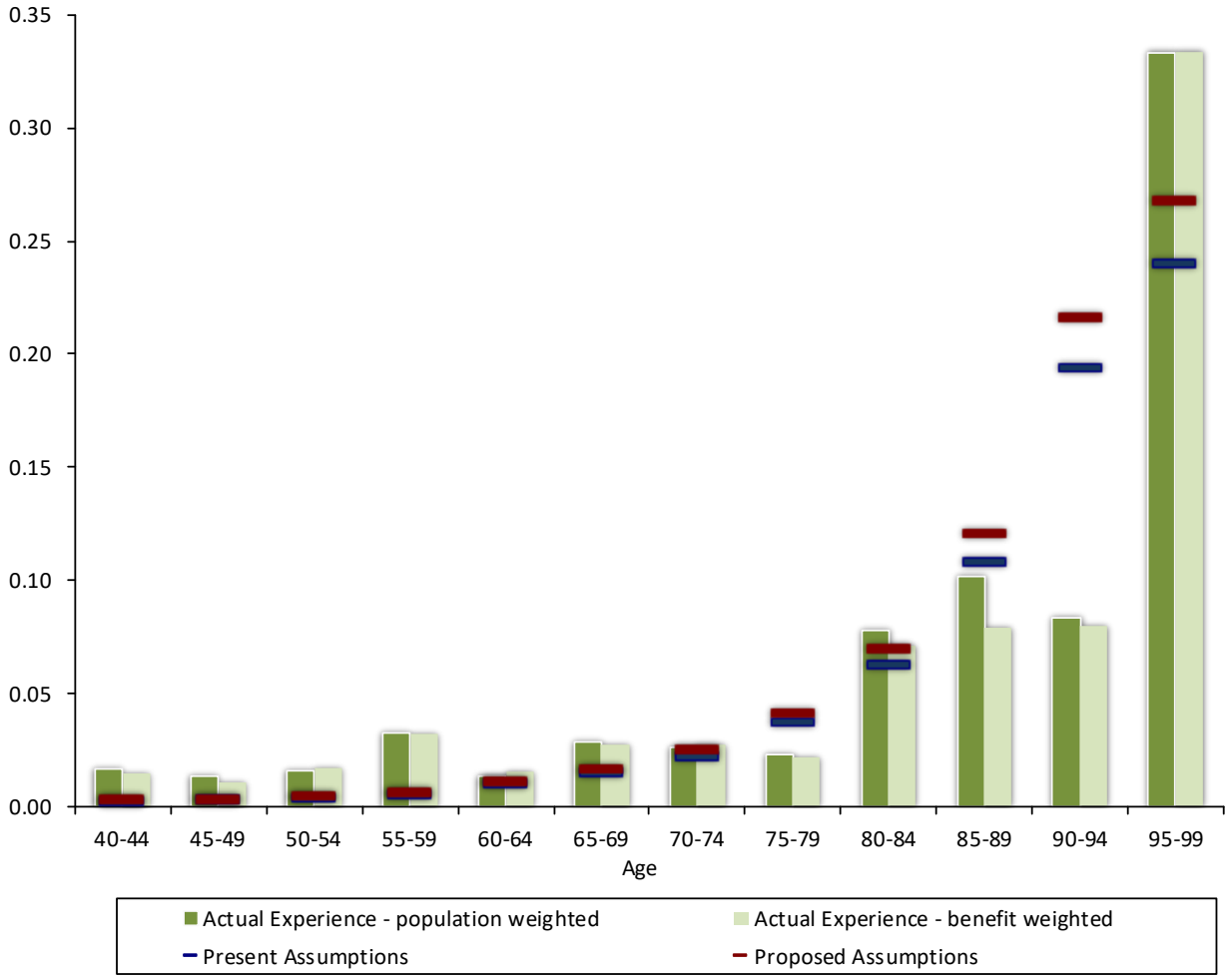
Post-Retirement Mortality Experience
Healthy Females

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Population	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed	Present	Proposed	Present	Proposed
50-54	-	7,139	0.0000	0.0000	0.0019	0.0019	14	14	0.0%	0.0%
55-59	97	36,892	0.0026	0.0031	0.0035	0.0035	127	127	76.1%	76.1%
60-64	85	36,825	0.0023	0.0015	0.0056	0.0056	205	205	41.5%	41.5%
65-69	122	20,657	0.0059	0.0045	0.0085	0.0085	176	176	69.4%	69.4%
70-74	222	8,113	0.0274	0.0199	0.0140	0.0140	114	114	194.9%	194.9%
75-79	74	2,136	0.0346	0.0313	0.0252	0.0252	54	54	137.4%	137.4%
80-84	-	2,163	0.0000	0.0000	0.0469	0.0469	101	101	0.0%	0.0%
85-89	94	1,562	0.0602	0.0400	0.0786	0.0786	123	123	76.5%	76.5%
90-94	310	647	0.4791	0.4375	0.1350	0.1350	87	87	355.0%	355.0%
95-99	33	138	0.2391	0.2222	0.2032	0.2032	28	28	117.7%	117.7%
100+	-	-	N/A	N/A	0.3765	0.3765	-	-	N/A	N/A
Totals	**1,037**	**116,272**	**0.0089**	**0.0093**	**0.0089**	**0.0089**	**1,029**	**1,029**	**100.7%**	**100.7%**



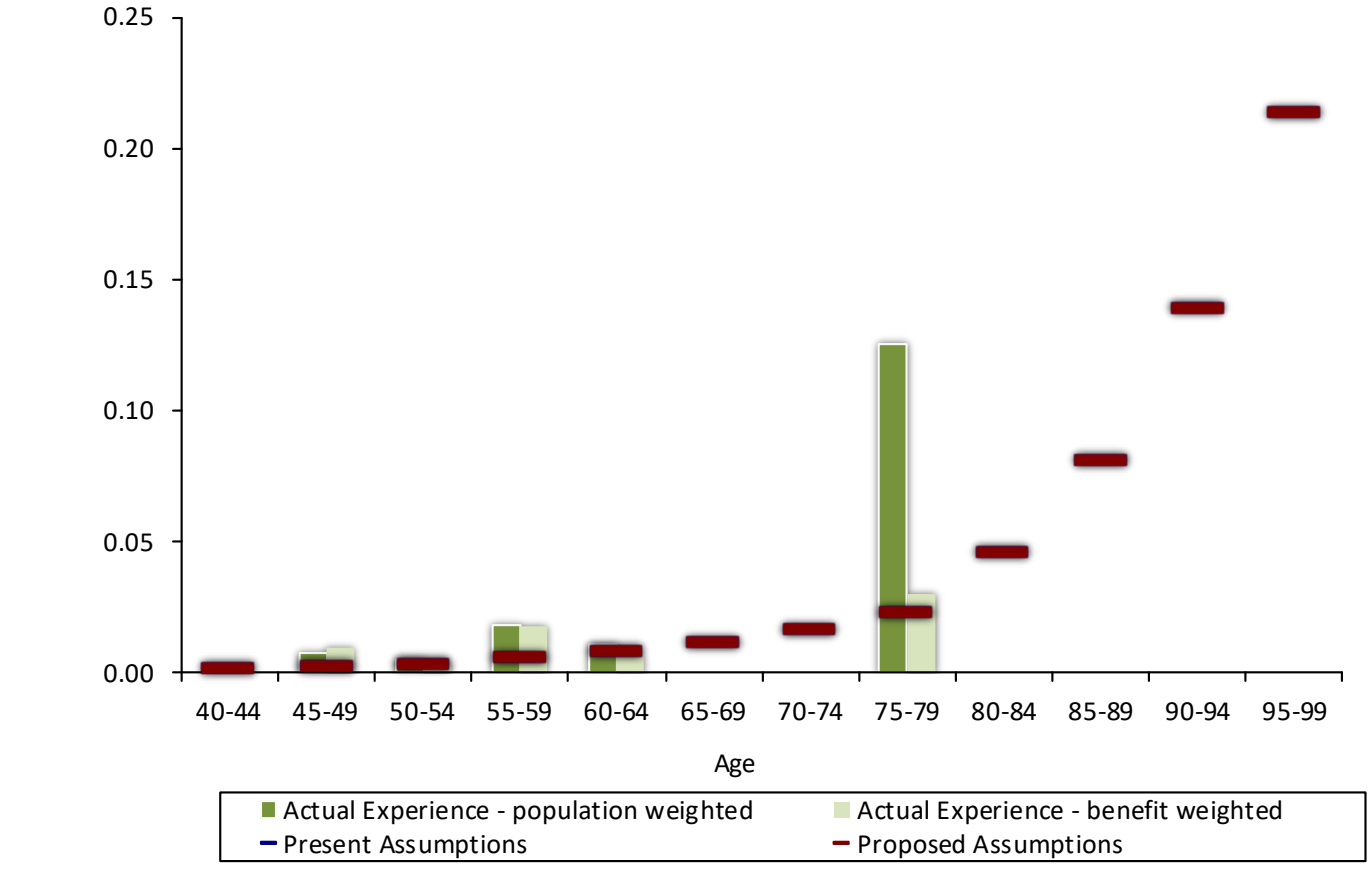
Post-Retirement Mortality Experience
Disabled Males

Age	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
<40	294	14,210	2.07%	1.89%	0.22%	0.25%	31	35	940.6%	844.1%
40-44	241	16,334	1.48%	1.63%	0.25%	0.28%	41	46	584.1%	524.2%
45-49	264	24,536	1.08%	1.30%	0.30%	0.33%	73	82	360.0%	323.1%
50-54	668	38,843	1.72%	1.59%	0.39%	0.44%	153	170	437.5%	392.6%
55-59	964	30,263	3.19%	3.24%	0.59%	0.65%	177	198	543.8%	488.0%
60-64	412	26,744	1.54%	1.35%	0.99%	1.10%	264	294	156.2%	140.2%
65-69	945	35,028	2.70%	2.88%	1.49%	1.67%	524	584	180.5%	161.9%
70-74	1,318	48,687	2.71%	2.61%	2.26%	2.51%	1,099	1,224	120.0%	107.7%
75-79	596	27,141	2.20%	2.27%	3.70%	4.12%	1,004	1,119	59.4%	53.3%
80-84	653	9,159	7.13%	7.78%	6.27%	6.99%	574	640	113.7%	102.0%
85-89	272	3,429	7.93%	10.17%	10.82%	12.06%	371	413	73.3%	65.8%
90-94	52	654	7.95%	8.33%	19.41%	21.62%	127	141	41.0%	36.8%
95-99	65	195	33.33%	33.33%	24.02%	26.77%	47	52	138.8%	124.5%
100+	-	-	N/A	N/A	43.03%	47.95%	-	-	N/A	N/A
Totals	**6,744**	**275,223**	**2.45%**	**2.45%**	**1.63%**	**1.82%**	**4,485**	**4,998**	**150.4%**	**134.9%**



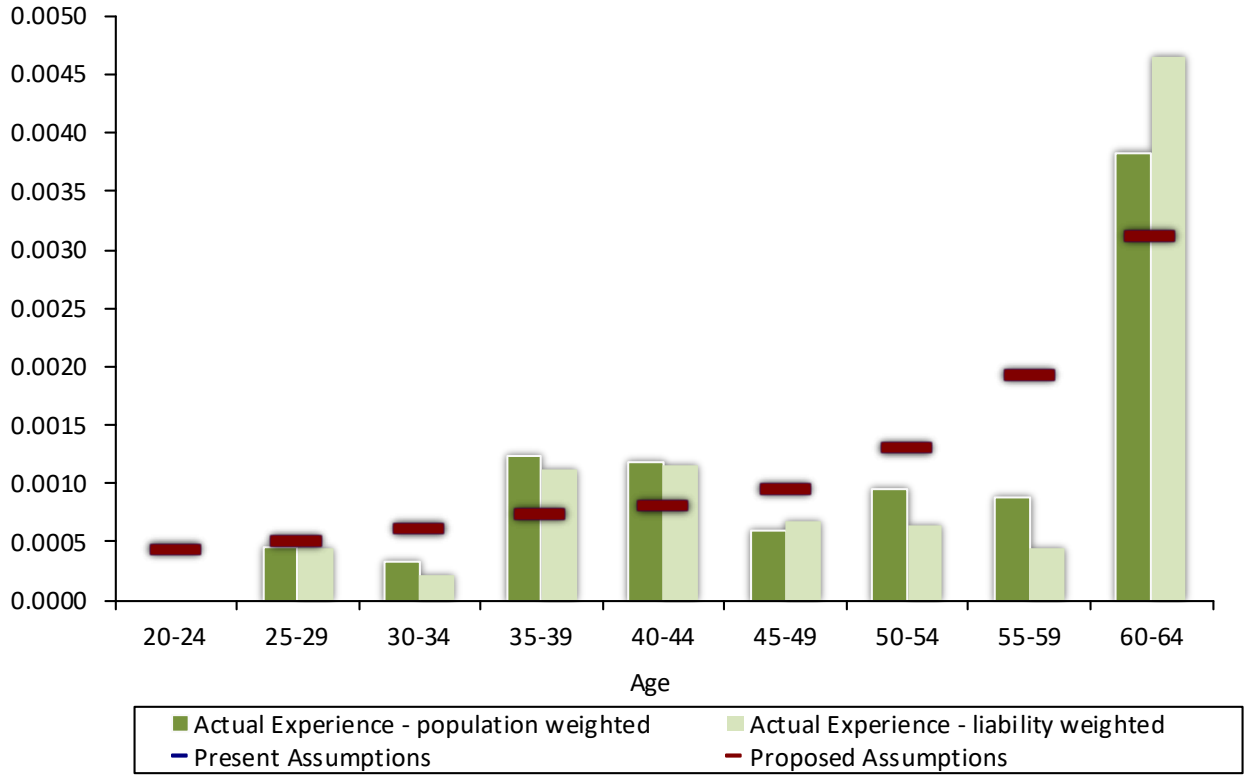
Post-Retirement Mortality Experience
Disabled Females

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of Actuals/Expecteds	
			Benefit	Population	Sample Rates		Expected Deaths			
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed	Present	Proposed	Present	Proposed
<40	34	3,383	1.01%	1.16%	0.16%	0.16%	5	5	638.8%	638.8%
40-44	-	4,950	0.00%	0.00%	0.20%	0.20%	10	10	0.0%	0.0%
45-49	64	6,513	0.98%	0.71%	0.24%	0.24%	16	16	409.3%	409.3%
50-54	34	9,385	0.36%	0.49%	0.34%	0.34%	32	32	105.5%	105.5%
55-59	136	7,600	1.79%	1.80%	0.55%	0.55%	42	42	323.9%	323.9%
60-64	22	3,653	0.60%	1.10%	0.83%	0.83%	30	30	72.9%	72.9%
65-69	-	3,653	0.00%	0.00%	1.14%	1.14%	42	42	0.0%	0.0%
70-74	-	1,190	0.00%	0.00%	1.68%	1.68%	20	20	0.0%	0.0%
75-79	14	467	3.00%	12.50%	2.32%	2.32%	11	11	129.1%	129.1%
80-84	-	-	N/A	N/A	4.60%	4.60%	-	-	N/A	N/A
85-89	-	-	N/A	N/A	8.11%	8.11%	-	-	N/A	N/A
90-94	-	-	N/A	N/A	13.88%	13.88%	-	-	N/A	N/A
95-99	-	-	N/A	N/A	21.36%	21.36%	-	-	N/A	N/A
100+	-	-	N/A	N/A	31.32%	31.32%	-	-	N/A	N/A
Totals	**304**	**40,794**	**0.75%**	**0.87%**	**0.51%**	**0.51%**	**208**	**208**	**146.2%**	**146.2%**



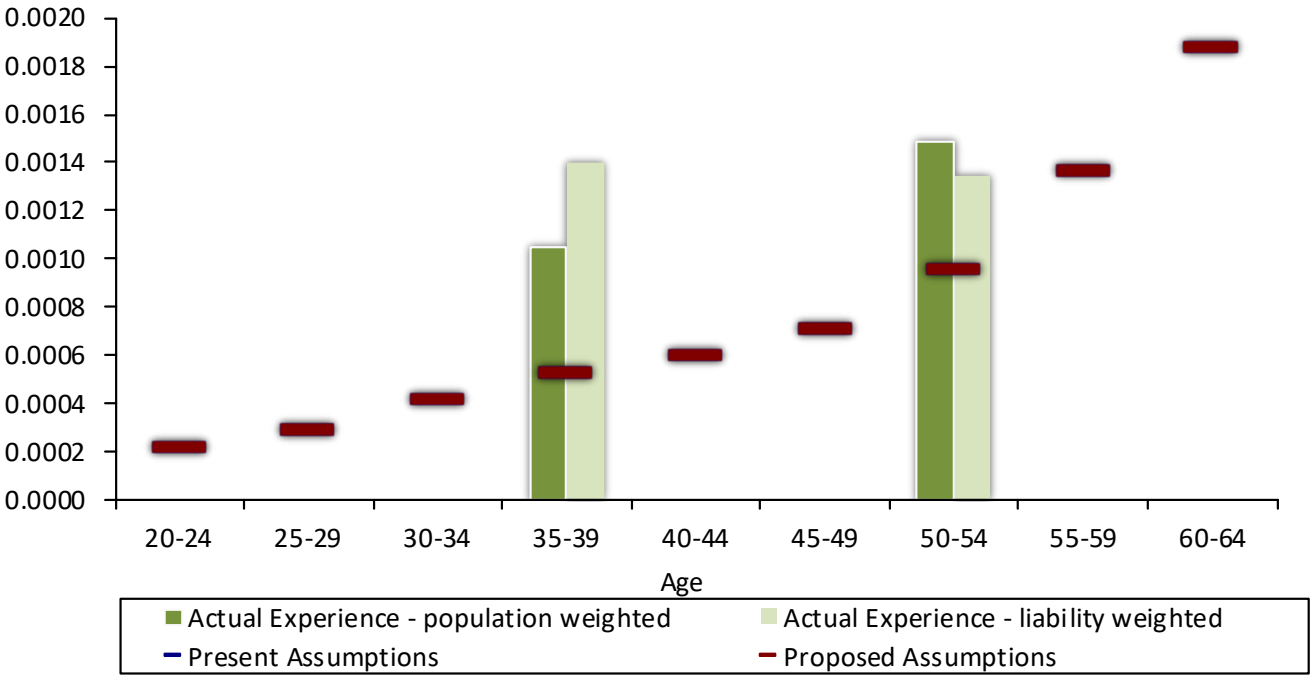
Pre-Retirement Mortality Experience
Healthy Males

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
20-24	-	158,253	0.00%	0.00%	0.04%	0.04%	68	68	0.0%	0.0%
25-29	479	1,088,405	0.04%	0.04%	0.05%	0.05%	546	546	87.7%	87.7%
30-34	394	1,854,546	0.02%	0.03%	0.06%	0.06%	1,153	1,153	34.2%	34.2%
35-39	3,177	2,819,756	0.11%	0.12%	0.07%	0.07%	2,058	2,058	154.4%	154.4%
40-44	3,822	3,289,091	0.12%	0.12%	0.08%	0.08%	2,656	2,656	143.9%	143.9%
45-49	2,810	4,158,772	0.07%	0.06%	0.10%	0.10%	3,988	3,988	70.5%	70.5%
50-54	3,211	5,040,002	0.06%	0.09%	0.13%	0.13%	6,622	6,622	48.5%	48.5%
55-59	864	1,912,975	0.05%	0.09%	0.19%	0.19%	3,680	3,680	23.5%	23.5%
60-64	1,804	388,465	0.46%	0.38%	0.31%	0.31%	1,209	1,209	149.2%	149.2%
Totals	**16,561**	**20,710,265**	**0.08%**	**0.08%**	**0.11%**	**0.11%**	**21,979**	**21,979**	**75.3%**	**75.3%**



Pre-Retirement Mortality Experience
Healthy Females

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s)		Ratio of	
							Expected Deaths		Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
20-24	-	39,125	0.00%	0.00%	0.02%	0.02%	8	8	0.0%	0.0%
25-29	-	206,221	0.00%	0.00%	0.03%	0.03%	60	60	0.0%	0.0%
30-34	-	255,122	0.00%	0.00%	0.04%	0.04%	107	107	0.0%	0.0%
35-39	495	353,722	0.14%	0.10%	0.05%	0.05%	188	188	263.5%	263.5%
40-44	-	400,361	0.00%	0.00%	0.06%	0.06%	240	240	0.0%	0.0%
45-49	-	505,155	0.00%	0.00%	0.07%	0.07%	360	360	0.0%	0.0%
50-54	737	549,731	0.13%	0.15%	0.10%	0.10%	528	528	139.5%	139.5%
55-59	-	172,255	0.00%	0.00%	0.14%	0.14%	236	236	0.0%	0.0%
60-64	-	29,236	0.00%	0.00%	0.19%	0.19%	55	55	0.0%	0.0%
Totals	**1,232**	**2,510,928**	**0.05%**	**0.04%**	**0.07%**	**0.07%**	**1,783**	**1,783**	**69.1%**	**69.1%**



SECTION G

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Marital Status

Married members will frequently make different annuity selections than non-married members. The current valuation assumption is that 85% of male members are married and 70% of female members are married. Actual marital status is used for retired members.

Findings

We reviewed the marital status of healthy members retiring from active status during the four-year period. The results are shown below:

Gender	Married New Retirees	Total New Retirees	Crude Rates	Sample Rates		Expected Married Retirees		Ratio of Actual/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Males	797	942	84.61%	85.00%	85.00%	801	801	99.5%	99.5%
Females	61	107	57.01%	70.00%	65.00%	75	70	81.4%	87.7%
Total	**858**	**1,049**	**81.79%**			**876**	**870**	**98.0%**	**98.6%**

The experience shows the number of married new retirees is approximately as expected for males and lower than expected for female retirees.

Recommendation

We recommend maintaining the current marital status assumption for males and lowering the assumed marital status assumption for females.

Age of Survivor

Joint & Survivor annuity benefit amounts are determined based on the member's and survivor's age. Currently, the valuation assumes that male members have a beneficiary two years younger and female members have a beneficiary two years older. This assumption is used to predict the length of expected payments payable to a future survivor.

Findings

We reviewed the ages of married new retirees and their beneficiaries during the four-year period. In cases where a new retiree had a beneficiary that is more than 20 years older or younger, we classified those retirees as unmarried in order to not skew the age difference results.

The results are shown below:

Gender	Married New Retirees	Average Age Difference	Expected Age Difference		Ratio of Actual/Expected	
			Present	Proposed	Present	Proposed
Males	797	1.83	2.00	2.00	91.5%	91.5%
Females	61	-0.28	-2.00	-2.00	14.0%	14.0%
Total	**858**					

The experience shows that average age difference for males was approximately as expected. The experience shows that the average age difference for females is 0.28 years younger. However, the year-by year experience ranges from 1.9 years younger (2020-2021 average of 20 retirees) to 3.0 years older (2022-2023 experience of 7 retirees).

Recommendation

We recommend continuing the present assumption for male retirees. Due to the varied experience and the low number of retirements, we also recommend continuing the present assumption for female retirees.

Form of Payment

Upon retirement, a member can elect any of the following forms of payment:

- Single-Life Annuity – the benefit is paid for the lifetime of the member. No benefit is payable to a beneficiary upon the member's death.
- 25% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 25% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 50% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 50% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 75% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 75% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 100% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 100% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.

If the member elects a joint & survivor form of payment and the beneficiary predeceases the member, the benefit "bounces back" to the single life annuity at the time of the beneficiary's death. There is no actuarial reduction for the bounce-back feature (i.e., this is subsidized by the plan). In order to capture the cost of this subsidy in the annual valuation, an assumption is made regarding the form of payment elections for future retirees.

Married members retiring from active status are currently assumed to elect annuities as follows:

Males:	7.5% elect 25% Joint & Survivor option
	15.0% elect 50% Joint & Survivor option
	12.5% elect 75% Joint & Survivor option
	55.0% elect 100% Joint & Survivor option
Females:	15.0% elect 25% Joint & Survivor option
	30.0% elect 50% Joint & Survivor option
	5.0% elect 75% Joint & Survivor option
	20.0% elect 100% Joint & Survivor option

Remaining married and unmarried members are assumed to elect the Single-life option.

Recommendation

We recommend minor changes to the form of payment assumptions as indicated on the next page.

Form of Payment

Male Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Single-life annuity	66	797	8.28%	10.00%	7.50%	79.70	59.78	82.8%	110.4%
25% joint & survivor	58	797	7.28%	7.50%	7.50%	59.78	59.78	97.0%	97.0%
50% joint & Survivor	123	797	15.43%	15.00%	15.00%	119.55	119.55	102.9%	102.9%
75% joint & Survivor	115	797	14.43%	12.50%	15.00%	99.63	119.55	115.4%	96.2%
100% joint & Survivor	435	797	54.58%	55.00%	55.00%	438.35	438.35	99.2%	99.2%
Total	**797**	**797**	**100.00%**	**100.00%**	**100.00%**	**797.00**	**797.00**		

Female Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Single-life annuity	20	61	32.79%	30.00%	30.00%	18.30	18.30	109.3%	109.3%
25% joint & survivor	11	61	18.03%	15.00%	15.00%	9.15	9.15	120.2%	120.2%
50% joint & Survivor	5	61	8.20%	30.00%	20.00%	18.30	12.20	27.3%	41.0%
75% joint & Survivor	6	61	9.84%	5.00%	10.00%	3.05	6.10	196.7%	98.4%
100% joint & Survivor	19	61	31.15%	20.00%	25.00%	12.20	15.25	155.7%	124.6%
Total	**61**	**61**	**100.00%**	**100.00%**	**100.00%**	**61.00**	**61.00**		

Actuarial Equivalent Factors

Joint and Survivor benefits are actuarially equivalent to the Single-life annuity. Effective July 1, 2019, actuarial equivalent factors are based on the RP-2014 mortality table for healthy annuitants for a member turning age 55 in 2021, reflecting projected mortality improvements using Scale MP-2017, male rates multiplied by a factor of 0.96, blended 90% males. Reflecting statutory requirements, joint and survivor factors are based on an interest assumption of 6.5%.

Recommendation

We recommend updating the actuarial equivalent factors to reflect changes in expected mortality and developing an appropriate implementation schedule.

Assumptions for Missing Participant Data

Background

To prepare the annual valuation report, GRS uses and relies on participant data supplied by PERA. In cases where submitted data was missing or incomplete, the following assumptions are currently applied:

Data for active members:

- For members reported with zero or invalid salary (<$100): Salary is set equal to prior year salary, if available, otherwise, high five salary with a 10% load to account for salary increases. If neither pay nor high five salary is available, salary is set to $60,000.
- For members reported without a gender: assume the member is male.
- For members reported with an invalid date of birth: assume the member was hired at age 30.

Data for terminated members:

- For members reported without Credited Service: assume a value equal to elapsed time from hire to termination date; if elapsed time is not available, assume nine years.
- For members reported with a termination date: assume termination date is equal to hire date plus credited service; otherwise the valuation date. If reported termination date occurs prior to reported hire date, the two dates are swapped.
- For members reported without a gender: assume male gender.
- For members reported without a date of birth: assume a birth date of July 1, 1966.

Data for retired members:

- For members reported without a gender: assume retirees are male and beneficiaries are female.
- Because PERA reclassifies disabled members as retirees once the member reaches Normal Retirement Age, GRS compares the members that PERA reports as retirees to our disabled group from the last valuation. If a member was disabled in the prior valuation, we reclassify that member as a disabled retiree in this year's valuation.

Recommendation

We recommend updating the assumptions for missing participant data as follows:

- *For active members reported with zero or invalid salary (<$100) and prior pay or high five salary is not available: assume salary is equal to the average salary at hire of new members with one to five years of service as of the prior valuation date. This value is $73,000 as of July 1, 2023.*
- *For active members reported with an invalid date of birth: assume member was hired the same at the same age as new members with one to five years of service as of the prior valuation date. This value is 30 years as of July 1, 2023.*
- *For terminated members and Average Salary was not reported or invalid: assume Average Salary equals $62,000.*
- *For terminated members reported without Credited Service: assume a value equal to elapsed time from hire to termination date; if elapsed time is not available, assume eight years.*
- *For terminated members reported without a date of birth: assume age 45 at valuation date.*

Proposed Miscellaneous and Technical Assumptions

Background

A number of miscellaneous and technical assumptions are used in the actuarial valuation. The present assumptions are listed on the following page.

The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016.

Recommendation

Miscellaneous and Technical Assumptions are listed on the next page. We recommend continued use of the other Miscellaneous and Technical Assumptions.

Miscellaneous and Technical Assumptions

Benefit Service	Exact fractional service is used to determine the amount of benefit payable.
Decrement Operation	Withdrawal decrements do not operate during retirement eligibility.
Decrement Timing	Decrements of all types are assumed to occur mid-year.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Forfeitures	For vested separations from service, it is assumed that members separating will withdraw their contributions and forfeit an employer financed benefit when the value of member contributions is greater than the value of the employer financed benefit.
Incidence of Contributions	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
Liability Adjustments	Liabilities for former members are increased by 33% for vested members and 2% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Service Credit Accruals	Members were assumed to accrue one year of service credit per year.

SECTION H

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Merit and Seniority Pay Increases

% Merit Increases in Salaries Next Year	
Service Index	Rate
1	7.75%
2	5.00%
3	4.25%
4	3.50%
5	2.25%
6	1.75%
7	1.25%
8	1.00%
9	0.90%
10	0.80%
11	0.60%
12	0.40%
13	0.30%
14	0.30%
15	0.30%
16	0.30%
17	0.20%
18	0.20%
19	0.20%
20	0.20%
21	0.10%
22	0.10%
23	0.10%
24	0.00%
25	0.00%
26	0.00%
27	0.00%
28	0.00%
29	0.00%
30+	0.00%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Age & Service Retirement Pattern
Unreduced (Normal) Retirement

Age	% Retiring
55	40.0%
56	25.0%
57	25.0%
58	25.0%
59	25.0%
60	25.0%
61	25.0%
62	30.0%
63	30.0%
64	32.5%
65	40.0%
66	45.0%
67	45.0%
68	45.0%
69	45.0%
70+*	100.0%

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Age & Service Retirement Pattern
Reduced (Early) Retirement

Age	% Retiring
50	5.0%
51	4.0%
52	5.0%
53	9.0%
54	15.0%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Withdrawal

Year	% Withdrawals Males and Females
1	8.00%
2	5.00%
3	3.25%
4	2.75%
5	2.75%
6	2.75%
7	2.50%
8	2.25%
9	2.25%
10	2.25%
11	2.25%
12	2.00%
13	2.00%
14	1.75%
15	1.50%
16	1.50%
17	1.50%
18	1.50%
19	1.50%
20	1.50%
21	1.25%
22	1.00%
23	1.00%
24	1.00%
25+	1.00%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Disability Rates

Age	% Becoming Disabled Males and Females
20	0.1100%
21	0.1100%
22	0.1200%
23	0.1200%
24	0.1300%
25	0.1800%
26	0.2500%
27	0.3200%
28	0.3800%
29	0.4400%
30	0.5100%
31	0.5300%
32	0.6000%
33	0.6500%
34	0.7100%
35	0.9000%
36	1.0800%
37	1.3100%
38	1.3300%
39	1.3300%
40	1.3500%
41	1.3800%
42	1.4100%
43	1.5100%
44	1.5100%
45	1.5500%
46	1.5500%
47	1.6800%
48	1.8400%
49	1.9700%
50	1.9700%
51	2.0200%
52	2.1300%
53	2.1800%
54	2.1900%
55*	2.1900%
56*	2.1900%
57*	2.1900%
58*	2.1900%
59*	2.5600%
59-69*	2.5600%

** Disability retirements are assumed to continue until the earlier of age 55 with 20 years of service or age 70.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
50	0.28%	0.20%
51	0.30%	0.21%
52	0.33%	0.23%
53	0.35%	0.24%
54	0.38%	0.26%
55	0.41%	0.28%
56	0.45%	0.30%
57	0.49%	0.32%
58	0.54%	0.35%
59	0.59%	0.37%
60	0.64%	0.40%
61	0.69%	0.43%
62	0.74%	0.46%
63	0.80%	0.50%
64	0.86%	0.54%
65	0.93%	0.58%
66	1.00%	0.63%
67	1.09%	0.69%
68	1.18%	0.76%
69	1.30%	0.84%
70	1.42%	0.93%
71	1.57%	1.03%
72	1.73%	1.15%
73	1.92%	1.30%
74	2.13%	1.46%
75	2.38%	1.64%
76	2.67%	1.86%
77	3.00%	2.10%
78	3.37%	2.37%
79	3.80%	2.69%
80	4.29%	3.05%

Age in 2023	% Dying Next Year*	
	Male	Female
81	4.85%	3.47%
82	5.49%	3.94%
83	6.21%	4.48%
84	7.02%	5.11%
85	7.92%	5.82%
86	8.91%	6.63%
87	10.00%	7.55%
88	11.18%	8.58%
89	12.46%	9.71%
90	13.83%	10.94%
91	15.28%	12.23%
92	16.79%	13.58%
93	18.36%	14.97%
94	19.98%	16.40%
95	21.63%	17.88%
96	23.43%	19.51%
97	25.29%	21.23%
98	27.21%	23.06%
99	29.19%	24.98%
100	31.22%	27.00%
101	33.26%	29.09%
102	35.30%	31.21%
103	37.33%	33.34%
104	39.31%	35.45%
105	41.23%	37.54%
106	43.10%	39.57%
107	44.90%	41.55%
108	46.60%	43.45%
109	48.23%	45.27%
110	49.56%	46.99%

** The rates shown are Pub-2010 mortality for healthy annuitants, Public Safety table, with adjustments, if applicable (see Section F). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
20	0.15%	0.06%
21	0.15%	0.06%
22	0.15%	0.07%
23	0.15%	0.07%
24	0.15%	0.07%
25	0.15%	0.08%
26	0.16%	0.09%
27	0.17%	0.10%
28	0.18%	0.11%
29	0.19%	0.11%
30	0.20%	0.12%
31	0.21%	0.13%
32	0.22%	0.14%
33	0.23%	0.15%
34	0.24%	0.16%
35	0.25%	0.17%
36	0.25%	0.18%
37	0.26%	0.18%
38	0.27%	0.19%
39	0.27%	0.19%
40	0.28%	0.20%
41	0.28%	0.20%
42	0.29%	0.20%
43	0.29%	0.21%
44	0.30%	0.21%
45	0.31%	0.22%
46	0.32%	0.23%
47	0.33%	0.23%
48	0.35%	0.25%
49	0.37%	0.26%
50	0.39%	0.28%
51	0.41%	0.30%
52	0.43%	0.33%
53	0.46%	0.37%
54	0.49%	0.41%
55	0.53%	0.45%

Age in 2023	% Dying Next Year*	
	Male	Female
56	0.58%	0.50%
57	0.64%	0.55%
58	0.71%	0.61%
59	0.79%	0.67%
60	0.88%	0.72%
61	0.97%	0.78%
62	1.07%	0.84%
63	1.18%	0.89%
64	1.28%	0.95%
65	1.40%	1.01%
66	1.51%	1.07%
67	1.63%	1.14%
68	1.76%	1.22%
69	1.90%	1.30%
70	2.06%	1.40%
71	2.24%	1.52%
72	2.45%	1.64%
73	2.70%	1.79%
74	3.00%	1.95%
75	3.35%	2.13%
76	3.75%	2.34%
77	4.20%	2.57%
78	4.70%	2.85%
79	5.25%	3.20%
80	5.83%	3.60%
81	6.46%	4.05%
82	7.16%	4.54%
83	7.94%	5.10%
84	8.83%	5.72%
85	9.84%	6.42%
86	10.98%	7.19%
87	12.34%	8.05%
88	13.84%	9.00%
89	15.49%	10.07%
90	17.32%	11.25%

** The rates shown are Pub-2010 mortality for disabled annuitants, Public Safety table, with adjustments, if applicable (see Section F). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
20	0.04%	0.02%
21	0.04%	0.02%
22	0.04%	0.02%
23	0.04%	0.02%
24	0.04%	0.02%
25	0.04%	0.02%
26	0.05%	0.03%
27	0.05%	0.03%
28	0.05%	0.03%
29	0.06%	0.03%
30	0.06%	0.04%
31	0.06%	0.04%
32	0.06%	0.04%
33	0.07%	0.05%
34	0.07%	0.05%
35	0.07%	0.05%
36	0.07%	0.05%
37	0.07%	0.06%
38	0.08%	0.06%
39	0.08%	0.06%
40	0.08%	0.06%
41	0.08%	0.06%
42	0.08%	0.06%
43	0.08%	0.06%
44	0.09%	0.06%
45	0.09%	0.07%

Age in 2023	% Dying Next Year*	
	Male	Female
46	0.09%	0.07%
47	0.10%	0.07%
48	0.10%	0.07%
49	0.11%	0.08%
50	0.11%	0.08%
51	0.12%	0.09%
52	0.13%	0.10%
53	0.14%	0.10%
54	0.15%	0.11%
55	0.17%	0.12%
56	0.18%	0.13%
57	0.20%	0.14%
58	0.22%	0.15%
59	0.25%	0.16%
60	0.27%	0.17%
61	0.30%	0.18%
62	0.32%	0.19%
63	0.35%	0.20%
64	0.38%	0.21%
65	0.41%	0.22%
66	0.46%	0.24%
67	0.51%	0.27%
68	0.57%	0.31%
69	0.63%	0.35%
70	0.71%	0.40%

* *The rates shown are Pub-2010 mortality for employees, Public Safety table, with adjustments, if applicable (see Section F). Rates are adjusted for mortality improvements using Scale MP-2021, from a base year of 2010.*

SECTION I

GLOSSARY

Glossary

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actuarial Decrement. The actual number of decrements which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of decrements will be subdivided by age and possibly sex.

Aggregate Assumptions. Assumptions which vary only by sex and/or age. The impact of year of service on the decrement is ignored. All experience is combined by age and/or sex without regard to service. Rates of death and disablement are more appropriate to aggregate measurement in a retirement system.

Crude Rate of Decrement. The rate of decrement determined by dividing the actual number of the respective decrement for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Decrements. The decrements are the means by which a member ceases to be a member. For active members, the decrements are death, withdrawal, service retirement, and disability retirement. For retired members, the only decrement is death. The purpose of the Experience Study is to determine the underlying rates of each decrement.

Expected Decrement. This is the number of occurrences of a given decrement expected to occur for a given age and sex based on the number of lives exposed to the risk of the particular decrement and the current assumed rate for that decrement. It may also be referred to as the tabular number of decrements. It is the number of deaths, withdrawals, retirements, or disabilities (whichever is applicable) that would have actually occurred had the actuarial assumptions been exactly realized.

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died, retired, become disabled, or withdrawn at that particular age and for that particular sex. This term will also be described as "the number exposed to a given risk."

Graduated Rates. Graduation is the mathematical process by which a set of crude rates of a particular type is translated into graduated or tabular rates. The graduation process attempts to smooth out statistical fluctuations and to arrive at a set of rates that adequately fit the underlying actual experience of the crude rates that are being graduated. The graduation process involves smoothing the results, but at the same time trying to fit the results to be consistent with the original data. It requires that the actuary exercise his or her judgment in what the underlying shape of the risk curve should look like.

Interpolated Rates. For the active rates of decrement (death, disability, retirement, and withdrawal), the actuary will develop graduated rates based on quinquennial age groupings (see definition). To arrive at the rates of decrement for ages between two quinquennial ages, the graduated quinquennial rates must be interpolated for these intermediate ages. The interpolated results are arrived at by applying a mathematical interpolation formula to the quinquennial graduated rates.

Glossary

Merit and Seniority Pay Increase Rate. The portion of the total salary scale which varies by service. It reflects the impact of moving up the salary grid in a given year, rather than the increase in the overall grid. It includes the salary increase associated with promotions during the year.

Quinquennial Age Groupings. For the active decrements, it is preferable to group the experience in five-year age groups for graduation and analysis purposes so as to minimize statistical fluctuations resulting from a lack of exposure which may occur for individual ages. Quinquennial age grouping is the five-year age grouping which is used to develop the graduated rates of decrement for active membership. The quinquennial age is the central age of the five-year grouping.

SECTION J

APPENDIX

Appendix – Detailed Experience Analysis

In this section, we present the annual experience for each major assumption that was analyzed for the study. Please note that totals may not sum correctly due to rounding of intermediate results.

Appendix – Detailed Experience Analysis
Salary Increases

2019-2023 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	1,545	12.06%	11.75%
2	2,193	9.25%	9.25%
3	2,232	8.64%	8.00%
4	2,179	7.94%	7.00%
5	2,148	6.67%	5.50%
6	2,019	6.67%	4.80%
7	1,834	5.79%	4.60%
8	1,576	5.87%	4.30%
9	1,264	5.59%	4.10%
10	1,050	5.70%	4.00%
11	1,065	4.93%	3.90%
12	1,192	5.16%	3.80%
13	1,377	5.15%	3.70%
14	1,575	4.86%	3.60%
15	1,546	5.47%	3.50%
16	1,375	5.12%	3.50%
17	1,288	4.73%	3.50%
18	1,212	4.52%	3.50%
19	1,228	4.78%	3.40%
20	1,360	5.16%	3.40%
21	1,375	4.61%	3.40%
22	1,367	4.92%	3.30%
23	1,268	4.73%	3.15%
24	1,129	5.27%	3.00%
25	906	5.31%	3.00%
26	722	4.80%	3.00%
27	530	4.61%	3.00%
28	375	5.24%	3.00%
29	277	5.47%	3.00%
30+	630	4.79%	3.00%
Totals	**39,837**	**5.92%**	**4.53%**

Appendix – Detailed Experience Analysis
Salary Increases

2019-2020 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	397	12.09%	11.75%
2	560	9.01%	9.25%
3	579	8.79%	8.00%
4	597	6.66%	7.00%
5	544	5.34%	5.50%
6	471	5.51%	4.80%
7	380	5.12%	4.60%
8	311	5.41%	4.30%
9	225	3.79%	4.10%
10	236	4.74%	4.00%
11	361	3.75%	3.90%
12	451	4.39%	3.80%
13	442	4.72%	3.70%
14	457	3.96%	3.60%
15	367	4.28%	3.50%
16	266	4.65%	3.50%
17	326	3.47%	3.50%
18	368	3.44%	3.50%
19	398	4.13%	3.40%
20	422	4.79%	3.40%
21	379	3.70%	3.40%
22	378	4.06%	3.30%
23	316	4.32%	3.15%
24	281	3.89%	3.00%
25	200	4.05%	3.00%
26	163	3.36%	3.00%
27	107	3.27%	3.00%
28	93	4.76%	3.00%
29	93	4.27%	3.00%
30+	201	3.85%	3.00%
Totals	**10,369**	**5.04%**	**4.51%**

2020-2021 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	403	11.48%	11.75%
2	552	8.61%	9.25%
3	547	7.88%	8.00%
4	561	7.77%	7.00%
5	583	6.52%	5.50%
6	515	5.96%	4.80%
7	457	5.11%	4.60%
8	361	5.42%	4.30%
9	299	4.11%	4.10%
10	221	5.64%	4.00%
11	235	5.06%	3.90%
12	341	5.33%	3.80%
13	418	4.78%	3.70%
14	412	4.74%	3.60%
15	422	4.54%	3.50%
16	345	3.65%	3.50%
17	257	3.28%	3.50%
18	312	3.90%	3.50%
19	332	3.89%	3.40%
20	362	4.07%	3.40%
21	394	4.03%	3.40%
22	344	4.82%	3.30%
23	325	4.24%	3.15%
24	284	4.18%	3.00%
25	237	4.69%	3.00%
26	168	4.24%	3.00%
27	137	4.55%	3.00%
28	78	3.72%	3.00%
29	64	4.90%	3.00%
30+	170	4.47%	3.00%
Totals	**10,136**	**5.32%**	**4.53%**

Appendix – Detailed Experience Analysis
Salary Increases

2021-2022 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	357	11.32%	11.75%
2	590	9.42%	9.25%
3	540	8.68%	8.00%
4	523	8.15%	7.00%
5	529	6.79%	5.50%
6	538	6.44%	4.80%
7	492	5.75%	4.60%
8	433	4.87%	4.30%
9	337	5.82%	4.10%
10	284	5.56%	4.00%
11	211	4.88%	3.90%
12	207	4.53%	3.80%
13	322	5.26%	3.70%
14	400	4.60%	3.60%
15	384	5.91%	3.50%
16	397	5.24%	3.50%
17	326	5.20%	3.50%
18	233	5.03%	3.50%
19	288	4.96%	3.40%
20	304	5.67%	3.40%
21	323	5.97%	3.40%
22	347	5.41%	3.30%
23	312	5.01%	3.15%
24	284	5.70%	3.00%
25	232	5.42%	3.00%
26	189	4.71%	3.00%
27	130	5.15%	3.00%
28	103	6.32%	3.00%
29	50	6.09%	3.00%
30+	145	5.61%	3.00%
Totals	**9,810**	**6.09%**	**4.55%**

2022-2023 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	388	13.26%	11.75%
2	491	9.98%	9.25%
3	566	9.14%	8.00%
4	498	9.27%	7.00%
5	492	8.05%	5.50%
6	495	8.60%	4.80%
7	505	6.86%	4.60%
8	471	7.35%	4.30%
9	403	7.30%	4.10%
10	309	6.48%	4.00%
11	258	6.38%	3.90%
12	193	7.19%	3.80%
13	195	6.57%	3.70%
14	306	6.52%	3.60%
15	373	7.06%	3.50%
16	367	6.55%	3.50%
17	379	6.19%	3.50%
18	299	5.92%	3.50%
19	210	7.00%	3.40%
20	272	6.51%	3.40%
21	279	5.00%	3.40%
22	298	5.45%	3.30%
23	315	5.29%	3.15%
24	280	7.11%	3.00%
25	237	6.71%	3.00%
26	202	6.34%	3.00%
27	156	5.04%	3.00%
28	101	5.67%	3.00%
29	70	6.91%	3.00%
30+	114	5.69%	3.00%
Totals	**9,522**	**7.19%**	**4.54%**

Appendix – Detailed Experience Analysis
Retirement*

2019-2023 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	37,639	1,132,457	84,934	44.3%
51	37,806	1,183,940	59,197	63.9%
52	63,674	1,152,263	57,613	110.5%
53	110,187	1,077,846	80,838	136.3%
54	171,025	1,000,056	100,006	171.0%
55	395,801	820,226	246,068	160.9%
56	129,814	449,049	89,810	144.5%
57	90,393	347,271	78,136	115.7%
58	72,186	262,409	65,602	110.0%
59	48,535	187,967	46,992	103.3%
60	37,188	139,211	27,842	133.6%
61	24,524	96,304	24,076	101.9%
62	22,725	81,543	24,463	92.9%
63	17,547	58,418	16,065	109.2%
64	14,133	38,816	10,674	132.4%
65	8,925	25,503	12,751	70.0%
66	7,753	12,155	4,862	159.5%
67	2,424	9,081	4,540	53.4%
68	4,823	8,369	4,185	115.3%
69	0	1,456	728	0.0%
Totals	**1,297,103**	**8,084,338**	**1,039,383**	**124.8%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Retirement*

2019-2020 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	6,041	266,206	19,965	30.3%
51	8,680	289,829	14,491	59.9%
52	6,726	251,957	12,598	53.4%
53	13,524	233,626	17,522	77.2%
54	21,650	238,693	23,869	90.7%
55	72,088	183,855	55,157	130.7%
56	15,757	107,702	21,540	73.2%
57	12,136	74,590	16,783	72.3%
58	14,634	59,758	14,940	98.0%
59	5,146	36,655	9,164	56.2%
60	5,945	31,035	6,207	95.8%
61	5,295	20,920	5,230	101.3%
62	2,937	25,015	7,505	39.1%
63	3,052	10,711	2,946	103.6%
64	1,823	3,592	988	184.6%
65	1,982	6,617	3,308	59.9%
66	3,695	4,069	1,628	227.0%
67	857	4,534	2,267	37.8%
68	2,403	2,403	1,201	200.0%
69	0	31	15	0.0%
Totals	**204,371**	**1,851,798**	**237,323**	**86.1%**

2020-2021 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	9,116	291,835	21,888	41.7%
51	11,921	281,704	14,085	84.6%
52	17,076	301,461	15,073	113.3%
53	24,543	259,500	19,462	126.1%
54	46,035	233,698	23,370	197.0%
55	119,825	228,860	68,658	174.5%
56	41,254	120,280	24,056	171.5%
57	34,934	96,530	21,719	160.8%
58	22,195	66,344	16,586	133.8%
59	16,603	47,747	11,937	139.1%
60	9,763	33,531	6,706	145.6%
61	7,884	26,584	6,646	118.6%
62	4,765	15,776	4,733	100.7%
63	7,230	23,189	6,377	113.4%
64	5,464	8,726	2,400	227.7%
65	1,070	1,890	945	113.2%
66	1,657	4,825	1,930	85.8%
67	405	405	202	200.0%
68	2,421	3,759	1,879	128.8%
69	0	0	0	N/A
Totals	**384,160**	**2,046,644**	**268,653**	**143.0%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Retirement*

2021-2022 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	13,511	301,098	22,582	59.8%
51	8,850	299,470	14,973	59.1%
52	18,013	285,614	14,281	126.1%
53	33,522	298,198	22,365	149.9%
54	53,627	245,588	24,559	218.4%
55	103,566	200,941	60,282	171.8%
56	32,534	115,655	23,131	140.6%
57	19,190	84,474	19,007	101.0%
58	14,479	66,484	16,621	87.1%
59	8,481	46,171	11,543	73.5%
60	9,852	32,858	6,572	149.9%
61	6,259	24,908	6,227	100.5%
62	8,378	20,045	6,014	139.3%
63	2,955	11,865	3,263	90.6%
64	4,335	17,024	4,682	92.6%
65	884	3,393	1,696	52.1%
66	4	864	346	1.2%
67	1,163	3,252	1,626	71.5%
68	0	10	5	0.0%
69	0	1,418	709	0.0%
Totals	**339,601**	**2,059,329**	**260,483**	**130.4%**

2022-2023 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	8,971	273,319	20,499	43.8%
51	8,355	312,936	15,647	53.4%
52	21,858	313,232	15,662	139.6%
53	38,599	286,523	21,489	179.6%
54	49,713	282,076	28,208	176.2%
55	100,322	206,569	61,971	161.9%
56	40,270	105,411	21,082	191.0%
57	24,135	91,677	20,627	117.0%
58	20,878	69,824	17,456	119.6%
59	18,307	57,394	14,348	127.6%
60	11,628	41,786	8,357	139.1%
61	5,085	23,892	5,973	85.1%
62	6,645	20,707	6,212	107.0%
63	4,309	12,653	3,480	123.8%
64	2,511	9,473	2,605	96.4%
65	4,990	13,603	6,801	73.4%
66	2,397	2,397	959	250.0%
67	0	890	445	0.0%
68	0	2,198	1,099	0.0%
69	0	7	4	0.0%
Totals	**368,971**	**2,126,567**	**272,924**	**135.2%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Withdrawals*

2019-2023 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	17,548	173,955	10,438	168.1%
2	32,763	560,571	22,423	146.1%
3	23,948	626,291	17,224	139.0%
4	19,134	652,704	16,317	117.3%
5	21,379	674,348	16,858	126.8%
6	20,937	690,842	15,543	134.7%
7	18,914	685,744	15,429	122.6%
8	16,149	656,083	13,122	123.1%
9	9,328	580,908	11,618	80.3%
10	11,000	489,411	9,788	112.4%
11	12,094	426,712	7,467	162.0%
12	8,654	442,084	6,631	130.5%
13	12,446	519,450	7,792	159.7%
14	11,537	615,018	9,226	125.0%
15	11,252	723,963	10,860	103.6%
16	9,458	744,132	11,162	84.7%
17	10,857	684,107	10,261	105.8%
18	8,126	642,733	8,034	101.2%
19	12,737	606,595	7,583	168.0%
20	8,996	620,388	7,755	116.0%
21	9,255	680,464	6,805	136.0%
22	7,906	687,431	6,875	115.0%
23	10,070	640,582	6,406	157.2%
24	5,933	553,577	5,535	107.2%
25	4,086	409,049	4,091	99.9%
26	1,393	233,953	2,339	59.6%
27	4,636	100,495	1,004	461.5%
28	-	44,627	447	0.0%
29	-	12,130	121	0.0%
30+	-	2,556	26	0.0%
Totals	**340,537**	**15,180,904**	**269,180**	**126.5%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Withdrawals*

2019-2020 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	3,528	42,462	2,548	138.4%
2	5,824	141,125	5,645	103.2%
3	5,601	157,836	4,341	129.0%
4	3,372	164,092	4,102	82.2%
5	2,265	175,891	4,397	51.5%
6	5,119	170,422	3,834	133.5%
7	1,993	149,069	3,354	59.4%
8	3,375	128,651	2,573	131.2%
9	1,633	106,821	2,136	76.5%
10	729	82,273	1,645	44.3%
11	3,985	91,145	1,595	249.8%
12	1,567	143,295	2,149	72.9%
13	3,361	190,591	2,859	117.6%
14	2,813	180,234	2,704	104.0%
15	1,962	198,182	2,973	66.0%
16	573	166,400	2,496	22.9%
17	1,001	120,216	1,803	55.5%
18	992	144,823	1,810	54.8%
19	2,552	173,016	2,163	118.0%
20	2,361	189,434	2,368	99.7%
21	1,176	197,851	1,979	59.4%
22	1,341	178,657	1,787	75.0%
23	1,889	155,259	1,553	121.6%
24	582	130,630	1,306	44.6%
25	1,018	105,869	1,059	96.1%
26	-	37,316	373	0.0%
27	-	20,347	203	0.0%
28	-	12,152	122	0.0%
29	-	5,119	51	0.0%
30+	-	764	8	0.0%
Totals	**60,611**	**3,759,942**	**65,936**	**91.9%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Withdrawals*

2020-2021 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	5,926	50,708	3,042	194.8%
2	10,093	152,644	6,106	165.3%
3	4,859	162,164	4,460	109.0%
4	4,563	162,601	4,065	112.3%
5	7,178	174,254	4,356	164.8%
6	4,475	182,356	4,103	109.1%
7	3,601	174,917	3,936	91.5%
8	2,537	157,263	3,145	80.7%
9	2,009	133,345	2,667	75.3%
10	609	111,900	2,238	27.2%
11	706	84,608	1,481	47.7%
12	1,905	94,943	1,424	133.8%
13	1,267	147,767	2,217	57.1%
14	3,619	195,741	2,936	123.2%
15	2,743	179,900	2,699	101.6%
16	3,028	204,832	3,072	98.6%
17	4,448	169,280	2,539	175.2%
18	2,123	121,979	1,525	139.2%
19	962	147,890	1,849	52.0%
20	2,137	164,266	2,053	104.1%
21	4,965	183,801	1,838	270.1%
22	2,031	189,308	1,893	107.3%
23	2,869	160,442	1,604	178.8%
24	1,353	140,823	1,408	96.0%
25	978	103,562	1,036	94.4%
26	742	69,958	700	106.1%
27	-	23,620	236	0.0%
28	-	7,270	73	0.0%
29	-	4,374	44	0.0%
30+	-	-	-	N/A
Totals	**81,725**	**3,856,515**	**68,744**	**118.9%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Withdrawals*

2021-2022 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	3,603	35,044	2,103	171.4%
2	7,754	119,763	4,791	161.9%
3	7,361	162,132	4,459	165.1%
4	5,936	155,764	3,894	152.4%
5	4,825	159,421	3,986	121.1%
6	6,233	170,763	3,842	162.2%
7	5,037	181,375	4,081	123.4%
8	5,077	175,925	3,518	144.3%
9	2,436	156,811	3,136	77.7%
10	3,638	133,132	2,663	136.6%
11	2,496	113,504	1,986	125.7%
12	1,599	86,954	1,304	122.6%
13	4,392	91,529	1,373	319.9%
14	2,372	146,372	2,196	108.0%
15	3,781	194,448	2,917	129.6%
16	3,651	179,906	2,699	135.3%
17	3,525	207,475	3,112	113.3%
18	2,666	170,715	2,134	124.9%
19	2,695	116,763	1,460	184.6%
20	2,366	149,607	1,870	126.5%
21	2,410	155,435	1,554	155.1%
22	3,231	169,053	1,691	191.1%
23	2,860	172,758	1,728	165.5%
24	2,526	132,559	1,326	190.5%
25	682	105,445	1,054	64.7%
26	-	49,447	494	0.0%
27	2,796	30,745	307	909.5%
28	-	10,940	109	0.0%
29	-	973	10	0.0%
30+	-	794	8	0.0%
Totals	**95,947**	**3,735,551**	**65,804**	**145.8%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Withdrawals*

2022-2023 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	4,491	45,741	2,744	163.6%
2	9,092	147,040	5,882	154.6%
3	6,127	144,159	3,964	154.5%
4	5,263	170,247	4,256	123.6%
5	7,110	164,782	4,120	172.6%
6	5,110	167,301	3,764	135.8%
7	8,283	180,383	4,059	204.1%
8	5,160	194,245	3,885	132.8%
9	3,250	183,931	3,679	88.3%
10	6,025	162,105	3,242	185.8%
11	4,907	137,456	2,405	204.0%
12	3,583	116,892	1,753	204.4%
13	3,426	89,563	1,343	255.0%
14	2,733	92,670	1,390	196.6%
15	2,766	151,432	2,271	121.8%
16	2,207	192,994	2,895	76.2%
17	1,883	187,136	2,807	67.1%
18	2,346	205,215	2,565	91.4%
19	6,528	168,926	2,112	309.2%
20	2,132	117,081	1,464	145.7%
21	704	143,377	1,434	49.1%
22	1,304	150,413	1,504	86.7%
23	2,453	152,123	1,521	161.2%
24	1,473	149,565	1,496	98.5%
25	1,409	94,173	942	149.6%
26	651	77,232	772	84.3%
27	1,839	25,784	258	713.3%
28	-	14,265	143	0.0%
29	-	1,665	17	0.0%
30+	-	999	10	0.0%
Totals	**102,254**	**3,828,895**	**68,697**	**148.8%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Disability Retirements

2019-2023 Experience

	Males and Females			
Age Group	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**
Under 20	-	-	-	N/A
20-24	2	1,191	1.5	134.5%
25-29	24	5,342	9.4	254.4%
30-34	65	7,008	16.0	407.1%
35-39	152	8,291	39.2	387.8%
40-44	169	7,649	42.5	397.8%
45-49	186	7,434	56.2	331.0%
50-54	190	7,042	78.3	242.5%
55-59	19	650	8.5	224.9%
60+	3	232	3.0	99.5%
Totals	**810**	**44,839**	**254.6**	**318.2%**

Appendix – Detailed Experience Analysis
Disability Retirements

2019-2020 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	272	0.3	0.0%
25-29	1	1,306	2.3	43.2%
30-34	3	1,701	3.9	77.1%
35-39	12	2,113	9.9	121.0%
40-44	20	1,878	10.4	191.6%
45-49	27	2,014	15.3	176.4%
50-54	29	1,717	19.1	152.2%
55-59	5	164	2.1	234.5%
60+	1	64	0.8	120.2%
Totals	**98**	**11,229**	**64.2**	**152.6%**

2020-2021 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	1	300	0.4	266.2%
25-29	5	1,364	2.4	207.0%
30-34	21	1,748	4.0	526.9%
35-39	53	2,143	10.1	523.8%
40-44	57	1,902	10.6	539.4%
45-49	62	1,928	14.6	423.6%
50-54	58	1,791	19.9	291.6%
55-59	6	161	2.1	286.7%
60+	1	55	0.7	139.9%
Totals	**264**	**11,392**	**64.8**	**407.4%**

Appendix – Detailed Experience Analysis
Disability Retirements

2021-2022 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	1	290	0.4	276.6%
25-29	11	1,324	2.3	470.9%
30-34	24	1,740	4.0	606.4%
35-39	46	2,060	9.8	470.3%
40-44	56	1,930	10.7	522.5%
45-49	47	1,787	13.5	348.6%
50-54	61	1,789	19.9	306.6%
55-59	4	165	2.1	186.5%
60+	-	55	0.7	0.0%
Totals	**250**	**11,140**	**63.4**	**394.4%**

2022-2023 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	329	0.4	0.0%
25-29	7	1,348	2.4	295.4%
30-34	17	1,819	4.1	411.5%
35-39	41	1,975	9.4	437.3%
40-44	36	1,939	10.8	334.6%
45-49	50	1,705	12.8	391.8%
50-54	42	1,745	19.5	215.4%
55-59	4	160	2.1	192.3%
60+	1	58	0.8	132.6%
Totals	**198**	**11,078**	**62.1**	**318.6%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality*

2019-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	61	40,608	96	63.6%	50-54	-	7,139	14	0.0%
55-59	788	276,740	1,041	75.7%	55-59	97	36,892	127	76.1%
60-64	1,508	312,476	2,013	74.9%	60-64	85	36,825	205	41.5%
65-69	2,237	310,794	3,320	67.4%	65-69	122	20,657	176	69.4%
70-74	5,231	290,927	5,188	100.8%	70-74	222	8,113	114	194.9%
75-79	5,929	204,338	6,379	92.9%	75-79	74	2,136	54	137.4%
80-84	9,546	146,205	8,304	115.0%	80-84	-	2,163	101	0.0%
85-89	8,955	75,155	7,746	115.6%	85-89	94	1,562	123	76.5%
90-94	7,033	32,519	5,568	126.3%	90-94	310	647	87	355.0%
95-99	2,242	6,091	1,435	156.3%	95-99	33	138	28	117.7%
100+	205	393	124	164.7%	100+	-	-	-	N/A
Totals	**43,735**	**1,696,246**	**41,213**	**106.1%**	**Totals**	**1,037**	**116,272**	**1,029**	**100.7%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Post-Retirement Mortality*

2019-2020 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	61	12,496	30	205.8%	50-54	-	1,571	3	0.0%
55-59	106	63,807	242	43.9%	55-59	-	9,294	32	0.0%
60-64	161	74,238	480	33.6%	60-64	-	7,816	44	0.0%
65-69	517	76,331	815	63.5%	65-69	67	3,532	30	225.3%
70-74	1,682	69,281	1,232	136.5%	70-74	72	1,673	23	313.7%
75-79	1,640	47,411	1,514	108.3%	75-79	74	479	13	564.7%
80-84	1,604	32,183	1,806	88.8%	80-84	-	567	27	0.0%
85-89	2,117	19,038	1,941	109.1%	85-89	94	407	34	276.2%
90-94	1,405	8,438	1,458	96.4%	90-94	159	195	31	513.7%
95-99	514	1,226	303	169.7%	95-99	21	38	8	248.4%
100+	53	53	17	306.7%	100+	-	-	-	N/A
Totals	**9,860**	**404,502**	**9,837**	**100.2%**	**Totals**	**487**	**25,572**	**245**	**199.0%**

2020-2021 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	8,707	20	0.0%	50-54	-	1,361	3	0.0%
55-59	291	63,726	240	121.1%	55-59	97	9,359	32	302.1%
60-64	450	76,280	491	91.6%	60-64	-	8,842	49	0.0%
65-69	884	77,149	822	107.5%	65-69	-	4,707	40	0.0%
70-74	790	73,560	1,316	60.1%	70-74	-	1,718	25	0.0%
75-79	1,622	47,879	1,516	107.0%	75-79	-	428	11	0.0%
80-84	2,191	35,904	2,031	107.9%	80-84	-	555	26	0.0%
85-89	2,379	19,039	1,989	119.6%	85-89	-	271	20	0.0%
90-94	1,887	8,061	1,415	133.4%	90-94	-	185	23	0.0%
95-99	472	1,298	306	154.5%	95-99	12	17	3	349.6%
100+	110	172	52	209.7%	100+	-	-	-	N/A
Totals	**11,076**	**411,775**	**10,198**	**108.6%**	**Totals**	**109**	**27,443**	**233**	**46.8%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Post-Retirement Mortality*

2021-2022 Experience ($000s)

	Males				Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	9,233	22	0.0%	50-54	-	1,827	3	0.0%
55-59	156	71,961	270	57.7%	55-59	-	9,272	32	0.0%
60-64	349	79,253	511	68.2%	60-64	-	9,613	53	0.0%
65-69	327	77,981	836	39.1%	65-69	-	6,029	52	0.0%
70-74	1,513	74,490	1,337	113.2%	70-74	150	1,996	29	518.0%
75-79	1,354	51,811	1,613	83.9%	75-79	-	489	12	0.0%
80-84	2,710	38,157	2,189	123.8%	80-84	-	597	28	0.0%
85-89	2,078	17,918	1,859	111.8%	85-89	-	365	29	0.0%
90-94	2,076	8,121	1,368	151.7%	90-94	94	151	19	495.9%
95-99	780	1,873	428	182.1%	95-99	-	41	8	0.0%
100+	42	105	33	126.6%	100+	-	-	-	N/A
Totals	**11,385**	**430,903**	**10,466**	**108.8%**	**Totals**	**244**	**30,380**	**265**	**92.0%**

2022-2023 Experience ($000s)

	Males				Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	10,172	24	0.0%	50-54	-	2,380	5	0.0%
55-59	235	77,246	289	81.4%	55-59	-	8,967	31	0.0%
60-64	548	82,705	531	103.3%	60-64	85	10,554	59	144.5%
65-69	509	79,333	847	60.1%	65-69	55	6,389	54	101.1%
70-74	1,246	73,596	1,304	95.6%	70-74	-	2,726	37	0.0%
75-79	1,313	57,237	1,736	75.6%	75-79	-	740	18	0.0%
80-84	3,041	39,961	2,278	133.5%	80-84	-	444	20	0.0%
85-89	2,381	19,160	1,958	121.6%	85-89	-	519	39	0.0%
90-94	1,665	7,899	1,327	125.5%	90-94	57	116	15	392.1%
95-99	476	1,694	398	119.6%	95-99	-	42	9	0.0%
100+	-	63	22	0.0%	100+	-	-	-	N/A
Totals	**11,414**	**449,066**	**10,712**	**106.6%**	**Totals**	**197**	**32,877**	**287**	**68.7%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Disabled Mortality*

2019-2023 Experience ($000s)

Age Group	Males Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Females Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	294	14,210	31	940.6%	<40	34	3,383	5	638.8%
40-44	241	20,419	52	460.2%	40-44	-	6,154	13	0.0%
45-49	308	27,788	88	350.8%	45-49	64	6,869	17	368.0%
50-54	1,102	38,503	161	684.6%	50-54	79	9,700	36	216.5%
55-59	710	27,895	180	393.8%	55-59	91	6,833	41	219.7%
60-64	229	28,090	302	75.8%	60-64	22	3,247	29	75.2%
65-69	1,113	37,783	611	182.2%	65-69	-	3,222	38	0.0%
70-74	1,191	47,618	1,169	101.9%	70-74	-	1,114	20	0.0%
75-79	757	22,301	921	82.2%	75-79	14	272	7	211.2%
80-84	410	7,289	510	80.4%	80-84	-	-	-	N/A
85-89	272	2,574	301	90.2%	85-89	-	-	-	N/A
90-94	117	688	142	82.1%	90-94	-	-	-	N/A
95-99	-	65	16	0.0%	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**6,744**	**275,223**	**4,485**	**150.4%**	**Totals**	**304**	**40,794**	**208**	**146.2%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Disabled Mortality*

2019-2020 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	-	1,837	4	0.0%	<40	-	783	1	0.0%
40-44	-	2,886	7	0.0%	40-44	-	870	2	0.0%
45-49	32	5,082	16	200.7%	45-49	-	1,206	3	0.0%
50-54	208	6,459	28	756.2%	50-54	-	1,968	8	0.0%
55-59	136	6,179	40	340.4%	55-59	-	1,270	8	0.0%
60-64	160	7,866	84	190.7%	60-64	-	804	7	0.0%
65-69	249	11,016	179	139.3%	65-69	-	618	7	0.0%
70-74	310	10,928	265	117.1%	70-74	-	243	4	0.0%
75-79	419	4,352	183	229.3%	75-79	14	14	0	3037.3%
80-84	234	1,493	106	221.3%	80-84	-	-	-	N/A
85-89	108	541	59	183.4%	85-89	-	-	-	N/A
90-94	-	178	35	0.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,856**	**58,817**	**1,004**	**184.8%**	**Totals**	**14**	**7,776**	**41**	**34.4%**

2020-2021 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	-	1,939	4	0.0%	<40	-	666	1	0.0%
40-44	30	3,456	9	344.4%	40-44	-	1,358	3	0.0%
45-49	44	5,164	16	273.8%	45-49	-	1,549	4	0.0%
50-54	72	7,856	33	220.5%	50-54	-	2,160	8	0.0%
55-59	147	6,790	44	337.2%	55-59	-	1,494	9	0.0%
60-64	28	7,197	78	36.0%	60-64	-	880	8	0.0%
65-69	360	9,889	161	224.1%	65-69	-	683	8	0.0%
70-74	234	11,655	282	82.9%	70-74	-	321	6	0.0%
75-79	108	5,128	210	51.4%	75-79	-	-	-	N/A
80-84	98	1,458	100	98.1%	80-84	-	-	-	N/A
85-89	56	680	76	73.7%	85-89	-	-	-	N/A
90-94	-	179	38	0.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,177**	**61,391**	**1,050**	**112.1%**	**Totals**	**-**	**9,111**	**47**	**0.0%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Disabled Mortality*

2021-2022 Experience ($000s)

Age Group	Males Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Females Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	57	4,069	9	634.2%	<40	34	738	1	2971.7%
40-44	21	5,460	14	149.6%	40-44	-	1,815	4	0.0%
45-49	-	7,890	25	0.0%	45-49	-	2,018	5	0.0%
50-54	361	10,577	44	817.3%	50-54	79	2,555	9	831.8%
55-59	350	7,212	47	745.1%	55-59	39	1,924	12	333.9%
60-64	-	6,342	68	0.0%	60-64	22	796	7	305.2%
65-69	179	9,071	145	123.4%	65-69	-	914	11	0.0%
70-74	365	12,604	310	117.7%	70-74	-	271	5	0.0%
75-79	230	5,779	237	96.9%	75-79	-	54	1	0.0%
80-84	-	1,944	133	0.0%	80-84	-	-	-	N/A
85-89	108	741	89	120.8%	85-89	-	-	-	N/A
90-94	65	182	41	157.6%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,736**	**71,871**	**1,163**	**149.2%**	**Totals**	**174**	**11,085**	**56**	**310.7%**

2022-2023 Experience ($000s)

Age Group	Males Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Females Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	237	6,365	14	1663.9%	<40	-	1,196	2	0.0%
40-44	190	8,617	23	843.9%	40-44	-	2,111	4	0.0%
45-49	232	9,652	31	751.3%	45-49	64	2,096	5	1223.8%
50-54	461	13,611	57	813.9%	50-54	-	3,017	11	0.0%
55-59	77	7,714	50	154.8%	55-59	52	2,145	13	397.1%
60-64	41	6,685	73	56.6%	60-64	-	767	7	0.0%
65-69	325	7,807	126	257.1%	65-69	-	1,007	12	0.0%
70-74	282	12,431	312	90.4%	70-74	-	279	5	0.0%
75-79	-	7,042	290	0.0%	75-79	-	204	5	0.0%
80-84	78	2,394	171	45.7%	80-84	-	-	-	N/A
85-89	-	612	77	0.0%	85-89	-	-	-	N/A
90-94	52	149	28	185.0%	90-94	-	-	-	N/A
95-99	-	65	16	0.0%	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,975**	**83,144**	**1,268**	**155.8%**	**Totals**	**116**	**12,822**	**64**	**180.9%**

** Results are benefits weighted.*

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality*

2019-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	158,253	68	0.0%	20-24	-	39,125	8	0.0%
25-29	479	1,088,405	546	87.7%	25-29	-	206,221	60	0.0%
30-34	394	1,854,546	1,153	34.2%	30-34	-	255,122	107	0.0%
35-39	3,177	2,819,756	2,058	154.4%	35-39	495	353,722	188	263.5%
40-44	3,822	3,289,091	2,656	143.9%	40-44	-	400,361	240	0.0%
45-49	2,810	4,158,772	3,988	70.5%	45-49	-	505,155	360	0.0%
50-54	3,211	5,040,002	6,622	48.5%	50-54	737	549,731	528	139.5%
55-59	864	1,912,975	3,680	23.5%	55-59	-	172,255	236	0.0%
60-64	1,804	388,465	1,209	149.2%	60-64	-	29,236	55	0.0%
Totals	**16,561**	**20,710,265**	**21,979**	**75.3%**	**Totals**	**1,232**	**2,510,928**	**1,783**	**69.1%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality*

2019-2020 Experience ($000s)

	Males				Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	36,497	15	0.0%	20-24	-	7,286	2	0.0%
25-29	-	264,995	131	0.0%	25-29	-	43,734	13	0.0%
30-34	-	447,651	270	0.0%	30-34	-	56,409	23	0.0%
35-39	1,419	708,069	495	286.6%	35-39	495	89,512	46	1076.6%
40-44	1,846	788,338	614	300.4%	40-44	-	99,241	59	0.0%
45-49	422	1,074,348	1,018	41.5%	45-49	-	136,930	98	0.0%
50-54	-	1,160,895	1,531	0.0%	50-54	-	125,369	122	0.0%
55-59	-	422,539	819	0.0%	55-59	-	44,077	60	0.0%
60-64	-	84,152	261	0.0%	60-64	-	7,674	14	0.0%
Totals	**3,687**	**4,987,484**	**5,155**	**71.5%**	**Totals**	**495**	**610,232**	**435**	**113.7%**

2020-2021 Experience ($000s)

	Males				Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	41,986	18	0.0%	20-24	-	10,110	2	0.0%
25-29	270	285,445	143	188.7%	25-29	-	53,082	16	0.0%
30-34	-	468,684	290	0.0%	30-34	-	61,365	26	0.0%
35-39	310	729,683	528	58.7%	35-39	-	91,544	48	0.0%
40-44	-	811,922	649	0.0%	40-44	-	100,593	60	0.0%
45-49	-	1,063,092	1,017	0.0%	45-49	-	134,119	96	0.0%
50-54	1,736	1,248,354	1,640	105.8%	50-54	-	130,049	124	0.0%
55-59	604	514,851	992	60.9%	55-59	-	47,998	65	0.0%
60-64	-	100,270	316	0.0%	60-64	-	8,021	15	0.0%
Totals	**2,920**	**5,264,287**	**5,593**	**52.2%**	**Totals**	**-**	**636,881**	**451**	**0.0%**

** Results are liability weighted.*

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality*

2021-2022 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	36,008	15	0.0%	20-24	-	9,789	2	0.0%
25-29	209	267,103	135	154.9%	25-29	-	51,381	15	0.0%
30-34	237	448,322	282	84.1%	30-34	-	65,698	28	0.0%
35-39	816	693,211	514	158.7%	35-39	-	86,937	47	0.0%
40-44	1,068	829,091	678	157.6%	40-44	-	98,561	59	0.0%
45-49	1,364	1,012,378	976	139.8%	45-49	-	119,914	85	0.0%
50-54	986	1,297,771	1,701	58.0%	50-54	-	143,472	137	0.0%
55-59	260	478,184	917	28.4%	55-59	-	40,468	56	0.0%
60-64	1,063	101,309	318	333.9%	60-64	-	6,345	12	0.0%
Totals	**6,003**	**5,163,377**	**5,536**	**108.4%**	**Totals**	**-**	**622,565**	**442**	**0.0%**

2022-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	43,762	19	0.0%	20-24	-	11,940	3	0.0%
25-29	-	270,862	137	0.0%	25-29	-	58,024	17	0.0%
30-34	157	489,889	311	50.4%	30-34	-	71,650	31	0.0%
35-39	632	688,793	521	121.3%	35-39	-	85,729	47	0.0%
40-44	908	859,740	715	127.0%	40-44	-	101,966	62	0.0%
45-49	1,024	1,008,954	977	104.8%	45-49	-	114,192	81	0.0%
50-54	489	1,332,982	1,749	28.0%	50-54	737	150,841	145	506.8%
55-59	-	497,401	952	0.0%	55-59	-	39,712	55	0.0%
60-64	741	102,734	314	235.7%	60-64	-	7,196	13	0.0%
Totals	**3,951**	**5,295,117**	**5,695**	**69.4%**	**Totals**	**737**	**641,250**	**454**	**162.3%**

** Results are liability weighted.*