Dallas Police and Fire Pension System

Actuarial Valuation and Review as of January 1, 2021

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Segal

Segal

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November 8, 2021

Board of Trustees
Dallas Police and Fire Pension System
4100 Harry Hines Blvd., Suite 100
Dallas, TX 75219-3207

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2021. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and calculates the funding requirements for fiscal 2021; actual funding is determined by State law.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist in administering the Pension System. The census information on which our calculations were based was provided by the System's IT Department, under the supervision of John Holt, and the financial information on which our calculations were based was prepared by the System's Finance Department. That assistance is gratefully acknowledged.

The actuarial calculations were directed under my supervision. I am a member of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of my knowledge, the information supplied in this actuarial valuation is complete and accurate. Further, in my opinion, the assumptions as approved by the Board are reasonably related to the experience of and the expectations for the System.

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

Sincerely,
Segal

Jeffrey S. Williams, FCA, ASA, MAAA, EA
Vice President and Consulting Actuary

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Section 1: Actuarial Valuation Summary

Purpose and basis

This report was prepared by Segal to present a valuation of the Plan as of January 1, 2021. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits and to provide information for required disclosures under Governmental Accounting Standards Board (GASB) Statement No. 67. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of Plan assets to cover the estimated cost of settling the Plan's benefit obligations. 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 contribution requirements presented in this report are based on:

- The benefit provisions of the Pension Plan, as administered by the Board;
- The characteristics of covered active members, inactive members, and retired members and beneficiaries as of December 31, 2020, provided by the System's IT Department;
- The assets of the Plan as of December 31, 2020, provided by the System's Finance Department;
- Economic assumptions regarding future salary increases and investment earnings;
- Other actuarial assumptions regarding employee terminations, retirement, death, etc.;
- Article 6243a-1, as amended by House Bill 3158 (HB 3158), signed into law by the Governor of Texas on May 31, 2017; and
- The funding policy adopted by the Board of Trustees of the Pension System on December 12, 2019 as amended through July 9, 2020.

The majority of assumptions and methods used to value the Plan were set by the Board based on recommendations made by Segal following a five-year experience study for the period ended December 31, 2019.

Certain disclosure information required by GASB Statement No. 68 as of September 30, 2021 for the City will be provided in a separate report.

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 (UAL), and the principal UAL balance. The funding policy adopted by the Board meets this standard, if future payroll matches the City's Hiring Plan payroll projection. The Board's funding policy was adopted in December 2019 and amended in July 2020. In the Board's amended policy, the provisions of which were reflected for the first time in last year's valuation, the amortization period was changed from an open 30-year period to a closed, 25-year period. Beginning in 2021, future gains or losses each year are amortized over separate, closed, 20-year periods. Amortization remains on a level percentage of pay basis. If the City's actual contributions differ from the actuarially determined contribution (ADC) by more than 2%, the Board can recommend a change in the City's contribution rate. The Board's funding policy also meets the standard of targeting 100% funding of the actuarial accrued liability.
2. The City's actuarially determined contribution (ADC) for the 2021 plan year is $221.3 million, an increase of $35.9 million from last year. The ADC as a percentage of computation pay increased from 46.71% to 51.77%. Of the $35.9 million increase in the ADC, $19.9 million is due to assumption changes (primarily lowering the discount rate from 7.00% to 6.50%) and changes to the amortization methodology. Page 28 contains a reconciliation of the ADC from the prior valuation to this year.
3. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 41.59%, compared to the prior year funded ratio of 45.73%. 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 37.99%, compared to 43.56% as of the prior valuation date. These measurements are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the System's benefit obligation or the need for or the amount of future contributions.
4. Actual contributions made by the City during the plan year ending December 31, 2020 were $162.0 million, 87.3% of the 2020 ADC. In 2019, actual contributions were $155.7 million, 102.4% of the 2019 ADC. The total contributions made during the plan year were insufficient to reduce the UAL. The Board was advised previously that because the funding policy contributions as outlined in HB 3158 result in a long effective amortization period, it will be 20 years or more before the UAL starts to decline.
5. The rate of return on the market value of assets, as calculated by the actuary, was -0.45% for the 2020 plan year. The System has advised that short-term expectations will likely be lower than the long-term expected rate of return as the System continues to rebalance its investment portfolio. As shown in Section 3, Exhibit E, the System reduced the percentage of the invested portfolio exposed to private equity from 14% to 7%. The reduction in private equity assets led to an increase in the equity exposure, from 28% to 38%.

Section 1: Actuarial Valuation Summary

6. The return on the actuarial value of assets was 3.46% for the 2020 plan year. This resulted in an actuarial loss when measured against the assumed rate of return of 7.00%. This actuarial investment loss increased the ADC by $5.6 million. Given the low fixed income interest rate environment, target asset allocation and expectations of future investment returns for various classes, the Board lowered the assumed long-term rate of return on investments from 7.00% to 6.50% with this year's valuation.
7. There was a net experience loss for the year of $163.2 million, or 3.4% of the actuarial accrued liability. This loss was primarily due to the investment loss mentioned above, and to a lesser extent, salary increases greater than expected, and actual contributions less than the ADC. The investment loss was equivalent to 1.5% of actuarial accrued liability and net losses due to demographic and other factors were 1.9% of liability. This experience loss was amortized over 20 years.
8. The following actuarial assumptions were changed with this valuation:
   - The discount rate was lowered from 7.00% to 6.50%.
   - The starting year of the ad-hoc cost-of-living assumption was changed from 2063 to 2069, based on when the System is projected to be 70% funded on a market value basis after the COLA is reflected.

   As a result of these assumption changes, the total normal cost increased by $8.2 million and the actuarial accrued liability increased by $256.7 million. This change in the actuarial accrued liability was amortized over 20 years. The total impact was an increase in the ADC of $18.6 million, or 4.3% of computation pay.
9. The impact of amortizing the 2020 actuarial experience over 20 years instead of 25 years caused an increase in the ADC of $1.3 million, or 0.3% of computation pay.
10. The actuarial value of assets as of the valuation date is 109.5% of the market value of assets. The investment experience in recent years has only been partially recognized in the actuarial value of assets. As the deferred net loss of $184.1 million is recognized in future years, the System's ADC is likely to increase unless the net loss is offset by future experience. The recognition of these market losses will also have an impact on the future funded ratio. If the net deferred losses were recognized immediately in the actuarial value of assets, the ADC would increase from 51.77% to 54.89% of computation pay.
11. Assuming the City's Hiring Plan payroll projections materialize, the System's expected full-funding date is 2084. The City's Hiring Plan payroll projections are shown in Section 4, Exhibit I. From 2017 through 2021, valuation payroll based on participant data was cumulatively $32.0 million less than the City's projections, or 1.67% lower. Even though valuation payroll for 2021 exceeds the City's payroll projection, this remains an area of concern that needs to be carefully monitored.

12. With 100% funding projected in 2084, the effective amortization period for the UAL is 63 years. This period can vary on an annual basis due to actuarial experience, changes in assumptions, contributions higher or lower than expected, and assumed short-term market value asset returns provided by System staff. In the 2020 actuarial valuation, the projected full funding year was 2075 and the effective period was 55 years. Through 2024, there is a floor on the City's contributions levels. This floor is expected to override the long-term contribution rate of 34.50% of computation pay. Beginning in 2025, when the City is expected to contribute based solely on computation pay, differences between actual payroll and the City's Hiring Plan payroll will have an impact on when the System is projected to become fully funded.

13. The City's plan reflects significant growth in payroll over 20 years, from $372 million in 2017 to $684 million in 2037. The average annual growth in the City's Hiring Plan payroll projections is 3.09%, compared to the valuation assumption of 2.50%. If payroll growth is more modest, or if there is adverse actuarial experience, it will significantly impact the progress towards improved funding. For instance, if the City's Hiring Plan projections are not met and instead the current valuation payroll of $427.4 million increases by the assumed payroll growth of 2.50% each year, and City and member contributions are based on this level of payroll beginning in 2025, the System is projected to be only 66% funded in 2084, rather than 100%.

14. The System's normal cost (for benefits accruing each year) plus expenses is 19.22% of computation pay. Members contribute 13.50% of computation pay, and the City covers the balance. All remaining City contributions pay down the UAL. Although it is important for the System to meet its 6.50% annual rate of return assumption, the assets currently cover a relatively low percentage of the liabilities and investment returns alone cannot close the funding gap. It is therefore vital that the City's payroll projections are accurate, or that the long-term level of contributions is at least 34.50% of those payroll projections, for the System to achieve full funding.

15. 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 System's future financial condition, but have included a brief discussion of some risks that may affect the System in Section 2. A more detailed assessment would provide the Board with a better understanding of the inherent risks. This could be important because:

    - The outlook for financial markets is uncertain due to COVID-19.
    - The Plan's asset allocation has potential for a significant amount of investment return volatility, particularly as rebalancing continues.
    - Retired participants account for most of the System's liabilities, leaving limited options for reducing costs in the event of adverse experience.
    - The current political and social environment could impact the turnover and retirement patterns of public safety employees, as well as the availability of new hires.

Section 1: Actuarial Valuation Summary

16. This report constitutes an actuarial valuation for the purpose of determining the ADC under the Plan's funding policy. The information contained in Section 5 provides the accounting information for Governmental Accounting Standards Board (GASB) Statement No. 67 for inclusion in the plan and employer's financial statements as of December 31, 2020. The Net Pension Liability (NPL) and Pension Expense under GASB Statement No. 68 for inclusion in the plan and employer's financial statements as of September 30, 2021 will be provided separately.

17. The Net Pension Liability (NPL) is equal to the difference between the Total Pension Liability (TPL) and the Plan's fiduciary net position (equal to the market value of assets). The NPL as of December 30, 2020 is $3.2 billion, an increase from $2.7 billion as of December 31, 2019.

18. It is important to note that this actuarial valuation is based on plan assets as of December 31, 2020. Due to the COVID-19 pandemic, market conditions have changed significantly since the onset of the Public Health Emergency. The plan's funded status does not reflect short-term fluctuations of the market, but rather is based on the market values on the last day of the plan year. Moreover, this actuarial valuation does not include any possible short-term or long-term impacts on mortality of the covered population that may emerge after December 31, 2020. While it is impossible to determine how the pandemic will affect market conditions and other demographic experience of the plan in future valuations, Segal is available to prepare projections of potential outcomes upon request.

Summary of key valuation results

		2021	2020
Contributions for plan year beginning January 1, adjusted for timing:	Total actuarially determined contributions (City and member)	$280,836,090	$240,861,543
	Expected member contributions	59,550,344	55,432,779
	City's actuarially determined contributions (ADC)	221,285,746	185,428,764
	City's ADC as a percent of computation pay	51.77%	46.71%
	Actual City contributions	--	$161,950,183
	Effective amortization period for determination of ADC[1]	24 years	25 years
Actuarial accrued liability for plan year beginning January 1:	Retired members and beneficiaries	$3,488,001,678	$3,268,076,451
	Inactive vested members	38,441,221	32,099,477
	Active members	1,587,784,145	1,422,388,061
	Inactive members due a refund of employee contributions	1,739,548	1,408,491
	Total actuarial accrued liability	5,115,966,592	4,723,972,480
	Employer normal cost including administrative expenses	24,444,776	15,495,082
Assets for plan year beginning January 1:	Market value of assets (MVA)	$1,943,700,593	$2,057,857,317
	Actuarial value of assets (AVA)	2,127,834,406	2,160,125,611
	Actuarial value of assets as a percentage of market value of assets	109.47%	104.97%
Funded status for plan year beginning January 1:	Unfunded actuarial accrued liability on market value of assets	$3,172,265,999	$2,666,115,163
	Funded percentage on MVA basis	37.99%	43.56%
	Unfunded actuarial accrued liability on actuarial value of assets	$2,988,132,186	$2,563,846,869
	Funded percentage on AVA basis	41.59%	45.73%
	Projected year of full funding based on City's Hiring Plan payroll projections	2084	2075
Key assumptions	Net investment return	6.50%	7.00%
	Inflation rate	2.50%	2.50%
GASB information	Discount rate	6.50%	7.00%
	Total pension liability	$5,122,372,419	$4,731,959,822
	Plan fiduciary net position	1,943,700,593	2,057,857,317
	Net pension liability	3,178,671,826	2,674,102,505
	Plan fiduciary net position as a percentage of total pension liability	37.95%	43.49%
Demographic data for plan year beginning January 1:	Number of retired members and beneficiaries	5,110	5,039
	Number of inactive vested members	241	242
	Number of active members	5,106	5,121
	Number of inactive members due a refund of employee contributions	442	434
	Total computation pay[2]	$427,440,530	$396,954,743
	Average computation pay	83,713	77,515

[1] The unfunded actuarial accrued liability as of January 1, 2020 was amortized over a closed, 25-year period. Beginning on January 1, 2021, each year's experience due to actuarial gains and losses, or plan, assumptions, and method changes, are amortized over closed, 20-year periods.

[2] Total computation pay, or valuation pay, is the active members' actual payroll for the preceding year, increased by the salary scale applicable for each member to account for their anticipated salary increases in the upcoming year.

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 of benefits	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 data	An actuarial valuation for a plan is based on data provided to the actuary by the 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.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by the System. The System uses 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 projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan's assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results that does not mean that the previous assumptions were unreasonable.
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. Deterministic cost projections are based on a proprietary forecasting model. 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.

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 Board. Segal is not responsible for the use or misuse of its report, particularly by any other party.
An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. 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.
Actuarial results in this report are not rounded, but that does not imply precision.
If the 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's provisions, but they may be subject to alternative interpretations. The Board should look to their other advisors for expertise in these areas.

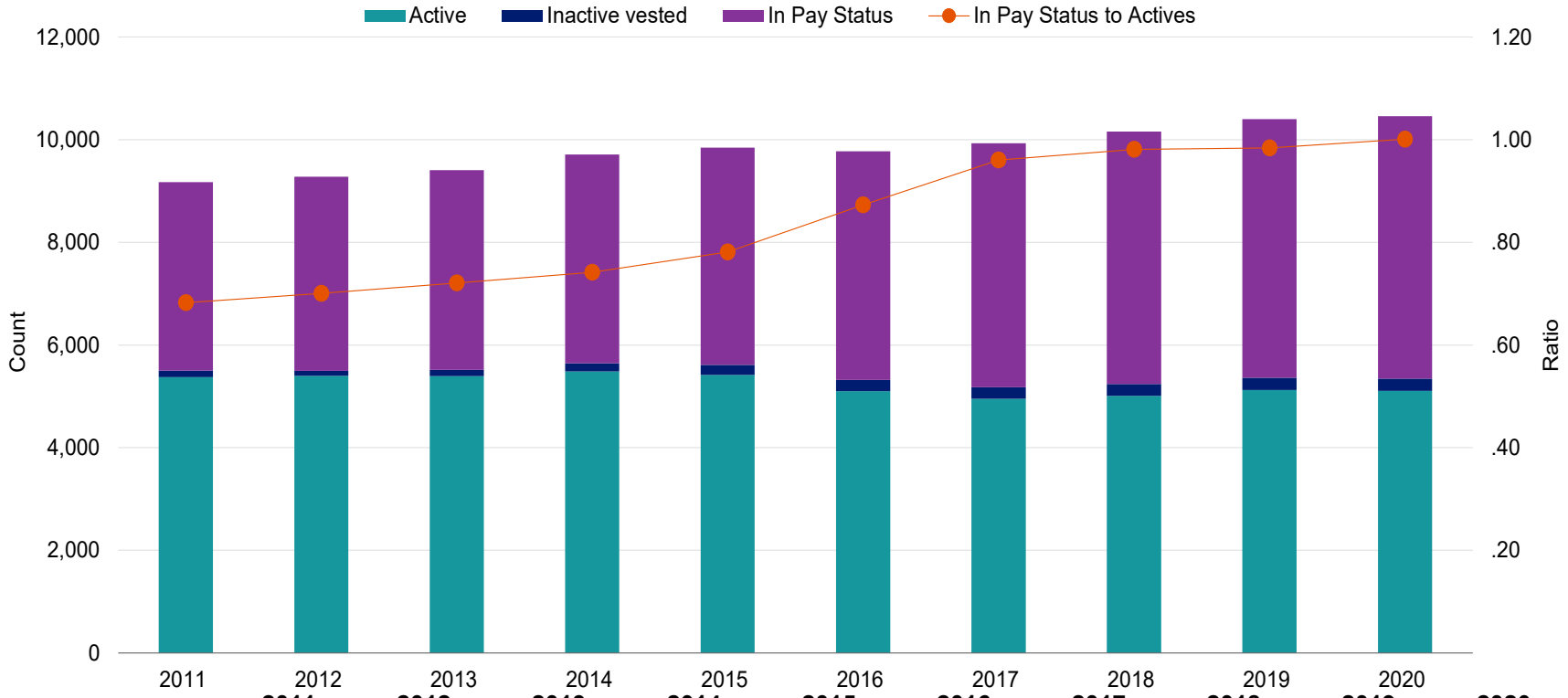
As Segal has no discretionary authority with respect to the management or assets of the System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the System.

Section 2: Actuarial Valuation Results

Member data

The average number of active members in the most recent five years is 7% less than the average for the preceding six years, and the number of retirees and beneficiaries has climbed 24% in the last five years.

Member Population: 2011 – 2020



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
In Pay Status	3,669	3,783	3,890	4,069	4,230	4,456	4,756	4,919	5,039	5,110
Inactive Vested[1]	128	96	122	157	200	215	226	230	242	241
Active	5,376	5,400	5,397	5,487	5,415	5,104	4,952	5,012	5,121	5,106
Ratio	0.68	0.70	0.72	0.74	0.78	0.87	0.96	0.98	0.98	1.00

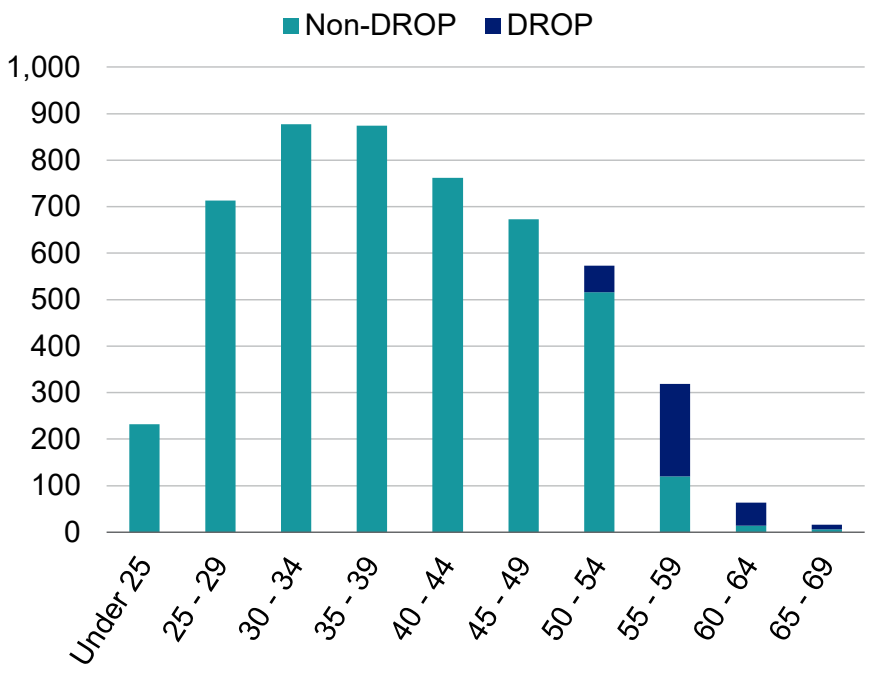
[1] Excludes non-vested terminated participants due a refund of employee contributions

Active members

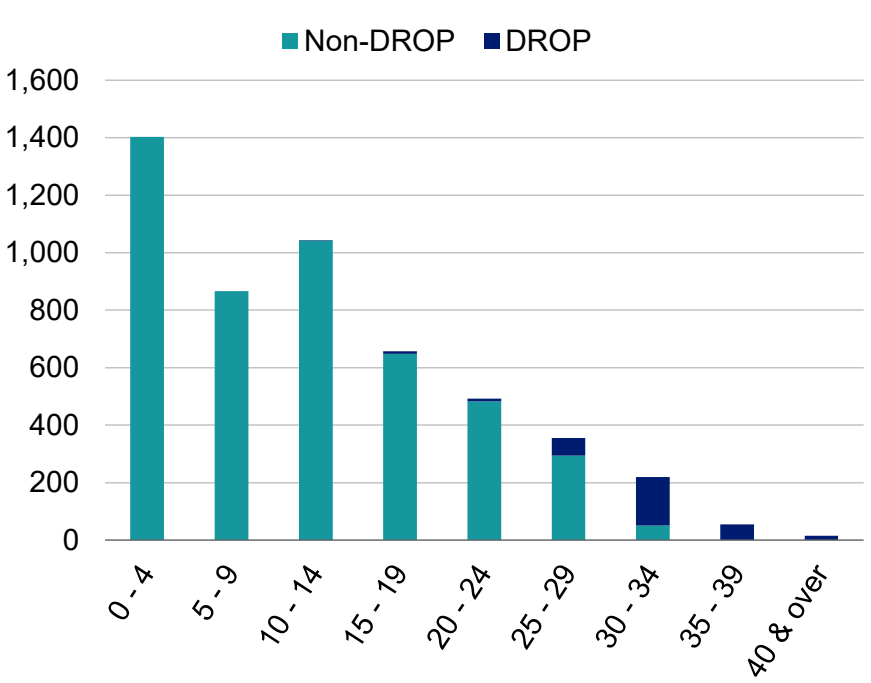
As of December 31,	2020	2019	Change
Firefighters			
Active participants	1,985	2,013	-1.4%
Average age	40.1	39.6	0.5
Average years of service	12.4	11.3	1.1
Average computation pay	$84,990	$78,301	8.5%
Police Officers			
Active participants	3,121	3,108	0.4%
Average age	40.0	39.9	0.1
Average years of service	12.7	12.2	0.5
Average computation pay	$82,867	$77,006	7.6%
Total			
Active participants	5,106	5,121	-0.3%
Average age	40.0	39.8	0.2
Average years of service	12.6	12.3	0.3
Average computation pay	$83,713	$77,515	8.0%

Distribution of Active Members as of December 31, 2020

Actives by Age



Actives by Years of Service



The number of active participants in the DROP decreased from 383 at the end of 2019 to 320 at the end of 2020.

Inactive members

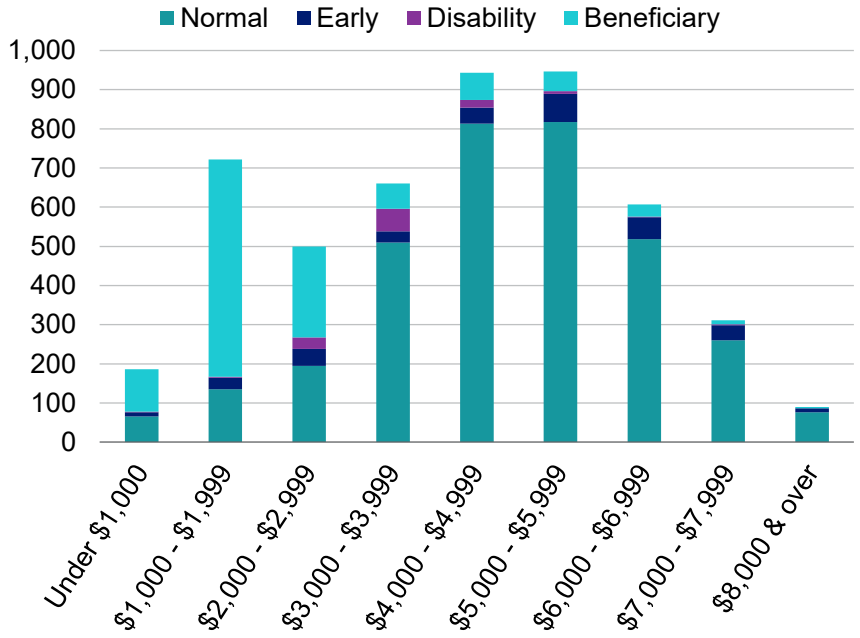
In this year's valuation, there were 241 members with a vested right to a deferred or immediate vested benefit. In addition, there were 442 non-vested members entitled only to a return of their member contributions.

Retired members and beneficiaries

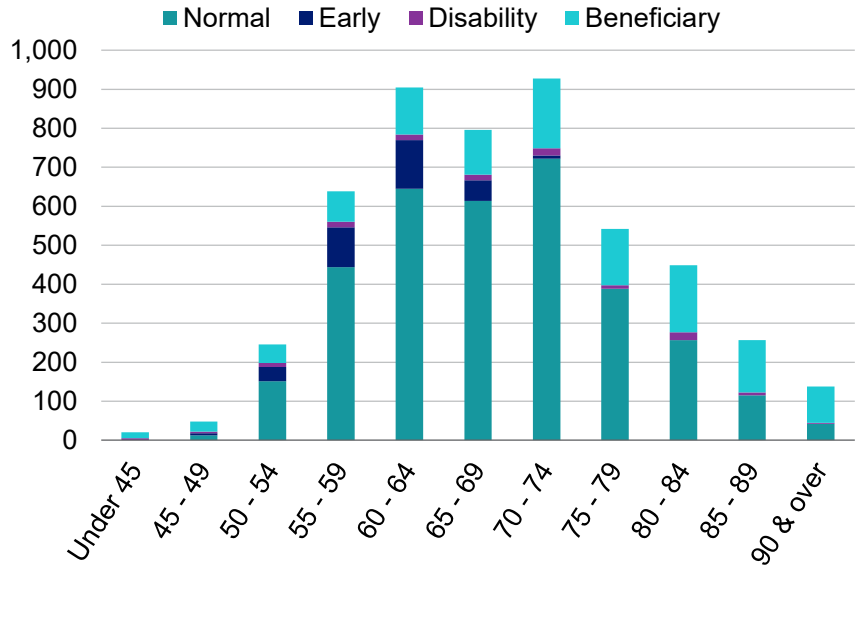
As of December 31,	2020	2019	Change
Retirees	3,840	3,803	1.0%
Beneficiaries[1]	1,163	1,153	0.9%
Average age	68.9	68.7	0.2
Average amount	$4,273	$4,250	0.5%
Total monthly amount	$21,384,025	$21,064,497	1.5%

Distribution of Pensioners as of December 31, 2020

Retired Participants by Type and Monthly Amount



Retired Participants by Type and Age



[1] Does not include beneficiaries with annuitized DROP accounts only and no lifetime annuity (107 for 2020 and 83 for 2019)

Historical plan population

The chart below demonstrates the progression of the active population over the last ten years. The chart also shows the growth among the retired population over the same time period.

Member Data Statistics: 2011 – 2020

	Active Members			Retired Members and Beneficiaries[1]		
Year Ended December 31	Count	Average Age	Average Service	Count	Average Age[2]	Average Monthly Amount[3]
2011	5,376	41.3	14.5	3,669	--	$3,380
2012	5,400	41.3	14.5	3,783	--	3,429
2013	5,397	41.3	14.4	3,890	--	3,543
2014	5,487	41.2	14.2	4,069	68.8	3,699
2015	5,415	41.4	14.3	4,182	69.0	3,826
2016	5,104	41.4	13.0	4,414	68.7	4,102
2017	4,952	40.6	13.4	4,706	67.7	4,171
2018	5,012	40.1	12.8	4,849	68.4	4,217
2019	5,121	39.8	12.3	4,956	68.7	4,250
2020	5,106	40.0	12.6	5,003	68.9	4,273

[1] Does not include DROP only beneficiaries
[2] Information for December 31, 2013 and earlier is not available
[3] Average benefits for December 31, 2013 and earlier include terminated vested members; average benefits for December 31, 2014 and later include the benefit supplement.

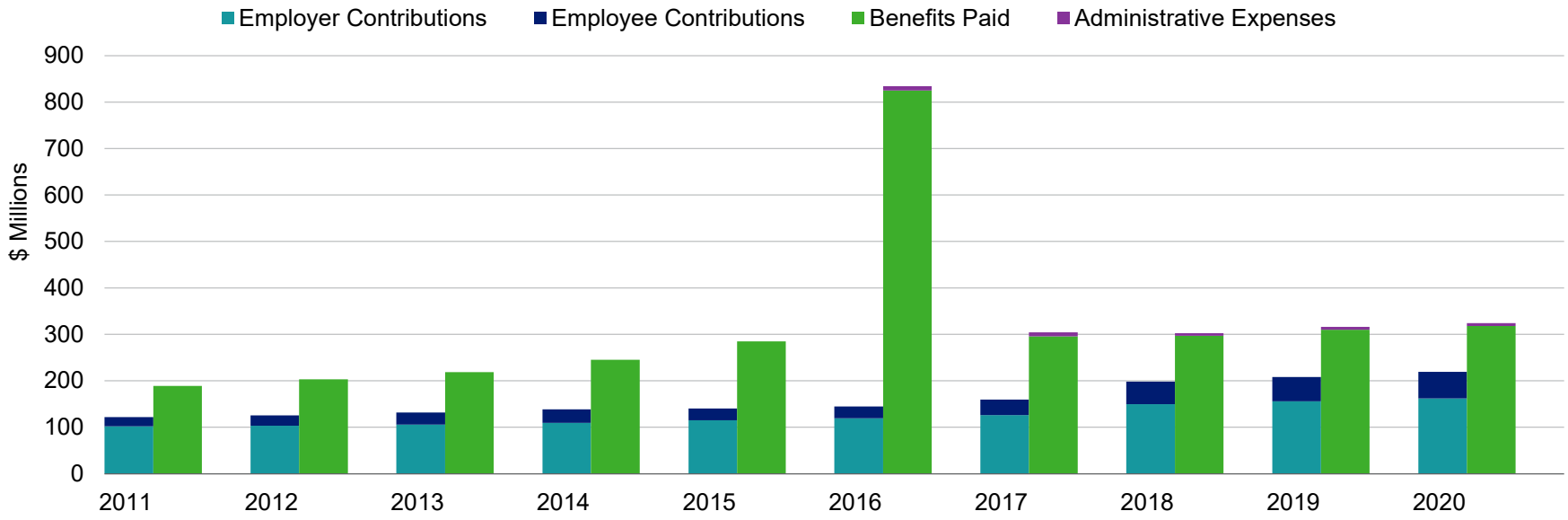
Financial information

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.

Benefit payments in 2016 totaled $825.1 million, of which $606.3 million were DROP lump-sum payments. This was a one-time event, as members reacted to pending changes in the plan provisions. DROP balances have been annuitized, resulting in more stable projected benefit payment levels in the future.

Additional financial information, including a summary of transactions for the valuation year, is presented in *Section 3, Exhibits D, E* and *F*.

Comparison of Contributions Made with Benefits and Expenses Paid
for Years Ended December 31, 2011 – 2020



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, 2020

1	Market value of assets, December 31, 2020				$1,943,700,593
2	Calculation of unrecognized return	**Original Amount[1]**	**Percent Deferred**	**Unrecognized Amount[3]**	
	(a) Year ended December 31, 2020	-$149,294,320	80%	-$119,435,456	
	(b) Year ended December 31, 2019	-19,852,697	60%	-11,911,617	
	(c) Year ended December 31, 2018	-105,891,055	40%	-42,356,422	
	(d) Year ended December 31, 2017	-52,151,589	20%	-10,430,318	
	(e) Total unrecognized return				-$184,133,813
3	Preliminary actuarial value: **(1) - (2e)**				2,127,834,406
4	Adjustment to be within 20% corridor				0
5	Final actuarial value of assets as of December 31, 2020: **(3) + (4)**				2,127,834,406
6	Actuarial value as a percentage of market value: **(5) ÷ (1)**				109.5%
7	Amount deferred for future recognition: **(1) - (5)**				-$184,133,813

[1] Total return minus expected return on a market value basis
[2] Percent deferred applies to the current valuation year
Deferred return as of December 31, 2020 recognized in each of the next four years:

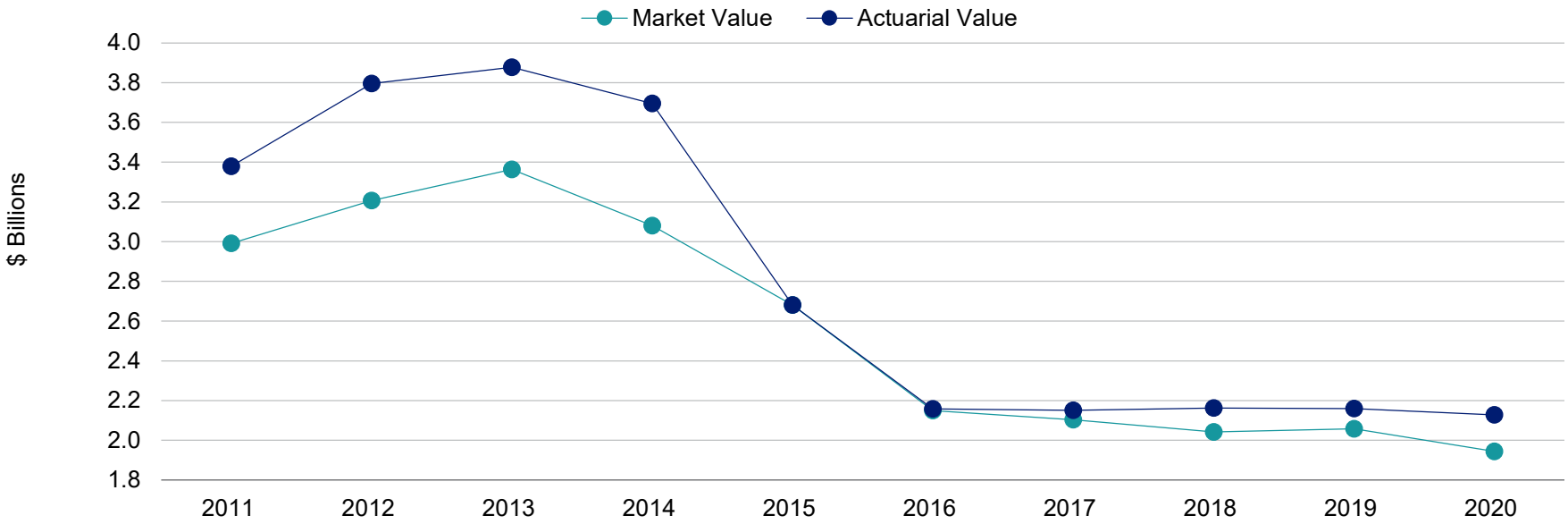
(a) Amount recognized on December 31, 2021	-$65,437,932
(b) Amount recognized on December 31, 2022	-55,007,614
(c) Amount recognized on December 31, 2023	-33,829,403
(d) Amount recognized on December 31, 2024	-29,858,864

Section 2: Actuarial Valuation Results

Both the actuarial value and market value of assets are representations of the Plan's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the Plan's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

The decline in asset values from 2013 to 2015 was primarily the result of significant write-downs in the System's asset holdings. The decline from 2015 to 2016 reflects the unusually large number of DROP payments made in 2016.

Market Value of Assets vs. Actuarial Value of Assets from December 31, 2011 - 2020



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Market Value[1]	$2.99	$3.21	$3.36	$3.08	$2.68	$2.15	$2.10	$2.04	$2.06	$1.94
Actuarial Value[1]	3.38	3.80	3.88	3.70	2.68	2.16	2.15	2.16	2.16	2.13

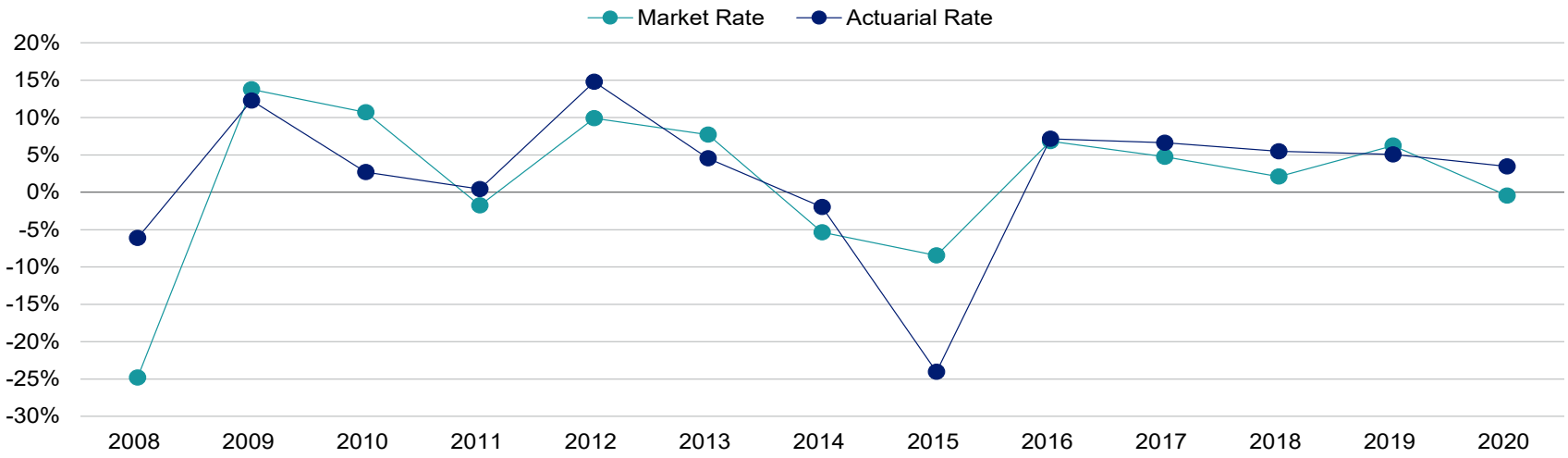
[1] In $ billions

Section 2: Actuarial Valuation Results

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the actual market value investment return for the last 13 years, including averages over select time periods.

As described earlier in this section, the actuarial asset valuation method gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

Market and Actuarial Rates of Return for Years Ended December 31, 2008 - 2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Market rate[1]	-24.8%	13.8%	10.7%	-1.8%	9.9%	7.7%	-5.3%	-8.5%	6.8%	4.7%	2.1%	6.3%	-0.4%
Actuarial rate[2]	-6.1%	12.3%	2.7%	0.4%	14.8%	4.5%	-2.0%	-24.0%	7.2%	6.6%	5.5%	5.1%	3.5%
Assumed rate	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	7.25%	7.25%	7.25%	7.25%	7.25%	7.0%

Average Rates of Return	Actuarial Value	Market Value
Most recent five-year average return:	5.59%	3.98%
Most recent ten-year average return:	-0.75%	1.79%
Most recent 13-year average return:	0.16%	0.80%

[1] Returns for 2014 and 2015 include significant write-downs in the System's assets.
[2] Includes a change in asset method for plan years 2012 and 2015.

Actuarial experience

To calculate any actuarially determined contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), any ADC requirement will decrease from the previous year. On the other hand, any ADC requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single years' experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience. If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

Actuarial Experience for Year Ended December 31, 2020

1	Net loss from investments[1]	-$74,587,581
2	Net gain from administrative expenses	2,033,284
3	Net loss from other experience	-68,463,421
4	Net loss from contributions less than recommended contribution	-22,306,418
5	Net experience loss: **1 + 2 + 3 + 4**	-$163,324,136

[1] Details on next page

Investment experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Plan's investment policy. The rate of return on the market value of assets was -0.45% for the year ended December 31, 2020.

For valuation purposes, the assumed rate of return on the actuarial value of assets was 7.00% for the year ended December 31, 2020. The actual rate of return on an actuarial basis for the 2020 plan year was 3.46%. Since the actual return for the year was less than the assumed return, the Plan experienced an actuarial loss during the year ended December 31, 2020 with regard to its investments. The Board lowered the assumed rate of return from 7.00% to 6.50% for the plan year beginning January 1, 2021.

Investment Experience

		Year Ended December 31, 2020	
		Market Value	**Actuarial Value**
1	Net investment income	-$8,927,336	$72,938,183
2	Average value of assets	2,005,242,623	2,107,510,917
3	Rate of return: **1 ÷ 2**	-0.45%	3.46%
4	Assumed rate of return	7.00%	7.00%
5	Expected investment income: **2 x 4**	140,366,984	147,525,764
6	Actuarial gain/(loss): **1 - 5**	-$149,294,320	-$74,587,581

Non-investment experience

Administrative expenses

- Administrative expenses for the year ended December 31, 2020 totaled $6,534,350, as compared to the assumption of $8,500,000. This resulted in a gain of $2,033,284 for the year, when adjusted for timing. Because it is expected that these expenses will increase, we have maintained the $8,500,000 assumption for the current year.

Mortality experience

- Mortality experience (more or fewer than expected deaths) yields actuarial gains or losses.
- The number of deaths for nondisabled pensioners over the past year was 91 compared to 73.2 projected deaths for the same period. The assumed mortality table is the Pub-2010 Public Safety Retiree Amount-Weighted Table, set back one year for females. The Pub-2010 family of tables were published by the Society of Actuaries in 2019, and the public sector tables are appropriate for the valuation of this plan.

Contribution experience

The net loss from total contributions less than the recommended contribution amount, prior to the timing adjustment, is $22,306,418, or 0.5% of the actuarial accrued liability.

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:

- the extent of turnover among members,
- retirement experience (earlier or later than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

The net loss from this other experience for the year ended December 31, 2020 amounted to $68,463,421, which is 1.4% of the actuarial accrued liability.

Actuarial assumptions and methods

The following actuarial assumption was approved by the Board and changed with this valuation:

- The net investment return assumption was lowered from 7.00% to 6.50%.

Based on a projection of the System's funded ratio, taking into account 2021 data, new long-term assumptions, and the System's near-term asset expectations, the ad-hoc COLA assumption was updated to begin October 1, 2069. Last year, the COLA was assumed to begin October 1, 2063.

These changes increased the actuarial accrued liability 5.28% and increased the total normal cost by 12.56%.

Details on actuarial assumptions and methods are in Section 4, Exhibit I.

Plan provisions

There were no changes in plan provisions since the prior valuation.

A summary of plan provisions is in Section 4, Exhibit II.

Section 2: Actuarial Valuation Results

Development of Unfunded Actuarial Accrued Liability for Year Ended December 31, 2020

1	Unfunded actuarial accrued liability at beginning of year		$2,563,846,869
2	Total normal cost at beginning of year, including administrative expense assumption		69,083,972
3	Total contributions		-219,255,582
4	Interest on 1, 2 & 3		176,718,042
5	Expected unfunded actuarial accrued liability		$2,590,393,301
6	Changes due to:		
	(a) Net experience loss	$141,017,718	
	(b) Assumptions	256,721,167	
	Total changes		$397,738,885
7	Unfunded actuarial accrued liability at end of year		$2,988,132,186

Actuarially determined contribution

The actuarially determined contribution is equal to the City normal cost payment and a payment on the unfunded actuarial accrued liability. As of January 1, 2021, the actuarially determined contribution is $221,285,746, or 51.77% of computation pay. The funding policy used to calculate the actuarially determined contribution as of January 1, 2020 was based on a closed amortization period of 25 years, established as of January 1, 2020. For the plan year beginning January 1, 2021 and forward, all changes in the unfunded actuarial accrued liability are amortized over closed, 20-year periods each year these changes occur. Amortization is on a level-percentage-of-pay basis.

Under the provisions of HB 3158, the City contributes mandated biweekly amounts through 2024 (but no less than 34.50% of computation pay), plus $13 million per year. Beginning January 1, 2025, the City will contribute 34.50% of computation pay. The effective amortization period, based on the City's Hiring Plan payroll projections, is 63 years. This is a significant increase from last year's effective period of 55 years, primarily due to a return of -0.45% on the market value of assets, as well as a decrease in the discount rate and expected long-term rate of return from 7.00% to 6.50%.

The contribution requirement as of January 1, 2021 is based on the data previously described, the actuarial assumptions and Plan provisions described in *Section 4*, including all changes affecting future costs adopted at the time of the actuarial valuation, actuarial gains and losses, and changes in the actuarial assumptions.

Actuarially Determined Contribution for Year Beginning January 1

		2021		2020	
		Amount	% of Pay	Amount	% of Pay
1	Total normal cost	$73,912,721	17.29%	$60,866,712	15.33%
2	Administrative expenses	8,236,527	1.93%	8,217,260	2.07%
3	Expected member contributions	-57,704,472	-13.50%	-53,588,890	-13.50%
4	Employer normal cost: (1) + (2) + (3)	$24,444,776	5.72%	$15,495,082	3.90%
5	Actuarial accrued liability	$5,115,966,592		$4,723,972,480	
6	Actuarial value of assets	2,127,834,406		2,160,125,611	
7	Unfunded actuarial accrued liability: (5) - (6)	$2,988,132,186		$2,563,846,869	
10	Payment on unfunded actuarial accrued liability	189,981,813	44.45%	163,765,670	41.26%
11	Adjustment for timing[1]	6,859,157	1.60%	6,168,012	1.55%
12	Actuarially determined contribution: (4) + (8) + (9)	$221,285,746	51.77%	$185,428,764	46.71%
13	Total computation pay[2]	$427,440,530		$396,954,743	

[1] Actuarially determined contributions are assumed to be paid at the middle of every year.
[2] Total computation pay, or valuation pay, is the active members' actual payroll for the preceding year, increased by the salary scale applicable for each member to account for their anticipated salary increases in the upcoming year.

Reconciliation of actuarially determined contribution

The chart below details the changes in the actuarially determined contribution from the prior valuation to the current year's valuation.

Reconciliation of Actuarially Determined Contribution from January 1, 2020 to January 1, 2021

		Amount
Actuarially Determined Contribution as of January 1, 2020		$185,428,764
1	Effect of expected change in amortization payment due to payroll growth	4,235,013
2	Effect of change in amortization methodology under amended funding policy	1,280,689
3	Effect of change in actuarial assumptions, including COLA timing	18,590,075
4	Effect of contributions less than actuarially determined contribution	1,683,113
5	Effect of investment loss	5,627,946
6	Effect of other gains and losses on accrued liability	5,012,432
7	Net effect of other changes, including composition and number of members	-572,286
Total change		$35,856,982
Actuarially Determined Contribution as of January 1, 2021		$221,285,746

History of employer contributions

A history of the most recent years of contributions is shown below.

History of Employer Contributions: 2016 – 2021

Fiscal Year Ended December 31	Actuarially Determined Employer Contribution (ADC)		Actual Employer Contribution		
	Amount	Percentage of Pay	Amount	Percentage of Pay	Percent Contributed
2016	$261,859,079	71.70%	$119,423,106	32.70%	45.61%
2017	168,865,484	47.25%	126,318,005	35.34%	74.80%
2018	157,100,128	45.40%	149,356,565	43.16%	95.07%
2019	152,084,297	41.88%	155,721,087	42.88%	102.39%
2020	185,428,764	46.71%	161,950,183	40.80%	87.34%
2021	221,285,746	51.77%	TBD	N/A	N/A

Risk

Since the actuarial valuation results are dependent on a given set of assumptions and data as of a specific date, there is a risk that emerging results may differ significantly as actual experience differs from the assumptions.

This report does not contain a detailed analysis of the potential range of future measurements, but does include a brief discussion of some risks that may affect the Plan. Upon request, a more detailed assessment would provide a better understanding of the risks inherent in the Plan. This assessment may include scenario testing, sensitivity testing, stress testing, and stochastic modeling.

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

  The System has experienced some of the challenges associated with investment risk, and has had to write down the value of its assets significantly in recent years. Recognized market returns have been well below the long-term assumption as the System rebalances the investment portfolio, and are expected to continue to be below average in the short-term.

  The market value rate of return over the last ten years has ranged from a low of -8.47% to a high of 9.92%.

- Contribution Risk (the risk that actual contributions will be different from expected)

  Plan contributions are set by statute. Periodic projections are prepared by the actuary to determine if expected statutory contributions are sufficient to fund the System and to ensure the payment of promised benefits.

  Although State law establishes minimums on the City contributions through 2024, the contribution is scheduled to be a flat 34.50% of computation pay beginning in 2025. If the payroll growth matches the City's Hiring Plan projections, and if all other assumptions are met, the System is projected to be fully funded by 2084. The City's plan reflects significant growth in payroll over 20 years, from $372 million in 2017 to $684 million in 2037. The annual average growth in the City's Hiring Plan is 3.09%, compared to the valuation assumption of 2.50%. If payroll growth is more modest, or if there is adverse experience in the System that leads to losses, the period required to achieve 100% funding could be significantly longer.

  If the City's Hiring Plan projections are not met and instead the current valuation payroll of $427.4 million increases by the assumed payroll growth of 2.50% each year, and City and member contributions are based on this level of payroll beginning in 2025, the System is projected to be only 66% funded in 2084, rather than 100%.

- 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.

Section 2: Actuarial Valuation Results

- 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. The value of retirement plan benefits is sensitive to the rate of benefit accruals and any early retirement subsidies that apply.

  – More or less active participant turnover than assumed.

- Actual Experience Over the Last 10 years and Implications for the Future

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

  – The annual market value investment experience has ranged from a loss of $473 million (including write-downs) to a gain of $42 million. If all investment returns were equal to the assumed rates of return over the last ten years, the market value of assets as of the current date would be approximately $4.0 billion as opposed to the actual value of $1.9 billion.

  – The funded percentage on the actuarial value of assets has ranged from a low of 41.6% to a high of 78.1%.

- Maturity Measures

  As pension plans mature, the cash need 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.

  Currently the Plan has a non-active to active participant ratio of 1.05. The non-active participants include inactive vested participants, retirees, and beneficiaries. For the prior year benefits and administrative expenses paid were $105.2 million more than contributions received. As the Plan matures, more cash will be needed from the investment portfolio to meet benefit payments.

GFOA funded liability by type

The Actuarial Accrued Liability represents the present value of benefits earned, calculated using the plan's actuarial cost method. The Actuarial Value of Assets reflects the financial resources available to liquidate the liability. The portion of the liability covered by assets reflects the extent to which accumulated plan assets are sufficient to pay future benefits, and is shown for liabilities associated with employee contributions, pensioner liabilities, and other liabilities.

The Government Finance Officers Association (GFOA) recommends that the funding policy aim to achieve a funded ratio of 100 percent. As noted previously, the funding policy adopted by the State in HB 3158 meets this standard, with full funding projected in 2084, if the City's Hiring Plan payroll projections come to fruition. City and member contributions as well as investment returns will be necessary to increase the assets sufficiently to cover the System's liabilities.

GFOA Solvency Test as of December 31

	2021	2020
Actuarial accrued liability (AAL)		
• Active member contributions	$352,375,747	$317,953,770
• Retirees and beneficiaries	3,488,001,678	3,268,076,451
• Active and inactive members (employer-financed)	1,275,589,167	1,137,942,259
Total	$5,115,966,592	$4,723,972,480
Actuarial value of assets	$2,127,834,406	$2,160,125,611
Cumulative portion of AAL covered		
• Active member contributions	100.00%	100.00%
• Retirees and beneficiaries	50.90%	56.37%
• Active and inactive members (employer-financed)	0.00%	0.00%

Actuarial balance sheet

An overview of the Plan's funding is given by an Actuarial Balance Sheet. In this approach, first the amount and timing of all future payments that will be made by the Plan for current members is determined. Then these payments are discounted at the valuation interest rate to the date of the valuation, thereby determining the present value, referred to as the "liability" of the Plan.

Second, this liability is compared to the assets. The "assets" for this purpose include the net amount of assets already accumulated by the Plan, the present value of future member contributions, the present value of future employer normal cost contributions, and the present value of future employer amortization payments for the unfunded actuarial accrued liability.

Actuarial Balance Sheet

	Year Ended	
	December 31, 2020	**December 31, 2019**
Liabilities		
• Present value of benefits for retired members and beneficiaries (non-DROP)	$2,618,034,514	$2,387,770,133
• Present value of benefits for retired members and beneficiaries (DROP)	869,967,164	880,306,318
• Present value of benefits for inactive vested members	40,180,769	33,507,968
• Present value of benefits for active members	2,287,518,365	1,964,594,153
Total liabilities	**$5,815,700,812**	**$5,266,178,572**
Assets		
• Total valuation value of assets	$2,127,834,406	$2,160,125,611
• Present value of future contributions by members	556,423,200	490,778,245
• Present value of future employer contributions for:		
◦ Entry age cost	143,311,020	51,427,847
◦ Unfunded actuarial accrued liability	2,988,132,186	2,563,846,869
Total of current and future assets	**$5,815,700,812**	**$5,266,178,572**

Section 3: Supplemental Information

Exhibit A: Table of Plan Demographics

Category	Year Ended December 31 2020	2019	Change From Prior Year
Active members in valuation:			
• Number	5,106	5,121	-0.3%
• Average age	40.0	39.8	0.2
• Average years of service	12.6	12.3	0.3
• Total pay	$427,440,530	$396,954,743	7.7%
• Average pay	83,713	77,515	8.0%
• Account balances	352,375,747	317,953,770	10.8%
• Total active vested members	3,704	3,692	0.4%
Active members (excluding DROP):			
• Number	4,786	4,738	1.0%
• Average age	38.8	38.4	0.4
• Average years of service	11.6	10.9	0.7
• Total computation pay	$396,849,741	$361,290,222	9.8%
• Average computation pay	82,919	76,254	8.7%
Active members (DROP only):			
• Number	320	383	-16.4%
• Average age	58.0	57.3	0.7
• Average years of service	31.2	30.6	0.6
• Total computation pay	$30,590,788	$35,664,520	-14.2%
• Average computation pay	95,596	93,119	2.7%
• DROP account balances	135,389,840	154,232,068	-12.2%
Inactive vested members			
• Number	241	242	-0.4%
• Average age	41.5	40.8	0.7
• Average monthly benefit	$1,243	$1,232	0.9%
Inactive nonvested members due a refund			
• Number	442	434	1.8%
• Accumulated contribution balance	$1,739,548	$1,408,491	23.5%

Section 3: Supplemental Information

Retired members:			
• Number in pay status	3,719	3,676	1.2%
• Average age	67.7	67.4	0.3
• Average monthly benefit	$4,905	$4,886	0.4%
Disabled members:			
• Number in pay status	121	127	-4.7%
• Average age	68.4	68.1	0.3
• Average monthly benefit	$3,612	$3,605	0.2%
Beneficiaries:			
• Number in pay status	1,163	1,153	0.9%
• Average age	73.2	72.9	0.3
• Average monthly benefit	$2,319	$2,294	1.1%
Beneficiaries with DROP only:			
• Number	107	83	28.9%

Exhibit B-1: Total Members in Active Service as of December 31, 2020 by Age, Years of Service, and Average Pay

		Years of Service								
Age	**Total**	**0 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35 - 39**	**40 & over**
Under 25	232	232	- -	- -	- -	- -	- -	- -	- -	- -
	$63,807	$63,807	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	713	600	113	- -	- -	- -	- -	- -	- -	- -
	67,597	66,351	$74,211	- -	- -	- -	- -	- -	- -	- -
30 - 34	877	371	375	131	- -	- -	- -	- -	- -	- -
	75,141	67,017	78,394	$88,837	- -	- -	- -	- -	- -	- -
35 - 39	874	143	225	448	58	- -	- -	- -	- -	- -
	83,437	66,873	79,573	89,454	$92,784	- -	- -	- -	- -	- -
40 - 44	762	43	109	288	246	75	1	- -	- -	- -
	89,808	68,377	78,406	89,898	95,713	$98,783	$102,155	- -	- -	- -
45 - 49	672	11	27	117	206	256	55	- -	- -	- -
	95,011	81,077	79,292	86,738	94,657	99,465	103,701	- -	- -	- -
50 - 54	573	1	12	40	95	134	205	85	1	- -
	95,035	69,436	75,955	85,685	93,253	97,031	97,800	$94,382	$113,851	- -
55 - 59	319	1	2	12	45	24	82	115	36	2
	96,192	69,455	79,880	87,590	93,243	95,376	98,494	95,965	100,496	$94,821
60 - 64	63	- -	3	2	6	4	11	18	15	4
	95,036	- -	87263	84,183	91,278	97,949	98,461	93,373	100,132	87,966
65 - 69	16	- -	- -	6	1	- -	- -	2	3	4
	97,383	- -	- -	89,571	91,710	- -	- -	94,683	105,163	106,036
70 & over	5	- -	- -	- -	- -	- -	- -	- -	- -	5
	109,430	- -	- -	- -	- -	- -	- -	- -	- -	109,430
Total	5,106	1,402	866	1,044	657	493	354	220	55	15
	$83,713	$66,342	$78,184	$89,019	$94,552	$98,488	$98,910	$95,129	$100,894	$100,853

Exhibit B-2: Police Members in Active Service as of December 31, 2020 by Age, Years of Service, and Average Pay

		Years of Service								
Age	**Total**	**0 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35 - 39**	**40 & over**
Under 25	173	173	- -	- -	- -	- -	- -	- -	- -	- -
	$63,798	$63,798	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	445	367	78	- -	- -	- -	- -	- -	- -	- -
	67,053	65,624	$73,775	- -	- -	- -	- -	- -	- -	- -
30 - 34	509	186	228	95	- -	- -	- -	- -	- -	- -
	74,983	66,973	76,467	$87,104	- -	- -	- -	- -	- -	- -
35 - 39	504	53	102	301	48	- -	- -	- -	- -	- -
	83,957	65,975	76,181	88,351	$92,783	- -	- -	- -	- -	- -
40 - 44	444	34	45	175	152	38	- -	- -	- -	- -
	88,027	67,011	75,286	88,371	94,207	$95,614	- -	- -	- -	- -
45 - 49	418	8	20	87	124	145	34	- -	- -	- -
	93,314	92,463	78,407	86,435	94,004	97,084	$102,948	- -	- -	- -
50 - 54	404	- -	10	38	62	79	150	65	- -	- -
	93,839	- -	75,541	85,440	93,499	94,662	97,475	$92,502	- -	- -
55 - 59	178	- -	- -	11	26	13	41	73	13	1
	94,969	- -	- -	86,867	93,308	92,751	99,225	94,921	$93,716	$101,427
60 - 64	34	- -	2	2	4	4	4	14	4	- -
	94,495	- -	90,955	84,183	92,918	97,949	95,788	93,335	102,312	- -
65 - 69	9	- -	- -	4	1	- -	- -	1	2	1
	94,437	- -	- -	88,711	91,710	- -	- -	96,261	95,309	116,506
70 & over	3	- -	- -	- -	- -	- -	- -	- -	- -	3
	101,793	- -	- -	- -	- -	- -	- -	- -	- -	101,793
Total	3,121	821	485	713	417	279	229	153	19	5
	$82,867	$65,818	$75,985	$87,768	$93,803	$96,008	$98,571	$93,757	$95,694	$104,662

Exhibit B-3: Fire Members in Active Service as of December 31, 2020 by Age, Years of Service, and Average Pay

		Years of Service								
Age	**Total**	**0 - 4**	**5 - 9**	**10 - 14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35 - 39**	**40 & over**
Under 25	59	59	- -	- -	- -	- -	- -	- -	- -	- -
	$63,833	$63,832	- -	- -	- -	- -	- -	- -	- -	- -
25 - 29	268	233	35	- -	- -	- -	- -	- -	- -	- -
	68,501	67,498	$75,182	- -	- -	- -	- -	- -	- -	- -
30 - 34	368	185	147	36	- -	- -	- -	- -	- -	- -
	75,359	67,061	81,383	$93,410	- -	- -	- -	- -	- -	- -
35 - 39	370	90	123	147	10	- -	- -	- -	- -	- -
	82,728	67,401	82,386	91,713	$92,791	- -	- -	- -	- -	- -
40 - 44	318	9	64	113	94	37	1	- -	- -	- -
	92,294	73,538	80,599	92,263	98,148	$102,038	$102,155	- -	- -	- -
45 - 49	254	3	7	30	82	111	21	- -	- -	- -
	97,803	69,467	81,823	87,616	95,646	102,576	104,919	- -	- -	- -
50 - 54	169	1	2	2	33	55	55	20	1	- -
	97,891	69,436	78,026	90,341	92,791	100,434	98,688	$100,493	$113,851	- -
55 - 59	141	1	2	1	19	11	41	42	23	1
	97,735	69,455	79,880	95,545	93,153	98,479	97,764	97,779	104,327	$88,215
60 - 64	29	- -	1	- -	2	- -	7	4	11	4
	95,670	- -	79,880	- -	87,998	- -	99,988	93,508	99,340	87,966
65 - 69	7	- -	- -	2	- -	- -	- -	1	1	3
	101,171	- -	- -	91,291	- -	- -	- -	93,106	124,871	102,546
70 & over	2	- -	- -	- -	- -	- -	- -	- -	- -	2
	120,886	- -	- -	- -	- -	- -	- -	- -	- -	120,886
Total	1,985	581	381	331	240	214	125	67	36	10
	$84,990	$67,082	$80,984	$91,715	$95,853	$101,722	$99,532	$98,264	$103,639	$98,949

Exhibit C: Reconciliation of Member Data

	Active Members	Inactive Vested Members[1]	Disableds	Retired Members	Beneficiaries[2]	Total
Number as of January 1, 2020	**5,121**	**242**	**127**	**3,676**	**1,153**	**10,319**
• New members	230	N/A	N/A	N/A	N/A	230
• Terminations – with vested rights	-28	28	0	0	0	0
• Terminations – without vested rights	-39	N/A	N/A	N/A	N/A	-39
• Retirements	-120	-14	N/A	134	N/A	0
• New disabilities	-1	0	1	N/A	N/A	0
• Deceased	-3	0	-7	-91	-50	-151
• New beneficiaries	N/A	N/A	N/A	N/A	67	67
• Lump sum payouts[3]	-57	-12	0	0	0	-69
• Rehire	3	-3	N/A	0	N/A	0
• Certain period expired	N/A	N/A	0	0	-7	-7
Number as of January 1, 2021	**5,106**	**241**	**121**	**3,719**	**1,163**	**10,350**

[1] Excludes non-vested terminated members due a refund of contributions.
[2] Excludes beneficiaries with a DROP only.
[3] Members who terminated and requested a refund of member contributions

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

	Year Ended December 31, 2020	Year Ended December 31, 2019
Net assets at market value at the beginning of the year	$2,057,857,317	$2,041,914,130
Contribution income:		
• City contributions	$161,950,183	$155,721,087
• Member contributions	57,305,399	52,268,293
• Less administrative expenses	-6,534,350	-6,445,251
Net contribution income	*$212,721,232*	*$201,544,129*
Investment income:		
Interest, dividends, and other income	$29,937,351	$38,127,259
Recognition of capital appreciation	-30,451,106	94,213,367
• Less investment fees	-8,413,581	-8,081,019
Net investment income	*-$8,927,336*	*$124,259,607*
Total income available for benefits	**$203,793,896**	**$325,803,736**
Less benefit payments:		
• Benefit Payments	-$315,674,779	-$307,243,319
• Refunds to members	-2,275,841	-2,617,230
Net benefit payments	*-$317,950,620*	*-$309,860,549*
Change in market value of assets	**-$114,156,724**	**$15,943,187**
Net assets at market value at the end of the year	**$1,943,700,593**	**$2,057,857,317**

Exhibit E: Summary Statement of Plan Assets

	December 31, 2020	December 31, 2019
Cash equivalents and prepaid expenses	$88,290,940	$89,113,933
Invested securities lending collateral	- -	12,916,355
Capital assets	11,986,674	12,225,827
Total accounts receivable	19,113,498	60,827,238
Investments:		
• Equity securities	$694,903,302	$550,594,317
• Real assets	520,936,531	562,450,805
• Fixed income securities	469,459,926	550,746,613
• Private equity	136,160,838	265,352,308
• Other	19,964,791	25,746,727
Total investments at market value	$1,841,425,388	$1,954,890,770
Total assets	$1,960,816,500	$2,129,974,123
Total accounts payable	-17,115,907	-72,116,806
Net assets at market value	**$1,943,700,593**	**$2,057,857,317**
Net assets at actuarial value	**$2,127,834,406**	**$2,160,125,611**

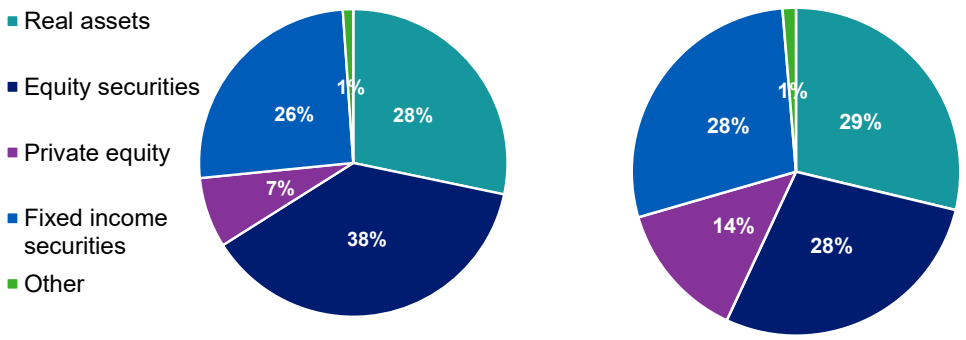


Exhibit F: Development of the Fund through December 31, 2020

Year Ended December 31	City Contributions	Employee Contributions	Net Investment Return[1]	Admin. Expenses[2]	Benefit Payments	Market Value of Assets at Year-End	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value
2011	$102,437,115	$19,493,460	-$54,844,275	$0	$188,829,489	$2,990,943,353	$3,378,481,222	113.0%
2012	103,310,264	22,490,884	292,719,981	0	203,099,511	3,206,364,971	3,795,024,584	118.4%
2013	105,711,435	26,044,579	243,514,011	0	218,884,493	3,362,750,503	3,877,321,261	115.3%
2014	109,791,512	28,969,429	-176,940,296	0	245,176,251	3,079,394,897	3,695,273,876	120.0%
2015	114,885,723	25,676,327	-254,829,470	0	285,003,174	2,680,124,303	2,680,124,303	100.0%
2016[3]	119,423,106	25,518,317	159,355,111	9,492,445	825,092,132	2,149,836,260	2,157,799,730	100.4%
2017	126,318,005	32,977,425	98,457,176	8,089,584	296,153,811	2,103,345,471	2,151,039,343	102.3%
2018	149,356,565	49,332,262	42,822,297	5,861,410	297,081,055	2,041,914,130	2,161,899,662	105.9%
2019	155,721,087	52,268,293	124,259,607	6,445,251	309,860,549	2,057,857,317	2,160,125,611	105.0%
2020	161,950,183	57,305,399	-8,927,336	6,534,350	317,950,620	1,943,700,593	2,127,834,406	109.5%

[1] On a market basis, net of investment fees and administrative expenses
[2] Administrative expenses were subtracted from net investment return prior to the 2016 valuation
[3] Unaudited assets were used for the January 1, 2017 actuarial valuation. When the audited financial statements were completed, there were updates to the employer contributions and investment return amounts, resulting in a revision to the market value of assets. Thus, the amounts shown above as of December 31, 2016 differ from the System's and City's Comprehensive Annual Financial Reports. The difference are immaterial to the System's actuarial results.

Exhibit G: Table of Amortization Bases

Type	Date Established	Initial Period	Initial Amount	Annual Payment[1]	Years Remaining	Outstanding Balance
2020 unfunded liability	01/01/2020	25	$2,563,846,869	$160,491,409	24	$2,568,086,883
Experience loss	01/01/2021	20	163,324,136	11,466,608	20	163,324,136
Change in assumptions	01/01/2021	20	256,721,167	18,023,796	20	256,721,167
Total				**$189,981,813**		**$2,988,132,186**

[1] Level percentage of payroll

Exhibit H: 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.

Section 3: Supplemental Information

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.
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 periodic required 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.

Section 3: Supplemental Information

Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Plan is calculated, including: Investment return - the rate of investment yield that the Plan will earn over the long-term future; Mortality rates - the rate or probability of death at a given age for employees and retirees; Retirement rates - the rate or probability of retirement at a given age or service; Disability rates - the rate or probability of disability retirement at a given age; Withdrawal rates - the rate or probability at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; Salary increase rates - 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.
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.

Section 3: Supplemental Information

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 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.
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.
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.

Section 4: Actuarial Valuation Basis

Exhibit I: Actuarial Assumptions and Actuarial Cost Method

Rationale for Assumptions	The information and analysis used by the Board in selecting each assumption that has a significant effect on the valuation is shown in the Experience Study Report for the five-year period ended December 31, 2019, with subsequent changes related to updated capital market assumptions.
Net Investment Return:	6.50% (previously, 7.00%). The net investment return assumption was chosen by the System's Board of Trustees, with input from the actuary. This 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:	**Rate (%)** **Year** / **Officers** / **Corporals, Drivers, Senior Officers & Chiefs** / **Sergeants, Lieutenants, Captains, Majors, Deputy Chiefs & Assistant Chiefs** 2020 – 2022: 3.25 / 3.00 / 2.50 2023+: 2.50 / 2.50 / 2.50 The salary scale assumption is based on the City's pay plan, along with analysis completed in conjunction with an Experience Study Report for the five-year period ended December 31, 2019 and the 2019 Meet and Confer Agreement.
Payroll Growth:	2.50%, used to amortize the unfunded actuarial accrued liability as a level percentage of payroll.
Cost-of-Living Adjustments:	*Prior to October 1, 2069:* 0.00% *Beginning October 1, 2069:* 2.00%, on original benefit The assumption for the year the COLA begins will be updated on an annual basis and set equal to the year the System is projected to be 70% funded on a market value basis after the COLA is reflected.

Section 4: Actuarial Valuation Basis

Funding Projections:

Payroll Growth:

For purposes of projecting the System's funded status to project when the System will reach 70% funded on a market value basis (and therefore meet COLA requirements), City contributions beginning January 1, 2025 are assumed to be 34.50% of the City's Hiring Plan projections. Beginning in 2038, after the end of the City's Hiring Plan projection, payroll is assumed to increase by 2.50%.

City's Hiring Plan Payroll Projection (in millions)

Year	Payroll	Year	Payroll
2017	$372	2028	$525
2018	364	2029	545
2019	383	2030	565
2020	396	2031	581
2021	408	2032	597
2022	422	2033	614
2023	438	2034	631
2024	454	2035	648
2025	471	2036	666
2026	488	2037	684
2027	507		

Market Value Asset Returns: 5.25% in 2021, 5.75% in 2022, 6.25% in 2023, and 6.50% annually thereafter

Administrative Expenses:

$8,500,000 per year, payable monthly (equivalent to $8,236,527 at the beginning of the year) or 1% of computation pay, if greater

Section 4: Actuarial Valuation Basis

Mortality Rates:

Healthy pre-retirement: Pub-2010 Public Safety Employee Amount-Weighted Mortality Table, set forward five years for males, projected generationally using Scale MP-2019

Healthy annuitants and dependent spouses: Pub-2010 Public Safety Retiree Amount-Weighted Mortality Table, set back one year for females, projected generationally using Scale MP-2019

Healthy contingent beneficiaries: Pub-2010 Public Safety Contingent Survivor Amount-Weighted Mortality Table, set back one year for females, projected generationally using Scale MP-2019

Disabled annuitants: Pub-2010 Public Safety Disabled Retiree Amount-Weighted Mortality Table, set forward four years for males and females, projected generationally using Scale MP-2019

The tables above, with adjustments as shown and projected to the measurement date, reasonably reflect the mortality experience of the System as of the measurement date. The mortality tables are then generationally projected using Scale MP-2019 to anticipate future mortality improvement.

Annuitant Mortality Rates:

	Rate (%)[1]			
	Healthy		Disabled	
Age	Male	Female	Male	Female
55	0.306	0.231	0.670	0.643
60	0.508	0.399	1.078	0.976
65	0.881	0.690	1.732	1.481
70	1.568	1.191	2.893	2.248
75	2.826	2.057	5.057	3.552
80	5.103	3.552	8.308	6.134
85	9.135	6.134	14.238	10.592
90	15.860	10.592	22.306	17.403

[1] Mortality rates shown for base table.

Section 4: Actuarial Valuation Basis

Mortality and Disability Rates Before Retirement:

	Rate (%)			
	Mortality[1]		Disabled[2]	
Age	Male	Female	Male	Female
20	0.037	0.016	0.010	0.010
25	0.041	0.020	0.015	0.015
30	0.047	0.027	0.020	0.020
35	0.059	0.036	0.025	0.025
40	0.082	0.049	0.030	0.030
45	0.120	0.067	0.035	0.035
50	0.175	0.091	0.040	0.040
55	0.264	0.123	--	--
60	0.410	0.168	--	--

[1] Mortality rates shown for base table

[2] 100% of disabilities are assumed to be service-related

Section 4: Actuarial Valuation Basis

Withdrawal Rates Before Retirement:

Years of Service	Rate (%)	
	Police	Fire
0	20.0	10.0
1	5.5	5.5
2	5.5	5.5
3	5.5	5.5
4	5.5	5.5
5	5.5	5.5
6	3.5	5.5
7	3.5	1.0
8	3.5	1.0
9	3.5	1.0
10	3.5	1.0
11-14	2.0	1.0
15-24	1.0	1.0
25 & over	0.0	0.0

Section 4: Actuarial Valuation Basis

Retirement Rates:

DROP Active Members

Age	Rate (%) Police	Fire
Under 50	1.00	0.75
50	10.00	0.75
51	15.00	0.75
52-53	15.00	10.00
54	25.00	10.00
55-57	25.00	15.00
58-62	30.00	40.00
63	40.00	50.00
64	50.00	50.00
65 & over	100.00	100.00

100% retirement rate after ten years in DROP.

Section 4: Actuarial Valuation Basis

Retirement Rates (continued):

Non-DROP Active Members

Age	Rate (%)	
	Member hired prior to March 1, 2011 with at least 20 years of service as of September 1, 2017	Member hired prior to March 1, 2011 with less than 20 years of service as of September 1, 2017 & Members hired on or after March 1, 2011
Under 50	1.0	1.0
50-51	8.0	2.0
52	10.0	2.0
53	15.0	2.0
54	20.0	2.0
55	35.0	2.0
56-57	40.0	2.0
58-60	75.0	25.0
61	75.0	50.0
62	100.0	100.0

100% retirement rate once benefit multiplier hits 90% maximum.

Weighted Average Retirement Age	Age 58, determined as follows: The weighted average retirement age for each participant is calculated as the sum of the product of each potential current or future retirement age times the probability of surviving from current age to that age and then retiring at that age, assuming no other decrements. The overall weighted retirement age is the average of the individual retirement ages based on all the active participants included in the January 1, 2021 actuarial valuation.
Retirement Rates for Inactive Vested Participants:	Terminated vested members who terminated prior to September 1, 2017 are assumed to retire at age 50 Terminated vested members who terminated on or after September 1, 2017 are assumed to retire at age 58 75% of members who terminated prior to age 40 are assumed to take a lump sum cash out at age 40
DROP Utilization:	No members are assumed to elect to enter the DROP
Interest on DROP Accounts:	2.75% on account balances as of September 1, 2017, payable upon retirement 0.00% on account balances accrued after September 1, 2017
DROP Payment Period:	Based on expected lifetime as of the later of September 1, 2017 or retirement date. Expected lifetime determined based on an 85% male/15% female blend of the current healthy annuitant mortality tables.

Section 4: Actuarial Valuation Basis

DROP Annuitization Interest:	2.75%. Based on United States Department of Commerce Daily Treasury Yield Curve Rates for durations between 5 and 30 years.
Actuarial Equivalence:	Actuarial equivalence for optional forms of benefit payments are based on an 85% male/15% female blend of the current healthy annuitant mortality tables, along with an interest rate of 6.50%
Unknown Data for Members:	Same age and service as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Family Composition:	75% of participants are assumed to be married. Females are assumed to be three years younger than males. The youngest child is assumed to be ten years old.
Benefit Election:	Married participants are assumed to receive the Joint and Survivor annuity form of payment and non-married participants are assumed to receive a Life Only annuity.
Actuarial Value of Assets:	Set to market value of assets as of December 31, 2015. Thereafter, market value of assets less unrecognized returns in each of the last five years beginning with 2016. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a five-year period, further adjusted, if necessary, to be within 20% of the market value.
Actuarial Cost Method:	Entry Age Actuarial Cost Method. Entry Age is the age at the time the member commenced employment. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis, with Normal Cost determined using the plan of benefits applicable to each participant. Actuarial Liability is allocated by salary.
Amortization Methodology:	The unfunded actuarial accrued liabiity as of January 1, 2020 is amortized on a closed, 25-year period. Beginning January 1, 2021, each year's gains and losses are amortized over a closed, 20-year period. Amortization is on a level-percentage-of-pay basis.
Justification for Change in Actuarial Assumptions and Methods:	Based on past experience and future expectations, the following actuarial assumptions were changed: • The net investment return assumption was lowered from 7.00% to 6.50% • The ad-hoc COLA assumption was updated to begin October 1, 2069 based on the updated projection of the unfunded actuarial accrued liability; last year, the COLA was assumed to begin October 1, 2063. As a result of an amendment to the System's funding policy, the amortization methodology was changed as follows: • Effective with the January 1, 2021 actuarial valuation, future gains and losses, along with assumption, plan, and method changes, will be amortized over closed, 20-year periods.

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

Members whose Participation Began Before March 1, 2011

Normal Retirement:	**Benefit Earned Prior to September 1, 2017:** • *Age Requirement:* 50 • *Service Requirement:* 5 • *Amount:* Greater of 3.0% of Average Computation Pay times years of Pension Service (maximum 96.0%) and $2,200 per month. The $2,200 per month minimum benefit is prorated if the Member retires with less than 20 years of service. • *Average Computation Pay:* 36 consecutive months that reflect the highest civil service rank held by a member, plus Educational Incentive Pay, Longevity Pay and City Service Incentive Pay **Benefit Earned Beginning September 1, 2017:** • *Age Requirement:* 58 • *Service Requirement:* 5 • *Amount:* Greater of 2.5% of Average Computation Pay times years of Pension Service (maximum 90.0%) and $2,200 per month. The $2,200 per month minimum benefit is prorated if the Member retires with less than 20 years of service. • *Average Computation Pay:* 60 consecutive months that reflect the highest civil service rank held by a member, plus Educational Incentive Pay, Longevity Pay and City Service Incentive Pay

20 and Out Reduced Retirement:

If Eligible as of September 1, 2017:

- *Age Requirement:* None
- *Service Requirement* 20 years
- *Amount:* 20 & Out Multiplier times 36-month (Table 1 Benefit) or 60-month (Table 2 Benefit) Average Computation Pay times years of Pension Service

Benefit Accrued Before September 1, 2017

20 & Out Table 1

Age	20 & Multiplier
45 & under	2.00%
46	2.25%
47	2.50%
48	2.75%
49	2.75%
50 & above	3.00%

Benefit Accrued Beginning September 1, 2017

20 & Out Table 2

Age	20 & Multiplier
53 & under	2.00%
54	2.10%
55	2.20%
56	2.30%
57	2.40%
58 & above	2.50%

If Not Eligible as of September 1, 2017:

- *Age Requirement:* None
- *Service Requirement* 20 years
- *Amount:* 20 & Out Multiplier times 60-month Average Computation Pay times years of Pension Service

20 & Out Table 2

Age	20 & Multiplier
53 & under	2.00%
54	2.10%
55	2.20%
56	2.30%
57	2.40%
58 & above	2.50%

Section 4: Actuarial Valuation Basis

Early Retirement:	If at least age 45 as of September 1, 2017 and less than age 50 • *Age Requirement:* 45 • *Service Requirement:* 5 • *Amount:* Normal pension accrued prior to September 1, 2017 plus the benefit accrued based on the 20 & Out Table 2 for service beginning September 1, 2017, reduced by 2/3 of 1% for each whole month by which the benefit commencement date precedes age 50.
Non-Service Connected Disability:	• *Eligibility:* Injury or illness (lasting more than 90 days) not related to or incurred while in the performance of the member's job, preventing the member from performing their departmental duties. • *Amount:* 3% of Average Computation Pay for service earned prior to September 1, 2017 and the applicable benefit multiplier from 20 & Out Table 2 times Average Computation Pay for service earned beginning September 1, 2017
Service Connected Disability:	• *Eligibility:* Injury or illness (lasting more than 90 days) obtained while on duty in the performance of the member's job. • *Amount:* 3% of Average Computation Pay for service earned prior to September 1, 2017 and the applicable benefit multiplier from 20 & Out Table 2 times Average Computation Pay for service earned beginning September 1, 2017; if the member has less than 20 years of service, the benefit will be calculated as if they had 20 years at the time of disability.
Benefit Supplement:	• *Age Requirement:* 55 • *Service Requirement:* 20 years, waived if member is receiving a service-connected disability • *Amount:* 3% of the total monthly benefit (including any applicable COLA's) payable to the Member when the Member attains age 55. The benefit supplement shall not be less than $75 per month. • Beginning September 1, 2017, only those annuitants and their survivors already receiving the supplement will be eligible to maintain their current supplement, which will not change ongoing; no additional retirees will be eligible for the supplement.
Termination Benefit:	• *With less than five years of pension service:* Upon request, the member's contributions will be returned without interest • *With at least five years of pension service:* The member may either withdraw contributions or leave contributions in the Plan and receive a monthly benefit to commence no earlier than the member's earliest eligibility for retirement benefits. Retirement benefit is equal to the accrued benefit as of the date of termination.
Pre-Retirement Death Benefit:	• *While in active service:* The greater of 50% of the Member's accrued benefit or a benefit based on 20 years of service. The benefit may not exceed 45% of Average Computation Pay. • *After leaving active service, with fewer than five years:* A lump sum benefit equal to the return of member contributions without interest • *After leaving active service, with at least five years:* 50% of the Member's accrued benefit, with no early retirement reduction, or a refund of member contributions

Section 4: Actuarial Valuation Basis

Post-Retirement Death Benefit:	50% or 100% of the pension the Member was receiving at the time of their death, depending on the form of joint and survivor annuity chosen; if there are no qualifying survivors, no further benefits will be paid
Qualified Surviving Children Benefit:	50% of the pension the Member was receiving at the time of their death, divided equally among the children, paid until the youngest child is 19 years old or for life if the child becomes disabled prior to age 23
Minimum Survivor Benefit:	$1,100 per month, not to exceed the actual amount the Member was receiving upon their death. If there are no Qualified Surviving Children, the minimum benefit to a spouse who is a Qualified Survivor shall be $1,200 per month. If the Member had less than 20 years of Pension Service, the minimum benefit will be prorated based on actual years of Pension Service.
Special Survivor Benefit	• *Eligibility:* Upon leaving active service or joining DROP: a) the Member was at least 55 years old with at least 20 years of pension service, or b) the sum of the Member's age plus Pension Service was at least 78; **and** Has no Qualified Surviving Children or disabled children currently eligible for survivor benefits; **and** Whose Qualified Surviving Spouse is at least 55 years old. The Qualified Surviving Spouse does not have to be 55 years old at the time of the Member's death. • *Amount:* Once all the eligibility conditions are met, the amount the Qualified Surviving Spouse will receive increases from 50% of the Member's pension benefit to a percentage of the Member's pension benefit based on the Member's applicable benefit multiplier times the number of years of Pension Service the Member worked.
Survivor Benefit if No Qualified Surviving Spouse:	A lump sum that is the actuarial equivalent of 120 monthly payments of the greater of: 50% of the Member's pension benefit at the time of their death, or a benefit based on 20 years of the Member's service.
DROP:	• *Eligibility:* Members in active service who are retirement eligible may elect to enter the Deferred Retirement Option Plan (DROP). • *Distribution:* The DROP account balance will be paid over the expected future lifetime of annuitants. • *Interest:* Based on United States Department of Commerce Daily Treasury Yield Curve Rates for durations between 5 and 30 years; interest rate is based on the expected lifetime of the members at the time they retire. Interest is only paid on DROP account balances as of September 1, 2017.

Members whose Participation Began On or After March 1, 2011

Normal Retirement:	• *Age Requirement:* 58 • *Service Requirement:* 5 • *Amount:* 2.5% of Average Computation Pay for each year of Pension Service, maximum 90% The minimum monthly benefit is $110 times the number of years of Pension Service at retirement, but not greater than $2,200. • *Average Computation Pay:* Average Computation Pay uses the 60 consecutive months that reflects the highest civil service rank held by a member plus Educational Incentive Pay plus Longevity Pay plus City Service Incentive Pay.
Early Retirement:	• *Age Requirement:* 53 • *Service Requirement:* 5 • *Amount:* Normal pension accrued, reduced by 2/3 of 1% for each whole month by which the benefit commencement date precedes the normal retirement date.
20 and Out Reduced Retirement:	• *Age Requirement:* None • *Service Requirement:* 20 years • *Amount:* 20 & Out Multiplier times Average Computation Pay times years of Pension Service
Non-Service Connected Disability:	• *Eligibility:* Injury or illness (lasting more than 90 days) not related to or incurred while in the performance of the member's job, preventing the member from performing their departmental duties. • *Amount:* The Member's accrued benefit, but not less than a pro-rated minimum benefit.
Service Connected Disability:	• *Eligibility:* Injury or illness (lasting more than 90 days) obtained while on duty in the performance of the member's job. • *Amount:* The greater of 50% of Average Computation Pay and the Member's accrued benefit; if the member has less than 20 years of service, the benefit will be calculated as if they had 20 years of service at the time of disability.

20 & Out Table 2

Age	20 & Multiplier
53 & under	2.00%
54	2.10%
55	2.20%
56	2.30%
57	2.40%
58 & above	2.50%

Section 4: Actuarial Valuation Basis

Termination Benefit:	• *With less than five years of pension service:* Upon request, the member's contributions will be returned without interest • *With at least five years of pension service:* The member may either withdraw contributions or leave contributions in the Plan and receive a monthly benefit to commence no earlier than the member's earliest eligibility for retirement benefits. Retirement benefit is equal to the accrued benefit as of the date of termination.
Pre-Retirement Death Benefit:	• *While in active service:* The greater of 50% of the Member's accrued benefit or a benefit based on 20 years of service. The benefit may not exceed 45% of Average Computation Pay. • *After leaving active service, with fewer than five years:* A lump sum benefit equal to the return of member contributions without interest • *After leaving active service, with at least five years:* 50% of the Member's accrued benefit, with no early retirement reduction, or a refund of member contributions
Post-Retirement Death Benefit:	50% or 100% of the pension the Member was receiving at the time of their death, depending on the form of joint and survivor annuity chosen; if there are no qualifying survivors, no further benefits will be paid
Qualified Surviving Children Benefit:	50% of the pension the Member was receiving at the time of their death, divided equally among the children, paid until the youngest child is 19 years old or for life if the child becomes disabled prior to age 23
Minimum Survivor Benefit:	$1,100 per month, not to exceed the actual amount the Member was receiving upon their death. If there are no Qualified Surviving Children, the minimum benefit to a spouse who is a Qualified Survivor shall be $1,200 per month. If the Member had less than 20 years of Pension Service, the minimum benefit will be prorated based on actual years of Pension Service.
Special Survivor Benefit	• *Eligibility:* Upon leaving active service or joining DROP: a) the Member was at least 55 years old with at least 20 years of pension service, or b) the sum of the Member's age plus Pension Service was at least 78; **and** Has no Qualified Surviving Children or disabled children currently eligible for survivor benefits; **and** Whose Qualified Surviving Spouse is at least 55 years old. The Qualified Surviving Spouse does not have to be 55 years old at the time of the Member's death. • *Amount:* Once all the eligibility conditions are met, the amount the Qualified Surviving Spouse will receive increases from 50% of the Member's pension benefit to a percentage of the Member's pension benefit based on the Member's applicable benefit multiplier times the number of years of Pension Service the Member worked.
Survivor Benefit if No Qualified Surviving Spouse:	A lump sum that is the actuarial equivalent of 120 monthly payments of the greater of: 50% of the Member's pension benefit at the time of their death, or a benefit based on 20 years of the Member's service.
DROP:	• *Eligibility:* Members in active service who are retirement eligible may elect to enter the Deferred Retirement Option Plan (DROP). • *Distribution:* The DROP account balance will be paid over the expected future lifetime of annuitants. • *Interest:* Based on United States Department of Commerce Daily Treasury Yield Curve Rates for durations between 5 and 30 years; interest rate is based on the expected lifetime of the members at the time they retire. Interest is only paid on DROP account balances as of September 1, 2017.

All Members

Cost of Living:	The Board may grant an ad hoc COLA based on the actual market return over the prior five years less 5%, not to exceed 4% of the base benefit, if, after granting a COLA, the funded ratio on a market value of assets basis is no less than 70%.
Member Contributions:	13.5% of computation pay for all members
City Contributions:	The City will contribute 34.5% of computation payroll each year. However, in no case shall the City's total contribution amount be less than: $5,173,000 for the biweekly pay periods beginning with the first biweekly pay period that begins after September 1, 2017 and ends on the last day of the first biweekly pay period that ends after December 31, 2017; $5,344,000 for the following 26 pay periods; $5,571,000 for the following 26 pay periods; $5,724,000 for the following 26 pay periods; $5,882,000 for the following 26 pay periods; $6,043,000 for the following 26 pay periods; $5,812,000 for the following 26 pay periods; and $6,024,000 for the following 26 pay periods. An additional 1/26th of $13 Million will be paid biweekly beginning with the first biweekly pay period that begins after September 1, 2017 and ending with the last biweekly pay period that ends after December 31, 2024.
Optional Forms of Benefits:	50% or 100% Joint and Survivor Pension

Section 5: GASB Information

Exhibit 1: Net Pension Liability

The components of the net pension liability at December 31, 2020 were as follows:

Total pension liability	$5,122,372,419
Plan fiduciary net position	1,943,700,593
Net pension liability	3,178,671,826
Plan fiduciary net position as a percentage of the total pension liability	37.95%

Actuarial assumptions. The total pension liability was determined by an actuarial valuation as of January 1, 2021, using the following actuarial assumptions, applied to all periods included in the measurement:

Inflation	2.50%
Real rate of return	4.00%
Investment rate of return	6.50%, net of pension plan investment expense, including inflation

Other assumptions used to determine the total pension liability are based on the results of an experience study for the period January 1, 2015 through December 31, 2019 and are detailed in Section 4, Exhibit I of this report.

Section 5: GASB Information

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of December 31, 2020 are summarized in the following table:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return[1]
Global Equity	40%	6.80%
Emerging Market Equity	10%	9.20%
Private Equity	5%	10.55%
Short-Term Investment Grade Bonds	12%	-0.10%
Investment Grade Bonds	4%	0.40%
High Yield Bonds	4%	3.10%
Global Bonds	4%	0.50%
Bank Loans	4%	2.30%
Emerging Markets Debt	4%	3.30%
Real Estate	5%	3.65%
Natural Resources	5%	7.90%
Cash	3%	-0.20%
Total	100%	

[1] The real rates of return are provided by Segal Marco Advisors and are net of inflation.

Discount rate: The discount rate used to measure the total pension liability was 6.50%. The projection of cash flows used to determine the discount rate assumed City contributions will be made in accordance with the provisions of House Bill 3158, including statutory minimums through 2024 and 34.50% of computation pay thereafter. Members are expected to contribute 13.50% of computation pay. For cash flow purposes, projected payroll is based on 90% of the City's Hiring Plan payroll projections through 2037, increasing by 2.50% per year thereafter. This payroll projection is used for cash flow purposes only and does not impact the Total Pension Liability. The normal cost rate for future members is assumed to be 15.66% for all years. Based on these assumptions, the System's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Therefore, the long-term expected rate of return on pension plan investments was applied to all periods of projected benefit payments to determine the total pension liability.

With this year's valuation, the long-term expected rate of return on investments was lowered from 7.00% to 6.50%.

Actuarial cost method: In accordance with GASB 67, the Total Pension Liability for active members is valued as the total present value of benefits once they enter the DROP. For the funding valuation, the liability for these members accumulates from their entry age until they are assumed to leave active service.

Discount rate sensitivity

Sensitivity of the net pension liability to changes in the discount rate. The following presents the net pension liability, calculated using the discount rate of 6.50%, as well as what the net pension liability would be if it were calculated using a discount rate that is one-percentage-point lower (5.50%) or one-percentage-point higher (7.50%) than the current rate:

	1% Decrease (5.50%)	Current Discount (6.50%)	1% Increase (7.50%)
Net pension liability	$3,787,842,513	$3,178,671,826	$2,672,601,865

Exhibit 2: Schedule of Changes in Net Pension Liability

	2020	2019
Total pension liability		
• Service cost	$56,244,288	$49,154,908
• Interest	324,046,016	318,702,388
• Change of benefit terms	0	0
• Differences between expected and actual experience	70,547,951	16,723,223
• Changes of assumptions	257,524,962	155,569,477
• Benefit payments, including refunds of employee contributions	-317,950,620	-309,860,549
Net change in total pension liability	**$390,412,597**	**$230,289,447**
Total pension liability – beginning	**4,731,959,822**	**4,501,670,375**
Total pension liability – ending (a)	**$5,122,372,419**	**$4,731,959,822**
Plan fiduciary net position		
• Contributions – employer	$161,950,183	$155,721,087
• Contributions – employee	57,305,399	52,268,293
• Net investment income	-8,927,336	124,259,607
• Benefit payments, including refunds of employee contributions	-317,950,620	-309,860,549
• Administrative expense	-6,534,350	-6,445,251
Net change in plan fiduciary net position	**-$114,156,724**	**$15,943,187**
Plan fiduciary net position – beginning	**2,057,857,317**	**2,041,914,130**
Plan fiduciary net position – ending (b)	**$1,943,700,593**	**$2,057,857,317**
Net pension liability – ending (a) – (b)	**$3,178,671,826**	**$2,674,102,505**
Plan fiduciary net position as a percentage of the total pension liability	**37.95%**	**43.49%**
Covered payroll	**$427,440,530**	**$396,954,743**
Net pension liability as percentage of covered payroll	**743.65%**	**673.65%**

Notes to Schedule:

Benefit changes: None.

Change of Assumptions: The assumption changes in 2019 were based on the recommendations in the experience study for the period January 1, 2015 to December 31, 2019 and included lowering the discount rate from 7.25% to 7.00% and changes to the salary scale, mortality rates, withdrawal rates, retirement rates, and DROP annuitization rates. The expected COLA start date was also updated from October 1, 2050 to October 1, 2063. The assumption changes in 2020 include lowering the discount rate from 7.00% to 6.50% and updating the expected COLA start date from October 1, 2063 to October 1, 2069.

Exhibit 3: Schedule of Employer Contributions

Year Ended December 31	Actuarially Determined Contributions	Contributions in Relation to the Actuarially Determined Contributions[1]	Contribution Deficiency (Excess)	Covered Payroll	Contributions as a Percentage of Covered Payroll
2015[2]	- -	$114,885,723	- -	$383,006,330	30.00%
2016	$261,859,079	119,345,000	$142,514,079	365,210,426	32.68%
2017	168,865,484	126,318,005	42,547,479	357,414,472	35.34%
2018	157,100,128	149,356,565	7,743,563	346,036,690	43.16%
2019	152,084,297	155,721,087	-3,636,790	363,117,415	42.88%
2020	185,428,764	161,950,183	23,478,581	396,954,743	40.80%

Notes to Schedule:

Methods and assumptions used to establish "actuarially determined contribution" rate for year ended December 31, 2020; these are not the same assumptions used in the January 1, 2021 actuarial valuation or for the Total Pension Liability measured as of December 31, 2020:

Valuation date	Actuarially determined contribution is calculated using a January 1, 2020 valuation date as of the beginning of the fiscal year in which contributions are reported
Actuarial cost method	Entry age
Amortization method	25-year level percent of payroll, using 2.50% annual increases
Remaining amortization period	55 years as of January 1, 2020
Asset valuation method	Market value of assets less unrecognized returns in each of the last five years. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a five-year period, further adjusted, if necessary, to be within 20% of the market value.
Investment rate of return	7.00%, including inflation, net of pension plan investment expense
Inflation rate	2.50%

[1] The City's contributions are based on statutory rates set by State law and not Actuarially Determined Contributions.
[2] The Actuarially Determined Contribution was not directly calculated as a dollar amount by the prior actuary for 2015.

Section 5: GASB Information

Projected salary increases	Inflation plus merit increases, varying by group and year
Retirement rates	Group-specific rates based on age
Cost-of-living adjustments	2.00% simple increases starting October 1, 2063
Mortality:	
Pre-retirement	Pub-2010 Public Safety Employee Amount-Weighted Mortality Table, set forward five years for males, projected generationally using Scale MP-2019
Healthy annuitant and dependent spouses	Pub-2010 Public Safety Retiree Amount-Weighted Mortality Table, set back one year for females, projected generationally using Scale MP-2019
Healthy contingent beneficiaries	Pub-2010 Public Safety Contingent Survivor Amount-Weighted Mortality Table, set back one year for females, projected generationally using Scale MP-2019
Disabled	Pub-2010 Public Safety Disabled Retiree Amount-Weighted Mortality Table, set forward four years for males and females, projected generationally using Scale MP-2019
Other information	See Section 4 of the January 1, 2020 actuarial valuation for a full outline of assumptions. See Exhibit 2 of this section for the history of changes to plan provisions and assumptions over the last two years.
DROP utilization	0% of Police and Fire members are assumed to elect to enter DROP
Interest on DROP Accounts	Beginning January 1, 2018, 2.75% payable upon retirement on active account balances as of September 1, 2017