

City of Worcester Retirement System

Actuarial Valuation and Review as of January 1, 2023



This report has been prepared at the request of the Retirement Board to assist in administering the City of Worcester Retirement System. This valuation report may not otherwise be copied or reproduced in any form without the consent of the Retirement Board and may only be provided to other parties in its entirety, unless expressly authorized by Segal. The measurements shown in this actuarial valuation may not be applicable for other purposes.

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June 8, 2023

Retirement Board
City of Worcester Retirement System
City Hall, Room 103, 455 Main Street
Worcester, MA 01608

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2023. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and establishes the funding requirements for fiscal 2024 and later years.

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

Segal does not audit the data provided. The accuracy and comprehensiveness of the data is the responsibility of those supplying the data. To the extent we can, however, Segal does review the data for reasonableness and consistency. Based on our review of the data, we have no reason to doubt the substantial accuracy of the information on which we have based this report and we have no reason to believe there are facts or circumstances that would affect the validity of these results.

The measurements shown in this actuarial valuation may not be applicable for other purposes. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

The actuarial calculations were directed under the supervision of Kathleen A. Riley, FSA, MAAA, EA. She is a member of the American Academy of Actuaries and she meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of her knowledge, the information supplied in this actuarial valuation is complete and accurate. The assumptions used in this actuarial valuation were selected by the Board based upon her analysis and recommendations. In her opinion, the assumptions are reasonable and take into account the experience of the Plan and reasonable expectations.

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

Sincerely,
Segal



Kathleen A. Riley, FSA, MAAA, EA
Senior Vice President and Chief Actuary



Andrew R. Luongo
Consultant

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Section 1: Actuarial Valuation Summary

Purpose and basis

This report has been prepared by Segal to present a valuation of the City of Worcester Retirement System as of January 1, 2023. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits.

The contribution requirements presented in this report are based on:

- The benefit provisions of Massachusetts General Law Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of December 31, 2022, provided by the staff of the Retirement System;
- The assets of the Plan as of December 31, 2022, provided by the Retirement System;
- Economic assumptions regarding future salary increases and investment earnings; and
- Other actuarial assumptions regarding employee terminations, retirement, death, etc.

Certain disclosure information required by GASB Statements No. 67 and 68 as of December 31, 2022 for the City of Worcester Retirement System is provided in a separate report.

Section 1: Actuarial Valuation Summary

Valuation highlights

1. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and the principal balance. The funding policy adopted by the City of Worcester Retirement System meets this standard and funds the unfunded actuarial accrued liability of the plan by June 30, 2034.
2. The rate of return on the market value of assets was -8.32% for the year ending December 31, 2022. The return on the actuarial value of assets was 5.20% for the same period due to the recognition of prior years' investment gains and losses. This resulted in an actuarial loss when measured against the assumed rate of return of 6.80%.
3. The actuarial value of assets is 103.2% of the market value of assets. The investment experience in the past years has only been partially recognized in the actuarial value of assets. As the deferred net loss is recognized in future years, the cost of the Plan is likely to increase unless the net loss is offset by future experience. The recognition of the net market loss of \$39.0 million will also have an impact on the future funded ratio. The unrecognized investment losses are not reflected in the funding schedule shown in *Section 2*.
4. The following actuarial assumption was changed with this valuation:
 - The administrative expense assumption was lowered from \$715,000 for calendar year 2022 to \$700,000 for calendar year 2023.
5. Pursuant to Chapter 269 of the Acts of 2022, the Board approved a one-time increase in the COLA from 3% to 5% effective July 1, 2022.
6. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 73.59%, compared to the prior year funded ratio of 72.92%. This ratio is one measure of funding status, and its history is a measure of funding progress. Using the market value of assets, the funded ratio is 71.30%, compared to 81.02% as of the prior valuation date. These measurements are not necessarily appropriate for assessing the sufficiency of the System assets to cover the estimated cost of settling the System's benefit obligation or the need for or the amount of future contributions.
7. The funding schedule included in this report shows a projection of the actuarially determined contribution. The fiscal 2024 total appropriation has been set equal to \$66,733,809 as determined with the prior valuation. For fiscal 2025, the total appropriation increases 4.79% over fiscal 2024. For fiscal 2026 and later years, each year's total appropriation increases 3.50%, with a smaller payment in fiscal 2034, so that the System will be fully funded by June 30, 2034, if all assumptions are met and there are no changes in the plan of benefits or assumptions. In the prior valuation, the System was also projected to be fully funded by June 30, 2034 with appropriations that increased 3.50% per year beginning in fiscal 2025 and a smaller payment in fiscal 2034. The change in the fiscal 2025 actuarially determined contribution to be a 4.79% increase over fiscal 2024 compared to a 3.50%

Section 1: Actuarial Valuation Summary

increase in the prior valuation was made to fund the additional liability resulting from the one-time increase in the COLA from 3% to 5% effective July 1, 2022.

8. The unfunded actuarial accrued liability is \$448.9 million, which is an increase of \$1.4 million since the prior valuation.

Risk

9. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the Plan's future financial condition, but have included a brief discussion of some risks that may affect the Plan in *Section 2*. A more detailed assessment would provide the Board with a better understanding of the inherent risks and could be important because relatively small changes in investment performance can produce large swings in the contribution requirements.

Section 1: Actuarial Valuation Summary

Summary of key valuation results

		2023	2022
Contributions for fiscal year beginning July 1	- Actuarially determined contributions for fiscal year 2024 and 2023 - Actuarially determined contributions as a percent of payroll	\$66,733,809 29.08%	\$62,761,035 29.82%
Actuarial accrued liability for plan year beginning January 1:	- Retired participants and beneficiaries - Inactive vested participants - Inactive participants due a refund of employee contributions - Active participants - Total - Normal cost including administrative expenses for plan year beginning January 1	\$1,026,745,517 32,234,904 8,155,050 632,854,564 1,699,990,035 39,212,323	\$996,565,467 26,004,508 7,257,375 622,295,819 1,652,123,169 36,407,910
Assets for plan year beginning January 1:	- Market value of assets (MVA) - Actuarial value of assets (AVA) - Actuarial value of assets as a percentage of market value of assets	\$1,212,020,446 1,251,062,070 103.2%	\$1,338,509,591 1,204,658,632 90.0%
Funded status for plan year beginning January 1:	- Unfunded actuarial accrued liability on market value of assets - Funded percentage on MVA basis - Unfunded actuarial accrued liability on actuarial value of assets - Funded percentage on AVA basis	\$487,969,589 71.30% \$448,927,965 73.59%	\$313,613,578 81.02% \$447,464,537 72.92%
Key assumptions	- Net investment return - Inflation rate	6.80% 3.00%	6.80% 3.00%
Demographic data for plan year beginning January 1:	- Number of retired participants and beneficiaries - Number of inactive vested participants - Number of inactive participants due a refund of employee contributions - Number of active participants - Average compensation¹	2,761 167 1,130 3,630 60,150	2,753 145 1,023 3,377 59,216

¹ Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2022 salaries were reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data. Calendar year 2021 salaries were increased by 3.0% for police and firefighters hired before December 31, 2019 to estimate the impact of salary increases on July 1, 2020 and July 1, 2021 attributable to unsettled bargaining contracts.

Section 1: Actuarial Valuation Summary

Important information about actuarial valuations

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

In order to prepare a valuation, Segal relies on a number of input items. These include:

Plan provisions	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant information	An actuarial valuation for a plan is based on data provided to the actuary by the City of Worcester Retirement System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Financial information	Part of the cost of a plan will be paid from existing assets — the balance will need to come from future contributions and investment income. The valuation is based on the asset values as of the valuation date, typically reported by the City of Worcester Retirement System. A snapshot as of a single date may not be an appropriate value for determining a single year's contribution requirement, especially in volatile markets. Plan sponsors often use an "actuarial value of assets" that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal starts by developing a forecast of the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of participants in each year, as well as forecasts of the plan's benefits for each of those events. In addition, the benefits forecasted for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The forecasted benefits are then discounted to a present value, typically based on an estimate of the rate of return that will be achieved on the plan's assets. All of these factors are uncertain and unknowable. Thus, there will be a range of reasonable assumptions, and the results may vary materially based on which assumptions are selected within that range. That is, there is no right answer (except with hindsight). It is important for any user of an actuarial valuation to understand and accept this constraint. The actuarial model may use approximations and estimates that will have an immaterial impact on our results. In addition, the actuarial assumptions may change over time, and while this can have a significant impact on the reported results, it does not mean that the previous assumptions or results were unreasonable or wrong.

Section 1: Actuarial Valuation Summary

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

The actuarial valuation is prepared at the request of the City of Worcester Retirement System. Segal is not responsible for the use or misuse of its report, particularly by any other party.

An actuarial valuation is a measurement at a specific date — it is not a prediction of a plan's future financial condition. Accordingly, Segal did not perform an analysis of the potential range of financial measurements, except where otherwise noted.

If the City of Worcester Retirement System is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.

Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan provisions, but they may be subject to alternative interpretations. The City of Worcester Retirement System should look to their other advisors for expertise in these areas.

While Segal maintains extensive quality assurance procedures, an actuarial valuation involves complex computer models and numerous inputs. In the event that an inaccuracy is discovered after presentation of Segal's valuation, Segal may revise that valuation or make an appropriate adjustment in the next valuation.

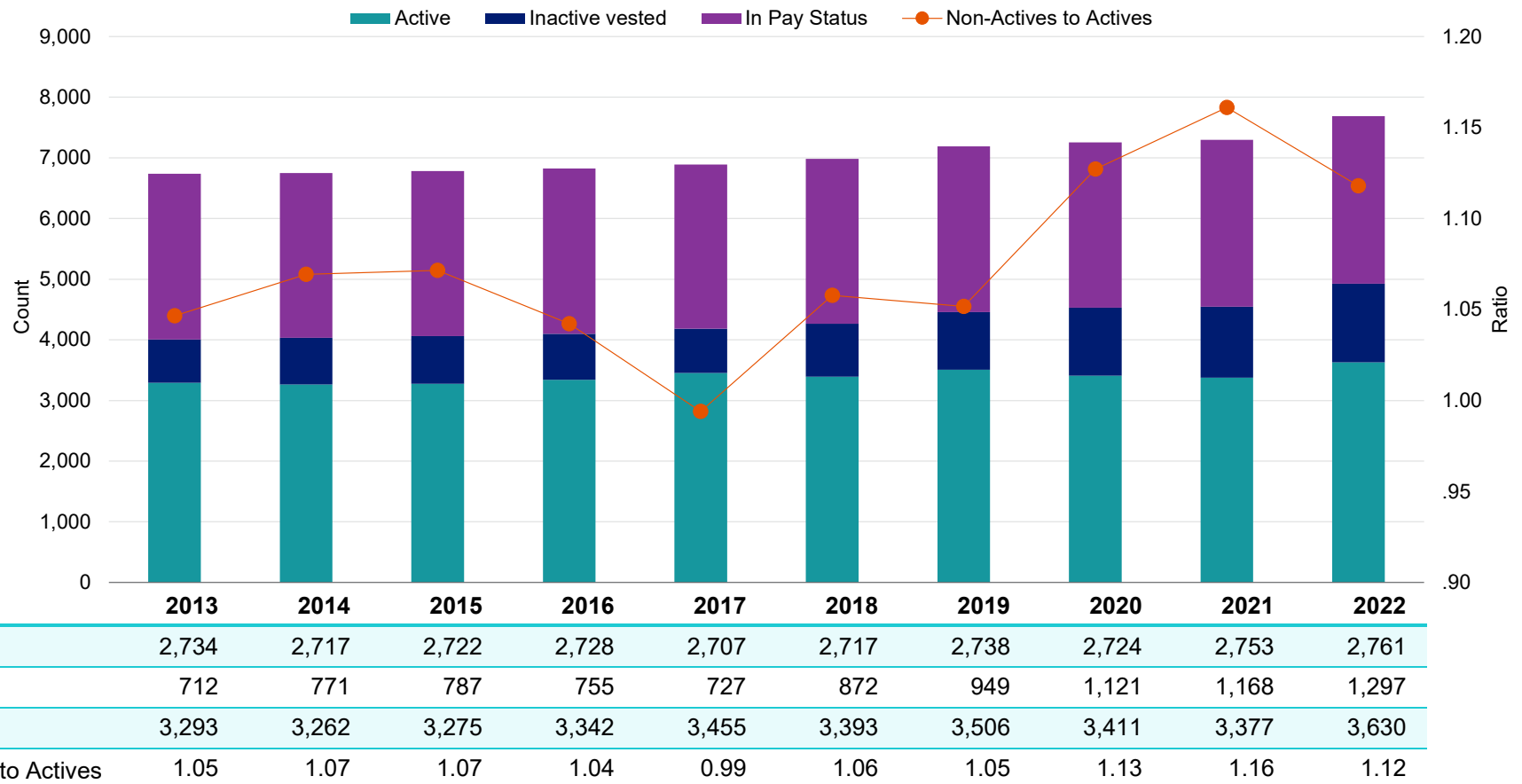
Segal's report shall be deemed to be final and accepted by the City of Worcester Retirement System upon delivery and review. Trustees should notify Segal immediately of any questions or concerns about the final content.

As Segal has no discretionary authority with respect to the management or assets of the City of Worcester Retirement System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the City of Worcester Retirement System.

Section 2: Actuarial Valuation Results

Participant information

Participant Population as of December 31



¹ Including inactive participants due a refund of employee contributions

Section 2: Actuarial Valuation Results

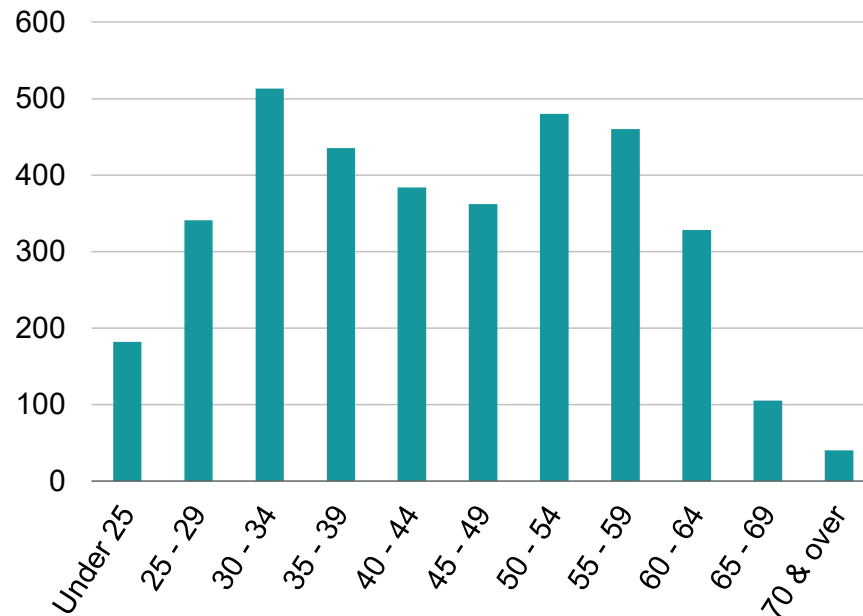
Active participants

As of December 31,	2022	2021	Change
Active participants	3,630	3,377	7.5%
Average age	44.7	45.7	-1.0
Average years of service	10.9	12.0	-1.1
Average compensation	\$60,150	\$59,216	1.6%

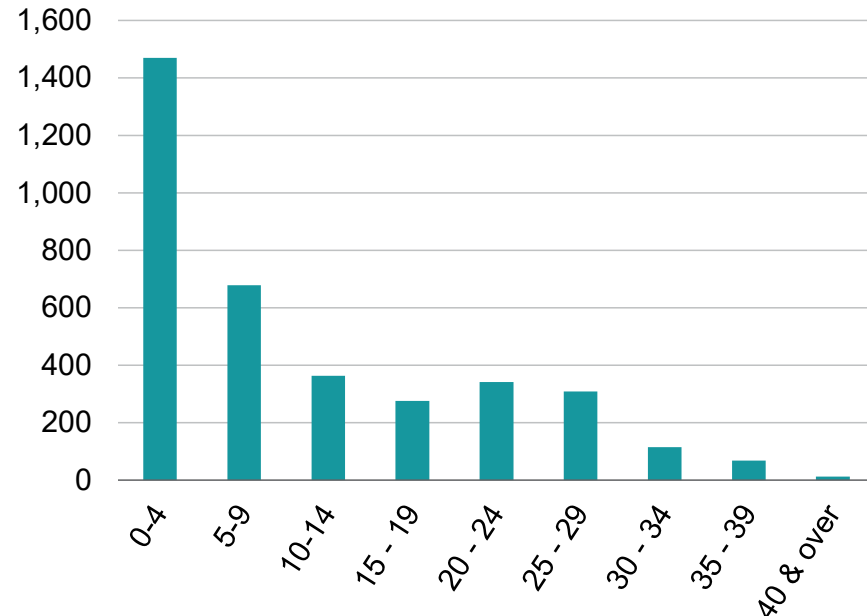
- Among the active participants, there were none with unknown age and/or service information.

Distribution of Active Participants as of December 31, 2022

Actives by Age



Actives by Years of Service



Section 2: Actuarial Valuation Results

Inactive participants

- In this year's valuation, there were 167 inactive participants with a vested right to a deferred or immediate vested benefit.
- In addition, there were 1,130 inactive participants entitled to a return of their employee contributions.

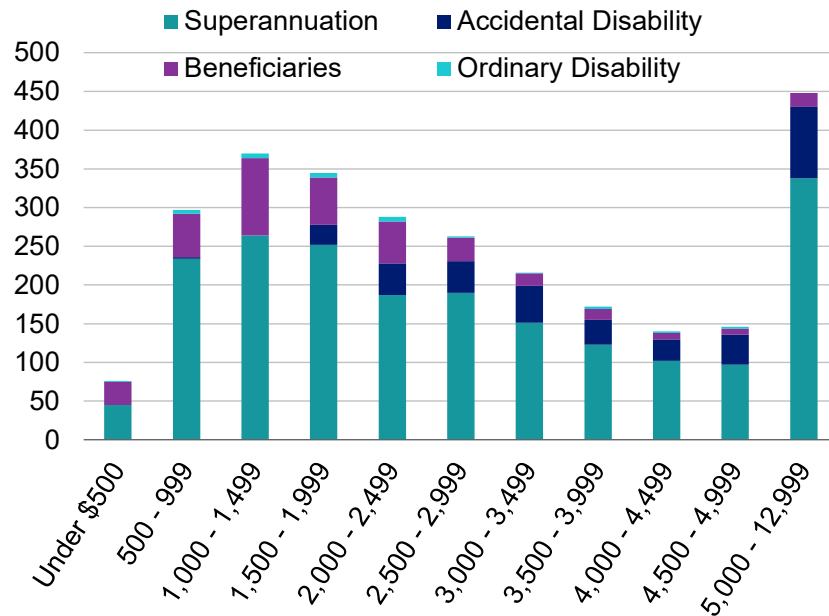
Section 2: Actuarial Valuation Results

Retired participants and beneficiaries

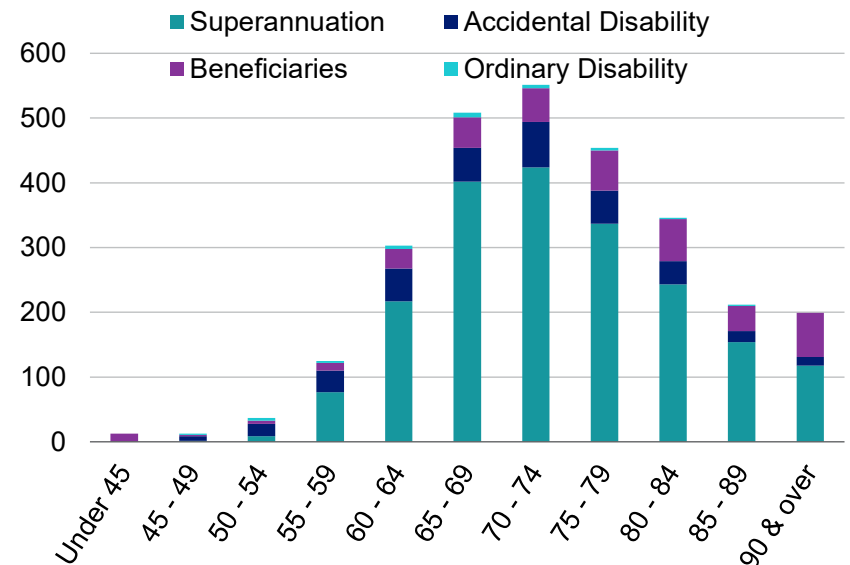
As of December 31,	2022 ¹	2021	Change
Retired participants	2,366	2,350	0.7%
Beneficiaries	395	403	-2.0%
Average age	73.6	73.7	-0.1
Average amount	\$2,924	\$2,820	3.7%
Total monthly amount ²	8,072,498	7,764,094	4.0%

Distribution of Retired Participants and Beneficiaries as of December 31, 2022

By Type and Monthly Amount



By Type and Age



¹ Average and total monthly benefits for December 31, 2022 have been increased by 2% to reflect the one-time increase in the COLA from 3% to 5% effective July 1, 2022.

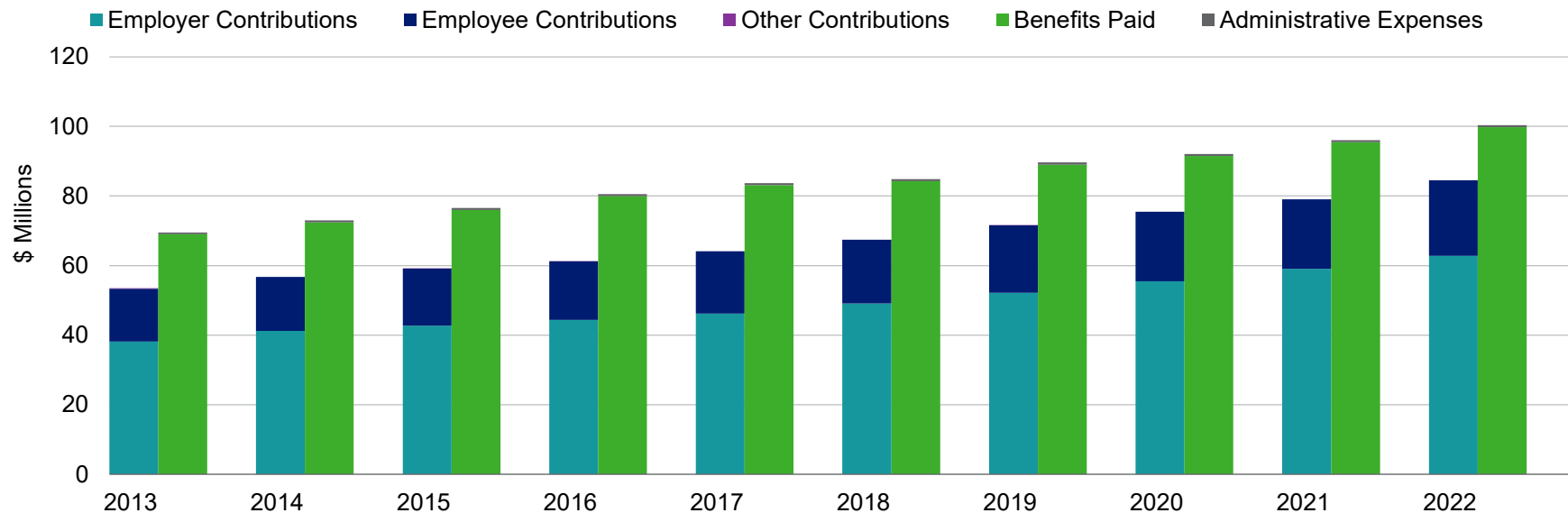
² Excludes COLAs reimbursed by the Commonwealth.

Section 2: Actuarial Valuation Results

Financial information

- Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components.

Comparison of Contributions with Benefits and Expenses for Years Ended December 31



Section 2: Actuarial Valuation Results

It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable. The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

Determination of Actuarial Value of Assets for Year Ended December 31, 2022

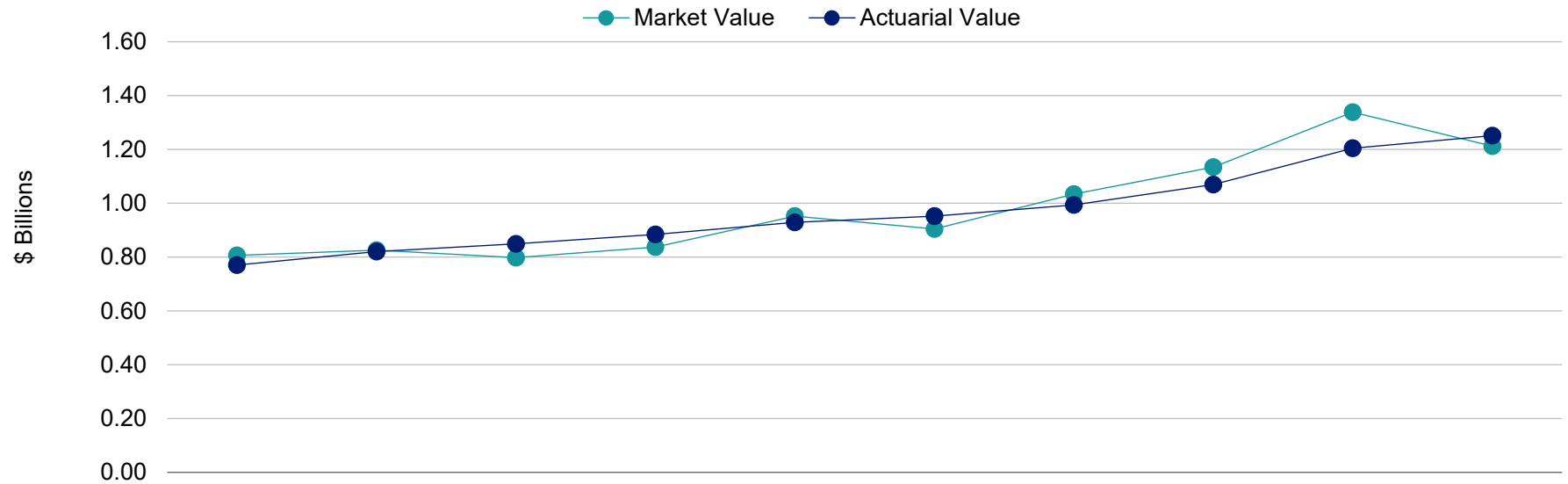
1	Market value of assets, December 31, 2022				\$1,212,020,446
2	Calculation of unrecognized return	Gain/(Loss) on Market Value of Assets	Percent Deferred	Unrecognized Amount¹	
(a)	Year ended December 31, 2022	-\$201,147,921	80%	-\$160,918,337	
(b)	Year ended December 31, 2021	143,804,413	60%	86,282,649	
(c)	Year ended December 31, 2020	46,286,489	40%	18,514,596	
(d)	Year ended December 31, 2019	85,397,341	20%	17,079,468	
(e)	Year ended December 31, 2018	-96,610,072	0%	0	
(f)	Total unrecognized return				<u>-39,041,624</u>
3	Preliminary actuarial value: (1) - (2f)				\$1,251,062,070
4	Adjustment to be within 10% corridor				<u>0</u>
5	Final actuarial value of assets as of December 31, 2022: (3) + (4)				\$1,251,062,070
6	Actuarial value as a percentage of market value: (5) ÷ (1)				103.2%
7	Amount deferred for future recognition: (1) - (5)				<u>-\$39,041,624</u>

¹ Recognition at 20% per year over five years

Section 2: Actuarial Valuation Results

Asset history for years ended December 31

Actuarial Value of Assets vs Market Value of Assets



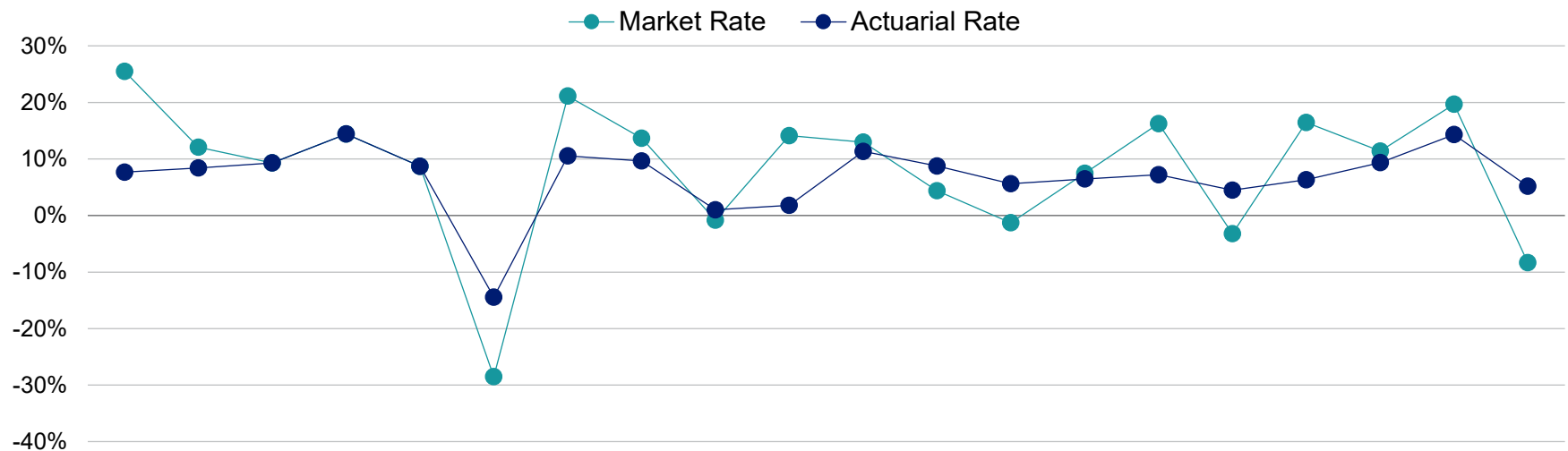
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Actuarial Value ¹	\$0.77	\$0.82	\$0.85	\$0.88	\$0.93	\$0.95	\$0.99	\$1.07	\$1.20	\$1.25
Market Value ¹	0.81	0.83	0.80	0.84	0.95	0.90	1.03	1.13	1.34	1.21
Ratio	0.955	0.994	1.064	1.056	0.975	1.053	0.962	0.943	0.900	1.032

¹ In \$ billions

Section 2: Actuarial Valuation Results

Historical investment returns

Market and Actuarial Rates of Return for Years Ended December 31



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Market rate	25.52%	12.09%	9.29%	14.42%	8.72%	-28.49%	21.12%	13.69%	-0.84%	14.10%	12.97%	4.38%	-1.28%	7.45%	16.27%	-3.24%	16.44%	11.41%	19.68%	-8.32%
Actuarial rate	7.65%	8.43%	9.29%	14.42%	8.72%	-14.45%	10.56%	9.64%	1.03%	1.80%	11.36%	8.75%	5.65%	6.49%	7.23%	4.51%	6.32%	9.38%	14.32%	5.20%
Assumed rate	8.50%	8.50%	8.50%	8.25%	8.25%	8.25%	8.25%	8.25%	8.25%	8.00%	8.00%	7.75%	7.625%	7.50%	7.375%	7.00%	6.90%	6.90%	6.90%	6.80%

Average Rates of Return	Actuarial Value	Market Value
Most recent five-year average return:	7.98%	6.47%
Most recent ten-year average return:	7.89%	7.07%
Most recent 15-year average return:	6.05%	5.78%
20-year average return:	6.78%	7.21%

Section 2: Actuarial Valuation Results

Actuarial experience

Assumptions should consider experience and should be based on reasonable expectations for the future.

Each year actual experience is compared to that projected by the assumptions. Differences are reflected in the actuarial valuation.

Assumptions are not changed if experience is believed to be a short-term development that will not continue over the long term. On the other hand, if experience is expected to continue, assumptions are changed.

Actuarial Experience for Year Ended December 31, 2022

1	Loss from investments	-\$19,153,472
2	Gain from administrative expenses	169,284
3	Net gain from other experience	<u>6,522,024</u>
4	Net experience loss: 1 + 2 + 3 + 4	-\$12,462,164

Section 2: Actuarial Valuation Results

Investment experience

Actuarial planning is long term. The obligations of a pension plan are expected to continue for the lifetime of all its participants.

The assumed long-term rate of return of 6.80% considers past experience, the asset allocation policy of the Board and future expectations. We will continue to monitor the Plan's actual and anticipated investment returns and may revise our assumed long-term rate of return in a future actuarial valuation, if warranted.

Investment Experience

		Year Ended December 31, 2022	
		Market Value	Actuarial Value
1	Net investment income	-\$110,667,214	\$62,225,369
2	Average value of assets	1,330,598,626	1,196,747,667
3	Rate of return: 1 ÷ 2	-8.32%	5.20%
4	Assumed rate of return	6.80%	6.80%
5	Expected investment income: 2 x 4	90,480,707	81,378,841
6	Investment gain/(loss): 1 - 5	-\$201,147,921	-\$19,153,472

Section 2: Actuarial Valuation Results

Non-investment experience

Administrative expenses

Administrative expenses for the year ended December 31, 2022 totaled \$575,104, as compared to the assumption of \$715,000. This resulted in an experience gain of \$169,284 for the year, including an adjustment for interest.

Other experience

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

- Mortality experience (more or fewer than expected deaths)
- The extent of turnover among participants
- Retirement experience (earlier or later than projected)
- The number of disability retirements (more or fewer than projected)
- Salary increases (greater or smaller than projected)

The net gain from this other experience for the year ended December 31, 2022 amounted to \$6,522,024, which is 0.4% of the actuarial accrued liability.

Liability Changes Due to Demographic Experience for Year Ended December 31, 2022

Gain due to mortality experience among retired members and beneficiaries	\$2,897,644
Loss due to salaries increasing more than expected for continuing actives	-5,309,569
Miscellaneous gain	<u>8,933,949</u>
Total	\$6,522,025

Section 2: Actuarial Valuation Results

Actuarial assumptions

The following actuarial assumption was changed with this valuation: The administrative expense assumption was decreased from \$715,000 for calendar year 2022 to \$700,000 for calendar year 2023.

Plan provisions

Pursuant to Chapter 269 of the Acts of 2022, the Board approved a one-time increase in the COLA from 3% to 5% effective July 1, 2022. This change increased the actuarial accrued liability by 0.4%.

Section 2: Actuarial Valuation Results

Unfunded Actuarial Accrued Liability

Development of Unfunded Actuarial Accrued Liability for Year Ended December 31, 2022

1	Unfunded actuarial accrued liability at beginning of year		\$447,464,537
2	Normal cost at beginning of year		36,407,910
3	Total contributions		-84,525,421
4	Interest on 1, 2 & 3		<u>30,300,240</u>
5	Expected unfunded actuarial accrued liability		\$429,647,266
6	Changes due to:		
	(a) Net experience loss	\$12,462,164	
	(b) Plan provisions	<u>6,818,535</u>	
	Total changes		<u>\$19,280,699</u>
7	Unfunded actuarial accrued liability at end of year		\$448,927,965

Section 2: Actuarial Valuation Results

Actuarially determined contribution

The actuarially determined contribution is equal to the employer normal cost payment and a payment on the unfunded actuarial accrued liability. For fiscal 2024, the actuarially determined contribution has been set equal to the previously budgeted amount of \$66,733,809, or 29.08% of projected payroll.

The funding schedule included in this report fully funds the System by June 30, 2034, if all assumptions are met and there are no changes in the plan of benefits. For fiscal 2025, the total appropriation increases 4.79% over fiscal 2024. For fiscal 2026 and later years, each year's total appropriation increases 3.50%, with a smaller payment in fiscal 2034. In the prior valuation, the System was also projected to be fully funded by June 30, 2034 with appropriations that increased 3.50% per year beginning in fiscal 2025 and a smaller payment in fiscal 2034. The change in the fiscal 2025 actuarially determined contribution to be a 4.79% increase over fiscal 2024 compared to 3.50% in the prior valuation was made to fund the additional liability resulting from the one-time increase in the COLA from 3% to 5% effective July 1, 2022.

Actuarially Determined Contribution for Year Beginning January 1

		2023		2022	
		Amount	% of Projected Payroll	Amount	% of Projected Payroll
1	Total normal cost	\$38,512,323	17.04%	\$35,692,910	17.21%
2	Administrative expenses	700,000	0.31%	715,000	0.34%
3	Expected employee contributions	<u>-22,356,013</u>	<u>-9.89%</u>	<u>-20,416,552</u>	<u>-9.84%</u>
4	Employer normal cost: (1) + (2) + (3)	\$16,856,310	7.46%	\$15,991,358	7.71%
5	Actuarial accrued liability	\$1,699,990,035		\$1,652,123,169	
6	Actuarial value of assets	<u>1,251,062,070</u>		<u>1,204,658,632</u>	
7	Unfunded actuarial accrued liability: (5) - (6)	\$448,927,965		\$447,464,537	
8	Employer normal cost projected to July 1, 2023 and 2022	\$17,107,286	7.46%	\$16,229,456	7.71%
9	Projected unfunded actuarial accrued liability	463,940,500		462,428,134	
10	Payment on projected unfunded actuarial accrued liability	49,626,523	21.63%	46,531,579	22.11%
11	Actuarially determined contribution: (8) + (10)	\$66,733,809	29.08%	\$62,761,035	29.82%
12	Projected payroll as of July 1	\$229,459,596		\$210,501,423	

Notes:

Actuarially Determined Contributions are assumed to be paid at the beginning of the fiscal year.

Actuarially Determined Contributions are set equal to the budgeted amounts determined with the prior valuation.

Section 2: Actuarial Valuation Results

Funding Schedule

(1) Fiscal Year Ended June 30	(2) Employer Normal Cost	(3) Amortization of Special Legislations	(4) Amortization of Remaining Unfunded Liability	(5) Actuarially Determined Contribution (ADC): (2) + (3) + (4)	(6) Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(7) Percent Increase in ADC Over Prior Year
2024	\$17,107,286	\$170,990	\$49,455,533	\$66,733,809	\$463,940,500	--
2025	17,680,892	170,990	52,080,834	69,932,716	442,487,327	4.79%
2026	18,273,611	170,990	53,935,761	72,380,362	416,771,517	3.50%
2027	18,886,076	170,990	55,856,609	74,913,675	387,325,970	3.50%
2028	19,518,942	170,990	57,845,722	77,535,654	353,826,660	3.50%
2029	20,172,886	170,990	59,905,526	80,249,402	315,925,024	3.50%
2030	20,848,605	170,990	62,038,536	83,058,131	273,246,207	3.50%
2031	21,546,820	170,990	64,247,356	85,965,166	225,387,175	3.50%
2032	22,268,278	170,990	66,534,679	88,973,947	171,914,709	3.50%
2033	23,013,745	170,990	68,903,300	92,088,035	112,363,255	3.50%
2034	23,784,019	170,990	46,061,625	70,016,634	46,232,615	-23.97%
2035	24,579,921	0	0	24,579,921	0	-64.89%

Notes:

Actuarially determined contribution for fiscal year 2024 is set equal to the amount determined with the prior valuation.

Actuarially determined contributions are assumed to be paid on July 1.

Item (2) reflects 3.0% growth in payroll and a 0.15% adjustment to total normal cost to reflect the effect of mortality improvements due to the generational mortality assumption.

Projected normal cost does not reflect the future impact of pension reform for new hires.

Projected unfunded actuarial accrued liability does not reflect the recognition of deferred investment gains or losses.

Section 2: Actuarial Valuation Results

Risk

The actuarial valuation results are dependent on a single set of assumptions; however, there is a risk that emerging results may differ significantly as actual experience proves to be different from the current assumptions.

We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the System's future financial condition but have included a brief discussion of some risks that may affect the System.

- Economic and Other Related Risks. Potential implications for the System due to the following economic effects (that were not reflected as of the valuation date) include:

- Volatile financial markets and investment returns lower than assumed
- High inflationary environment impacting salary increases
- Lingering direct and indirect effects of the COVID-19 pandemic

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

If the actual return on market value for the prior plan year were 1% different (either higher or lower), the unfunded actuarial liability would change by 2.96%, or about \$13,305,986, disregarding the asset smoothing method.

The market value rate of return over the last 20 years has ranged from a low of -28.49% to a high of 25.52%.

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

The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

- Contribution Risk (the risk that actual contributions will be different from actuarially determined contribution)
- Massachusetts General Law Chapter 32 requires payment of the actuarially determined contribution. If future experience matches current assumptions, we project the unfunded actuarial accrued liability will be paid off in 11 years.
- Demographic Risk (the risk that participant experience will be different than assumed)

Examples of this risk include:

- Actual retirements occurring earlier or later than assumed.
- More or less active participant turnover than assumed.
- Disability retirement experience different than assumed.
- Salary increases greater or less than expected

Section 2: Actuarial Valuation Results

- There are external factors including legislative or financial reporting changes that could impact the System's funding and disclosure requirements. While we do not assume any changes in such external factors, it is important to understand that they could have significant consequences for the System.

- Actual Experience Over the Last Ten Years

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

- The non-investment gain(loss) for a year has ranged from a loss of \$1.5 million to a gain of \$14.1 million.
- The investment gain(loss) for a year has ranged from a loss of \$201.1 million to a gain of \$143.8 million
- Since 2014, the funded percentage on the actuarial value of assets has ranged from a low of 63.22% as of January 1, 2019 to a high of 73.59% as of January 1, 2023.

- Maturity Measures

As pension plans mature, the cash needed to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Plan's asset allocation is aligned to meet emerging pension liabilities.

For the prior year, benefits paid and administrative expenses were \$15,821,931 more than contributions received. Plans with high levels of negative cash flows may have a need for a larger allocation to income generating assets, which can create a drag on investment return.

- Detailed Risk Assessment

We recommend a more detailed assessment of the risks to provide the Board with a better understanding of the risks inherent in the Plan. This assessment may include scenario testing, sensitivity testing, stress testing, and stochastic modeling.

Section 3: Supplemental Information

Exhibit A: Table of Plan Demographics

Category	Year Ended December 31		Change From Prior Year
	2022	2021	
Active participants in valuation:			
Number	3,630	3,377	7.5%
Average age	44.7	45.7	-1.0
Average years of service	10.9	12.0	-1.1
Average compensation ¹	\$60,150	\$59,216	1.6%
Account balances	199,717,823	197,366,946	1.2%
Inactive participants			
Inactive participants with a vested right to a deferred or immediate benefit	167	145	15.2%
Inactive participants due a refund of employee contributions	1,130	1,023	10.5%
Retired participants:			
Number in pay status	1,983	1,960	1.2%
Average age	73.7	73.8	-0.1
Average monthly benefit ²	\$2,944	\$2,845	3.5%
Disabled participants:			
Number in pay status	383	390	-1.8%
Average age	69.7	69.8	-0.1
Average monthly benefit ²	\$3,777	\$3,640	3.8%
Beneficiaries:			
Number in pay status	395	403	-2.0%
Average age	77.0	77.1	-0.1
Average monthly benefit ²	\$1,997	\$1,907	4.7%

¹ Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2022 salaries were reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data. Calendar year 2021 salaries were increased by 3.0% for police and firefighters hired before December 31, 2019 to estimate the impact of salary increases on July 1, 2020 and July 1, 2021 attributable to unsettled bargaining contracts.

² Monthly benefits for December 31, 2022 have been increased by 2% to reflect the one-time increase in the COLA from 3% to 5% effective July 1, 2022.

Section 3: Supplemental Information

Exhibit B: Participants in Active Service as of December 31, 2022 by Age, Years of Service, and Average Compensation¹

Age	Years of Service									
	Total	0-4	5-9	10-14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 & over
Under 25	182	180	2	--	--	--	--	--	--	--
	\$34,520	\$34,382	\$46,983	--	--	--	--	--	--	--
25 - 29	341	291	50	--	--	--	--	--	--	--
	\$48,417	\$46,629	\$58,822	--	--	--	--	--	--	--
30 - 34	513	297	183	33	--	--	--	--	--	--
	\$58,903	\$47,885	\$71,965	\$85,625	--	--	--	--	--	--
35 - 39	435	187	130	90	28	--	--	--	--	--
	\$63,382	\$45,223	\$67,654	\$89,214	\$81,795	--	--	--	--	--
40 - 44	384	142	71	77	70	23	1	--	--	--
	\$62,737	\$42,014	\$56,767	\$83,284	\$81,892	\$84,758	\$58,397	--	--	--
45 - 49	362	118	51	53	47	69	24	--	--	--
	\$64,394	\$45,249	\$47,208	\$58,369	\$90,264	\$87,538	\$91,145	--	--	--
50 - 54	480	93	80	34	52	84	107	28	2	--
	\$69,847	\$43,711	\$51,657	\$64,617	\$67,792	\$80,304	\$95,864	\$88,776	\$59,003	--
55 - 59	460	84	52	41	36	80	87	41	37	2
	\$65,681	\$45,957	\$49,133	\$52,266	\$55,993	\$62,298	\$86,913	\$86,820	\$90,278	\$97,052
60 - 64	328	54	40	18	31	56	68	33	23	5
	\$57,193	\$38,922	\$54,160	\$63,807	\$44,608	\$45,977	\$63,029	\$74,665	\$97,173	\$80,020
65 - 69	105	12	17	13	7	25	16	11	2	2
	\$53,537	\$51,160	\$51,011	\$53,307	\$51,851	\$47,863	\$54,806	\$70,468	\$48,654	\$69,196
70 & over	40	11	2	4	5	4	5	2	4	3
	\$54,613	\$42,114	\$25,878	\$54,576	\$61,722	\$47,248	\$60,702	\$54,622	\$76,727	\$77,976
Total	3,630	1,469	678	363	276	341	308	115	68	12
	\$60,150	\$44,143	\$60,783	\$73,722	\$71,958	\$69,440	\$82,893	\$81,684	\$89,669	\$80,544

¹ Compensation figures are for the prior year and reflect annualized salaries for participants hired during the year. Calendar year 2022 salaries were reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data.

Section 3: Supplemental Information

Exhibit C: Summary Statement of Income and Expenses on a Market Value Basis

	Year Ended December 31, 2022	Year Ended December 31, 2021
Net assets at market value at the beginning of the year	\$1,338,509,591	\$1,134,047,305
Contribution and other income:		
Employer contributions	\$62,761,035	\$59,024,767
Employee contributions	21,764,386	20,012,226
<i>Total contribution income</i>	<i>\$84,525,421</i>	<i>\$79,036,993</i>
Investment income:		
Investment income	-\$103,477,696	\$228,870,996
Less investment fees	<u>-7,189,518</u>	<u>-7,403,982</u>
<i>Net investment income</i>	<i><u>-\$110,667,214</u></i>	<i><u>\$221,467,014</u></i>
Total income available for benefits	-\$26,141,793	\$300,504,007
Less benefit payments and administrative expenses:		
Administrative expenses	-\$575,104	-\$568,333
Pensions	-97,814,691	-94,401,360
Net 3(8)(c) reimbursements	<u>-1,957,557</u>	<u>-1,072,028</u>
<i>Net benefit payments and administrative expenses</i>	<i><u>-\$100,347,352</u></i>	<i><u>-\$96,041,721</u></i>
Change in reserve for future benefits	-\$126,489,145	\$204,462,286
Net assets at market value at the end of the year	\$1,212,020,446	\$1,338,509,591

Section 3: Supplemental Information

Exhibit D: Development of the Fund through December 31, 2022

Year Ended December 31	Employer Contributions	Employee Contributions	Other Income	Net Investment Return ¹	Admin. Expenses	Benefit Payments	Market Value of Assets at Year-End	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value
2013	\$38,148,683	\$15,184,934	\$186,017	\$93,539,099	\$562,729	\$68,973,056	\$806,990,282	\$770,334,007	95.5%
2014	41,200,578	15,514,691	0	34,950,210	587,157	72,435,431	825,633,173	820,708,236	99.4%
2015	42,703,837	16,483,087	30,685	-10,490,025	572,743	75,957,944	797,830,070	849,286,321	106.4%
2016	44,411,990	16,816,229	55,027	58,737,894	565,669	79,940,830	837,344,711	884,576,848	105.6%
2017	46,188,470	17,970,100	0	134,646,815	583,404	83,122,621	952,444,071	928,286,125	97.5%
2018	49,098,344	18,336,273	0	-30,549,013	587,936	84,275,963	904,465,776	952,294,056	105.3%
2019	52,206,269	19,388,692	24,356	147,182,537	658,258	89,017,374	1,033,591,998	993,870,483	96.2%
2020	55,510,926	19,953,393	0	117,032,426	556,040	91,485,398	1,134,047,305	1,069,701,047	94.3%
2021	59,024,767	20,012,226	0	221,467,014	568,333	95,473,388	1,338,509,591	1,204,658,632	90.0%
2022	62,761,035	21,764,386	0	-110,667,214	575,104	99,772,248	1,212,020,446	1,251,062,070	103.2%

¹ On a market basis, net of investment fees

Section 3: Supplemental Information

Exhibit E: Table of Amortization Bases as of July 1, 2022

Type	Annual Payment	Years Remaining	Outstanding Balance
Special Legislation (Chapter 157 of the Acts of 2008)	\$83,296	11	\$673,778
Special Legislation (Chapter 203 of the Acts of 2020)	54,869	11	443,836
Special Legislation (Chapter 377 of the Acts of 2018)	32,825	11	265,519
Remaining unfunded liability	<u>49,455,533</u>	11	<u>462,557,367</u>
Total	\$49,626,523		\$463,940,500

Notes:

Actuarially determined contributions are assumed to be paid at the beginning of the fiscal year.

The Special Legislation liabilities are amortized in level payments.

Payment on remaining unfunded liability reflects adjustment to set fiscal 2024 appropriation to budgeted amount.

Section 3: Supplemental Information

Exhibit F: Department Results as of January 1, 2023

Category	DPW	Fire	Police	Schools	Housing	Other	All Department Total
Active participants in valuation							
• Number	269	428	505	1,617	216	595	3,630
• Average age	48.9	40.6	42.9	45.5	41.9	46.0	44.7
• Average service	13.5	13.0	16.6	8.8	7.3	10.5	10.9
• Average compensation	62,006	92,365	88,351	40,522	57,203	66,616	60,150
Inactive participants entitled to a return of their employee contributions							
	41	11	19	696	158	205	1,130
Inactive participants with a vested right to a deferred or immediate benefit							
	13	7	11	73	16	47	167
Retired participants and beneficiaries in pay status							
• Retired participants	225	237	239	733	76	473	1,983
• Average age	73.4	69.6	70.8	74.3	74.1	76.5	73.7
• Disabled participants	31	145	104	55	8	40	383
• Average age	70.1	70.5	70.6	69.7	64.0	65.5	69.7
• Beneficiaries	61	106	86	68	14	60	395
• Average age	76.8	77.5	78.5	72.4	77.0	79.3	77.0
• Total number in pay status	317	488	429	856	98	573	2,761
• Total monthly benefits	\$856,871	\$2,242,829	\$1,798,337	\$1,481,686	\$250,248	\$1,442,527	\$8,072,498
• Average monthly benefit	2,703	4,596	4,192	1,731	2,554	2,517	2,924
Department Results							
1. Total normal cost	\$2,549,555	\$8,415,031	\$8,958,178	\$10,694,106	\$1,856,070	\$6,039,383	\$38,512,323
2. Administrative expenses	46,341	152,951	162,824	194,376	33,736	109,772	700,000
3. Expected employee contribution	-1,702,681	-4,199,048	-4,631,496	-6,458,042	-1,264,611	-4,100,134	-22,356,012
4. Employer normal cost:	\$893,215	\$4,368,934	\$4,489,506	\$4,430,440	\$625,195	\$2,049,021	\$16,856,311
5. Employer normal cost as a percent of payroll	5.16%	10.65%	9.69%	6.55%	4.90%	4.99%	7.45%
6. Actuarial accrued liability	\$158,192,279	433,941,682	428,758,145	345,520,866	58,927,825	274,649,238	1,699,990,035
7. Actuarial value of assets	116,417,365	319,347,742	315,533,057	254,276,814	43,366,352	202,120,740	1,251,062,070
8. Unfunded actuarial accrued liability: (6) – (7)	\$41,774,914	\$114,593,940	\$113,225,088	\$91,244,052	\$15,561,473	\$72,528,498	\$448,927,965

Notes:

Actuarial value of assets allocated in proportion to the actuarial accrued liability.

Administrative expenses allocated in proportion to total normal cost.

Average age of retired participants and beneficiaries does not include surviving children collecting temporary annuities.

Section 4: Actuarial Valuation Basis

Exhibit I: Actuarial Assumptions, Methods and Models

Net Investment Return:	6.80% The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the System's target asset allocation.
Salary Increases:	4.00% per year, with an allowance for wage inflation of 3.00%. The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment.
Cost-of-Living Adjustments (COLA):	3.00% increase on the first \$15,000 of retirement allowance, increasing to \$16,000 on July 1, 2024. For recipients of Section 100 and Special Legislation benefits, 3.00% per year.
401(a)(17) Salary Limit Projection:	3.00% per year.
Interest on Employee Contributions:	3.5%
Administrative Expenses:	\$700,000 for calendar 2023, increasing 3.00% per year (previously, \$715,000 for calendar 2022, increasing 3.00% per year). The administrative expense assumption is based on information on expected expenses provided by the Retirement System.
Mortality Rates:	Pre-Retirement: RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2021 Healthy Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with MP-2021 Disabled Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2021 The mortality tables reasonably reflect the projected mortality experience of the Plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior years' assumptions over the most recent five years. The mortality tables were then adjusted to future years using generational projection under Scale MP-2021 to reflect future mortality improvement.

Section 4: Actuarial Valuation Basis

Termination Rates before Retirement:

Age	Groups 1 and 2 - Rate (%)			
	Mortality		Disability	Withdrawal
	Male	Female		
20	0.05	0.02	0.01	12.00
25	0.06	0.02	0.03	8.78
30	0.06	0.02	0.04	5.55
35	0.07	0.03	0.07	3.93
40	0.08	0.04	0.13	2.31
45	0.13	0.07	0.18	1.89
50	0.22	0.12	0.24	1.46
55	0.36	0.19	0.30	0.00
60	0.61	0.27	0.35	0.00

Notes:

Mortality rates do not reflect generational projection.

55% of the disability rates shown represent accidental disability.

20% of the accidental disabilities will die from the same cause as the disability.

55% of the death rates shown represent accidental death.

Section 4: Actuarial Valuation Basis

Group 4 - Rate (%)				
Age	Mortality		Disability	Withdrawal
	Male	Female		
20	0.05	0.02	0.13	2.10
25	0.06	0.02	0.25	1.88
30	0.06	0.02	0.38	1.65
35	0.07	0.03	0.38	1.11
40	0.08	0.04	0.38	0.56
45	0.13	0.07	1.25	0.28
50	0.22	0.12	1.56	0.00
55	0.36	0.19	1.50	0.00
60	0.61	0.27	1.06	0.00

Notes:

Mortality rates do not reflect generational projection.

90% of the disability rates shown represent accidental disability.

60% of the accidental disabilities will die from the same cause as the disability.

90% of the death rates shown represent accidental death.

The termination rates and disability rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of terminations and disability retirements and the projected number based on the prior years' assumptions over the past five years.

Section 4: Actuarial Valuation Basis

Retirement Rates:	Rate per year (%)	
	Age	Groups 1 and 2 Group 4
	50	3.0 5.0
	51 – 54	1.0 1.0
	55	2.0 16.0
	56	2.0 9.0
	57	3.0 9.0
	58	3.0 12.0
	59	3.0 11.0
	60	8.0 24.0
	61	7.0 14.0
	62	15.0 20.0
	63	11.0 13.0
	64	10.0 19.0
	65	36.0 100.00
	66	22.0
	67	22.0
	68	22.0
	69	25.0
	70	100.0
	The retirement rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of retirements by age and the projected number based on the prior years' assumptions over the past five years.	
Retirement Age for Inactive Vested Participants:	55 for participants hired prior to April 2, 2012. For participants hired April 2, 2012 or later, 60 for Group 1, 55 for Group 2 and 50 for Group 4. The retirement age for inactive vested participants was based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment.	

Section 4: Actuarial Valuation Basis

Unknown Data for Participants:	Same as those exhibited by participants with similar known characteristics. If not specified, participants are assumed to be male.
Family Composition:	80% of participants are assumed to be married. None are assumed to have dependent children. Females are assumed to be three years younger than their male spouses.
Benefit Election:	All participants are assumed to elect Option A. The benefit election reflects the fact that all benefit options are actuarially equivalent.
2022 Salary:	2022 salaries are equal to salaries provided in the data, annualized for new hires, and reduced by 3.0% for police and firefighters to reflect retroactive payments that were included in the salary data.
Total Service:	Total creditable service reported in the data. If missing, total creditable service estimated from date of hire.
Net 3(8)(c) Liability:	Estimated liability of \$15.8 million based on the average annual net 3(8)(c) benefits in the prior two years and the average demographics of retired participants.
Actuarial Value of Assets:	Market value of assets as reported in the System's Annual Statement less unrecognized return in each of the last five years. Unrecognized return is equal to the difference between the actual market value return and the expected market value return and is recognized over a five-year period, further adjusted, if necessary, to be within 10% of the market value.
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the attained age of the participant less Total Service as defined above. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined using the plan of benefits applicable to each participant.
Actuarial Models:	Segal valuation results are based on proprietary actuarial modeling software. The actuarial valuation models generate a comprehensive set of liability and cost calculations that are presented to meet regulatory, legislative and client requirements. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models, and reviews test lives and results, under the supervision of the responsible actuary.
Justification for Change in Actuarial Assumptions:	Based on information on expected expenses provided by the Retirement System, the administrative expense assumption was decreased from \$715,000 for calendar year 2022 to \$700,000 for calendar year 2023.

Section 4: Actuarial Valuation Basis

Exhibit II: Summary of Plan Provisions

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

Plan Year:	January 1 through December 31																																																							
Plan Status:	Ongoing																																																							
Retirement Benefits:	Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. (Officers and inspectors of the State Police are classified as Group 3.) For employees hired prior to April 2, 2012, the annual amount of the retirement allowance is based on the member's final three-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following table based on the age of the member at retirement: <table><tr><th colspan="4">Age Last Birthday at Date of Retirement</th></tr><tr><th>Percent</th><th>Group 1</th><th>Group 2</th><th>Group 4</th></tr><tr><td>2.5</td><td>65 or over</td><td>60 or over</td><td>55 or over</td></tr><tr><td>2.4</td><td>64</td><td>59</td><td>54</td></tr><tr><td>2.3</td><td>63</td><td>58</td><td>53</td></tr><tr><td>2.2</td><td>62</td><td>57</td><td>52</td></tr><tr><td>2.1</td><td>61</td><td>56</td><td>51</td></tr><tr><td>2.0</td><td>60</td><td>55</td><td>50</td></tr><tr><td>1.9</td><td>59</td><td>--</td><td>49</td></tr><tr><td>1.8</td><td>58</td><td>--</td><td>48</td></tr><tr><td>1.7</td><td>57</td><td>--</td><td>47</td></tr><tr><td>1.6</td><td>56</td><td>--</td><td>46</td></tr><tr><td>1.5</td><td>55</td><td>--</td><td>45</td></tr></table> A member's final three-year average salary is defined as the greater of the highest consecutive three-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last three years of creditable service prior to retirement.				Age Last Birthday at Date of Retirement				Percent	Group 1	Group 2	Group 4	2.5	65 or over	60 or over	55 or over	2.4	64	59	54	2.3	63	58	53	2.2	62	57	52	2.1	61	56	51	2.0	60	55	50	1.9	59	--	49	1.8	58	--	48	1.7	57	--	47	1.6	56	--	46	1.5	55	--	45
Age Last Birthday at Date of Retirement																																																								
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1.5	55	--	45																																																					

Section 4: Actuarial Valuation Basis

For employees hired on April 2, 2012 or later, the annual amount of the retirement allowance is based on the member's final five-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following tables based on the age and years of creditable service of the member at retirement:

**For members with less than 30 years of creditable service:
Age Last Birthday at Date of Retirement**

Percent	Group 1	Group 2	Group 4
2.50	67 or over	62 or over	57 or over
2.35	66	61	56
2.20	65	60	55
2.05	64	59	54
1.90	63	58	53
1.75	62	57	52
1.60	61	56	51
1.45	60	55	50

**For members with 30 years of creditable service or greater:
Age Last Birthday at Date of Retirement**

Percent	Group 1	Group 2	Group 4
2.500	67 or over	62 or over	57 or over
2.375	66	61	56
2.250	65	60	55
2.125	64	59	54
2.000	63	58	53
1.875	62	57	52
1.750	61	56	51
1.625	60	55	50

A member's final five-year average salary is defined as the greater of the highest consecutive five-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last five years of creditable service prior to retirement.

Section 4: Actuarial Valuation Basis

For employees who became members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit “spiking” of a member’s salary to increase the retirement benefit.

For all employees, the maximum annual amount of the retirement allowance is 80 percent of the member’s final average salary. Any member who is a veteran also receives an additional yearly retirement allowance of \$15 per year of creditable service, not exceeding \$300. The veteran allowance is paid in addition to the 80 percent maximum.

Employee Contributions:

Date of Hire	Contribution Rate
Prior to January 1, 1975	5%
January 1, 1975 – December 31, 1983	7%
January 1, 1984 – June 30, 1996	8%
July 1, 1996 onward	9%

In addition, employees hired after December 31, 1978 contribute an additional 2 percent of salary in excess of \$30,000.

Employees hired after 1983 who voluntarily withdraw their contributions with less than 10 ten years of credited service receive 3% interest on their contributions.

Employees in Group 1 hired on or after April 2, 2012 with 30 years of creditable service or greater will pay a base contribution rate of 6%.

Retirement Benefits (Superannuation):

Members of Group 1, 2 or 4 hired prior to April 2, 2012 may retire upon the attainment of age 55. For retirement at ages below 55, twenty years of creditable service is required.

Members hired prior to April 2, 2012 who terminate before age 55 with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System).

Members of Group 1 hired April 2, 2012 or later may retire upon the attainment of age 60. Members of Group 2 or 4 hired April 2, 2012 or later may retire upon the attainment of age 55. Members of Group 4 may retire upon attainment of age 50 with ten years of creditable service.

Members hired April 2, 2012 or later who terminate before age 55 (60 for members of Group 1) with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (60 for members of Group 1) provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System.

Section 4: Actuarial Valuation Basis

Ordinary Disability Benefit:	A member who is unable to perform his or her job due to a non-occupational disability will receive a retirement allowance if he or she has ten or more years of creditable service and has not reached age 55. The annual amount of such allowance shall be determined as if the member retired for superannuation at age 55 (age 60 for Group 1 members hired on or after April 2, 2012), based on the amount of creditable service at the date of disability. For veterans, there is a minimum benefit of 50 percent of the member's most recent year's pay plus an annuity based on his or her own contributions.
Accidental Disability Benefit:	For a job-connected disability, the benefit is 72 percent of the member's most recent annual pay plus an annuity based on his or her own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.
Death Benefits:	In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of death, a spouse's benefit will be paid equal to the amount the employee would have received under Option C. The surviving spouse of a member who dies with two or more years of credited service has the option of a refund of the employee's contributions or a monthly benefit regardless of eligibility to retire, if they were married for at least one year. There is also a minimum widow's pension of \$250 per month, and there are additional amounts for surviving children. If an employee's death is job-connected, the spouse will receive 72 percent of the member's most recent annual pay, in addition to a refund of the member's accumulated deductions, plus additional amounts for surviving children. However, in accordance with Section 100 of Chapter 32, the surviving spouse of a police officer, firefighter or corrections officer is killed in the line of duty will be eligible to receive an annual benefit equal to the maximum salary held by the member at the time of death. Upon the death of a job-connected disability retiree who retired prior to November 7, 1996 and could not elect an Option C benefit, a surviving spouse will receive an allowance of \$12,000 per year if the member dies for a reason unrelated to cause of disability.
"Heart And Lung Law" And Cancer Presumption:	Any case of hypertension or heart disease resulting in total or partial disability or death to a uniformed fireman, permanent member of a police department, or certain employees of a county correctional facility is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. Any case of disease of the lungs or respiratory tract resulting in total disability or death to a uniformed fireman is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. There is an additional presumption for uniformed firemen that certain types of cancer are job-related if onset occurs while actively employed or within five years of retirement.

Section 4: Actuarial Valuation Basis

Special Legislation Benefits:	The following legislation benefits are included in this valuation: - Chapter 377 of the Acts of 2018: Disabled firefighter is awarded a pension of 80% of the compensation, increased annually with salary-related COLAs through maximum retirement age, at which point the benefit is converted to a standard accidental disability benefit. Upon death prior to maximum retirement age, 67% of the benefit at time of death is payable to his surviving spouse. - Chapter 157 of the Acts of 2008: Disabled firefighter is awarded a pension of 100% of the compensation, increased annually with salary-related COLAs through maximum retirement age, at which point the benefit is converted to a standard accidental disability benefit. Upon death prior to maximum retirement age, 75% of the benefit at time of death is payable to his surviving spouse. - Chapter 203 of the Acts of 2020: Daughter of fallen firefighter is awarded an annual pension amount that otherwise would have been paid to a surviving spouse pursuant to Section 100 of Chapter 32 (increased annually with salary-related COLAs) until she attains the age of 26.
Options:	Members may elect to receive a full retirement allowance payable for life under Option A. Under Option B a member may elect to receive a lower monthly allowance in exchange for a guarantee that at the time of death any contributions not expended for annuity payments will be refunded to the beneficiary. Option C allows the member to take a lesser retirement allowance in exchange for providing a survivor with two-thirds of the lesser amount. Option C pensioners will have benefits converted from a reduced to a full retirement if the beneficiary predeceases the retiree.
Post-Retirement Benefits:	The Board has adopted the provisions of Section 51 of Chapter 127 of the Acts of 1999, which provide that the Retirement Board may approve an annual COLA in excess of the Consumer Price Index but not to exceed a 3% COLA on the first \$15,000 of a retirement allowance, increasing to \$16,000 on July 1, 2024. Cost-of-living increases granted prior to July 1, 1998 are reimbursed by the Commonwealth and not reflected in this report.
Changes in Plan Provisions:	Pursuant to Chapter 269 of the Acts of 2022, the Board approved a one-time increase in the COLA from 3% to 5% effective July 1, 2022.

Appendix A: Definition of Pension Terms

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

Actuarial Accrued Liability for Actives:	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial Accrued Liability for Retirees and Beneficiaries:	Actuarial Present Value of lifetime benefits to existing retirees and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the actuarially determined contribution.
Actuarial Gain or Loss:	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected.
Actuarially Equivalent:	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and Discounted according to an assumed rate (or rates) of return to reflect the time value of money.
Actuarial Present Value of Future Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund of member contributions or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.

Appendix A: Definition of Pension Terms

Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan, as well as actuarially determined contributions.
Actuarial Value of Assets (AVA):	The value of the Plan's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the actuarially determined contribution.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the Plan.
Actuarially Determined Contribution (ADC):	The employer's contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is intended to pay off the Unfunded Actuarial Accrued Liability.
Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Plan is calculated, including: <u>Investment return</u> - the rate of investment yield that the Plan will earn over the long-term future; <u>Mortality rates</u> - the rate or probability of death at a given age for employees and retirees; <u>Retirement rates</u> - the rate or probability of retirement at a given age or service; <u>Disability rates</u> - the rate or probability of disability retirement at a given age; <u>Withdrawal rates</u> - the rate or probability at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; <u>Salary increase rates</u> - the rates of salary increase due to inflation, real wage growth and merit and promotion increases.
Closed Amortization Period:	A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 20 years, it is 19 years at the end of one year, 18 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or withdrawal.
Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula based on the member's compensation, age and/or years of service.

Appendix A: Definition of Pension Terms

Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Plan that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified based on recommendations from the Actuary.
Funded Ratio:	The ratio of the Actuarial Value of Assets (AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes also calculate a market funded ratio, using the Market Value of Assets (MVA), rather than the AVA.
GASB 67 and GASB 68:	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment Return:	The rate of earnings of the Plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Net Pension Liability (NPL):	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal Cost:	The portion of the Actuarial Present Value of Future Benefits and expenses, if applicable, allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of the Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of member contributions and employer Normal Cost unless otherwise specifically stated.
Open Amortization Period:	An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in each future year in determining the Amortization Period.
Plan Fiduciary Net Position:	Market value of assets.
Service Costs:	The portions of the actuarial present value of projected benefit payments that are attributed to valuation years.
Total Pension Liability (TPL):	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.

Appendix A: Definition of Pension Terms

Unfunded Actuarial Accrued Liability:	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus or an Overfunded Actuarial Accrued Liability.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Benefits is determined. The expected benefits to be paid in the future are discounted to this date.