Houston Firefighters' Relief and Retirement Fund

Investing for Firefighters and Their Families

March 24, 2023

Amy Cardona
Texas Pension Review Board
300 West 15th Street, Suite 406
Austin, TX 78717

Re: HFRRF RSVS

Dear Ms. Cardona

Please find attached the Houston Firefighters' Relief and Retirement Fund's ("HFRRF") final Risk Sharing Valuation Study ("RSVS") as of July 1, 2022, which develops the estimated municipal contribution rate for FY 2024. HFRRF's and the City's estimated municipal contribution rate were within two percentage points; therefore, HFRRF's RSVS is considered to be the final RSVS for FY 2024.

However, since the estimated municipal contribution rate for FY 2024 was less than the initial RSVS' minimum contribution rate of 26.89% and HFRRF's statutory funded ratio exceeded 90% (but was less than 100%), required adjustments under §13E(c) of HFRRF's governing statute have been implemented. Please note that (i) adjusting the actuarial value of assets equal to the current market value of assets under §13E(c)(1) would not have caused the municipal contribution rate to increase, and (ii) an agreement was not reached with the City under section §13E(c)(2) or (3) by April 30th. Consequently, HFRRF has accelerated the payoff year of the legacy liability to the extent required to increase the estimated municipal contribution rate to equal the minimum contribution rate in accordance with §13E(c)(4). Accordingly, the final RSVS attached includes an addendum to the RSVS to demonstrate the accelerated payoff.

Sincerely,

Tim Schauer
Executive Director

200 Plaza Drive, 1st Floor
Secaucus, NJ 07094

March 24, 2023

Mr. Brett Besselman, Chairman of Board of Trustees
Mr. Tim Schauer, Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, Texas 77032

Re: Addendum to the July 1, 2022 Proposed Risk Sharing Valuation Study

This addendum is incorporated and made part of the attached July 1, 2022 Proposed Risk Sharing Valuation Study (Proposed RSVS) for the Houston Firefighters' Relief and Retirement Fund (Fund). Unless otherwise stated, the results presented in this addendum were prepared using the same data, methods and actuarial assumptions that have been used for the Proposed RSVS. Please refer to the Proposed RSVS report for all the other assumptions, methods and caveats related to this addendum.

Buck published its Proposed RSVS on November 18, 2022 pursuant to our engagement to provide actuarial services to the Fund. The Proposed RSVS developed the estimated municipal contribution rate for fiscal year ending June 30, 2024 (FY 2024). The Proposed RSVS was prepared, as required under Senate Bill 2190[1], for the Fund as of July 1, 2022. The Proposed RSVS reflects the benefit provisions of the Fund as amended by and funding policies mandated by Senate Bill 2190, but without regard to Section 13E.

Since the Fund's and the City's estimated municipal contribution rate were within two percentage points, the Fund's RSVS (the Proposed RSVS) is considered to be the final July 1, 2022 RSVS. However, since the estimated FY 2024 municipal contribution rate of 23.15% was less than the initial RSVS' FY 2024 minimum contribution rate of 26.89% and the Fund's statutory funded level of 95.4% exceeded 90.0% (but was less than 100%), this addendum presents the implementation of the required adjustments under §13E(c) of HFRRF's governing statute, as follows:

i. Adjusting the actuarial value of assets equal to the current market value of assets under §13E(c)(1) does not cause the municipal contribution rate to increase;

ii. An agreement was not reached between the Fund and the City under §13E(c)(2) and §13E(c)(3) by April 30th;

iii. Consequently, the Fund has accelerated the payoff year of the legacy liability to the extent required to increase the estimated municipal contribution rate to equal the minimum contribution rate in accordance with §13E(c)(4).

[1] This Risk Sharing Valuation Study has been provided without waiving the Fund's right to litigate the constitutionality of SB2190.

The following sections of the Proposed RSVS have been revised, in accordance with §13E(c) of HFRRF's governing statute.

Revised Amortization Schedule as of July 1, 2022 ($000) (Original on page 3 of Proposed RSVS)

Plan Year Ending	Initial Liability Layer	Liability Layer as of July 1, 2022	Remaining Amortization Payments as of July 1, 2022	Payment for Fiscal Year 2024	As a % of Fiscal Year 2024 Payroll[1]
June 30, 2016	$ 900,223	$ 1,006,958	7.68	$ 148,518	54.75%
June 30, 2017	(19,325)	(21,375)	7.68[2]	(3,153)	(1.16)%
June 30, 2018	(32,368)	(35,441)	7.68[2]	(5,227)	(1.93)%
June 30, 2019	(61,676)	(66,928)	7.68[2]	(9,871)	(3.64)%
June 30, 2020	(190,421)	(205,049)	7.68[2]	(30,243)	(11.15)%
June 30, 2021	(342,733)	(366,724)	7.68[2]	(54,089)	(19.94)%
June 30, 2022	(79,662)	(79,662)	7.68[2]	(12,993)	(4.79)%
Total		$ 231,779		$ 32,942	12.14%

Revised Risk Sharing Valuation Results[3] (Original on page 1 of Proposed RSVS)

($000)	2021 Risk Sharing Valuation Results	2022 Risk Sharing Valuation Results: Proposed RSVS (Published November 18, 2022)	2022 Risk Sharing Valuation Results: Adjustments in accordance with §13E(c)(4)
Present Value of Future Benefits	$ 5,562,116	$ 5,774,144	$ 5,774,144
Actuarial Accrued Liability	$ 4,881,608	$ 5,075,516	$ 5,075,516
Actuarial Value of Assets	$ 4,550,468	$ 4,843,737	$ 4,843,737
Unfunded Accrued Liability	$ 331,140	$ 231,779	$ 231,779
Funded Ratio	93.2%	95.4%	95.4%
City Normal Cost Rate[4]	14.98%	14.75%	14.75%
City Accrued Liability Rate	11.91%	8.40%	12.14%
Total City Contribution Rate[5]	26.89%	23.15%	26.89%
Estimated City Contribution for following Fiscal Year	$ 69,617	$ 62,800	$ 72,946
Employee Contribution Rate	10.50%	10.50%	10.50%

[1] Based on projected pensionable compensation of $271,274,000

[2] Per SB 2190, the amortization period for a new liability gain layer is equal to the remaining amortization period on the largest remaining liability loss layer.

[3] This Risk Sharing Valuation Study has been provided without waiving the Fund's right to litigate the constitutionality of SB2190.

[4] Contains an allowance for administrative expenses equal to 1.25% of payroll

[5] As a percentage of pensionable compensation.

Actuarial Certification

We certify that the information contained in this addendum to the July 1, 2022 Proposed RSVS has been prepared in accordance with the appropriate Actuarial Standards of Practice. Unless otherwise stated, the results presented herein were prepared using the same data, methods and actuarial assumptions that have been used for the Proposed RSVS. A summary of the actuarial assumptions and methods, major Fund provisions, and Fund participant data used to calculate the results of this study can be found in the appendices of the attached July 1, 2022 Proposed RSVS report. Please refer to the same Proposed RSVS for the applicable disclosures under Actuarial Standards of Practice ("ASOPs") 27, 35, 51 and 56.

In addition to the ASOP 51 "Contribution risk" discussion, the implementation of Section 13E accelerates the amortization of the Fund's liability layers and establishes a contribution rate that is greater than determined by the Proposed RSVS. If future contributions are established in this manner at levels greater than those presented in the Proposed RSVS, the Fund may achieve a fully funded position earlier than the 30-year time horizon contemplated in the statute based on the data, assumptions and methods set forth in the Proposed RSVS. On the other hand, the shorter amortization period may significantly increase future actuarially determined contributions, increasing the risk that such amounts are not contributed.

I am a Fellow of the Society of Actuaries and Member of the American Academy of Actuaries. I meet the Academy's Qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

If you have any questions concerning this information, please let me know.

Respectfully submitted,

Buck Global, LLC

Michael A. Ribble, FSA, EA, MAAA, FCA
Principal, Consulting Actuary

Attached: July 1, 2022 Proposed Risk Sharing Valuation Study dated November 18, 2022

200 Plaza Drive, 1st Floor
Secaucus, NJ 07094

November 18, 2022

Mr. Brett Besselman, Chairman of Board of Trustees
Mr. Tim Schauer, Executive Director
Houston Firefighters' Relief and Retirement Fund
4225 Interwood North Parkway
Houston, Texas 77032

Re: Proposed Risk Sharing Valuation Study

Dear Brett and Tim:

Pursuant to our engagement to provide actuarial services to the Houston Firefighters' Relief and Retirement Fund (Fund), we have prepared this Risk Sharing Valuation Study, as required under Senate Bill 2190[1], for the Fund as of July 1, 2022. This reflects the benefit provisions of the Fund as amended by, as well as funding policies mandated by, Senate Bill 2190 without regard to Section 13E. For comparison purposes the 2021 Risk Sharing Valuation Results shown below are based on adjustments in accordance with §13E(c)(4) per our Addendum dated June 8, 2022.

Risk Sharing Valuation Results[1]

($000)	2022 Risk Sharing Valuation Results	2021 Risk Sharing Valuation Results[2]
Present Value of Future Benefits	$ 5,774,144	$ 5,562,116
Actuarial Accrued Liability	$ 5,075,516	$ 4,881,608
Actuarial Value of Assets	$ 4,843,737	$ 4,550,468
Unfunded Accrued Liability	$ 231,779	$ 331,140
Funded Ratio	95.4%	93.2%
City Normal Cost Rate[3]	14.75%	14.98%
City Accrued Liability Rate	8.40%	11.91%
Total City Contribution Rate[4]	23.15%	26.89%
Estimated City Contribution for following Fiscal Year	$ 62,800	$ 69,617
Employee Contribution Rate	10.50%	10.50%

[1] This Risk Sharing Valuation Study has been provided without waiving the Fund's right to litigate the constitutionality of SB2190.
[2] As adjusted in accordance with §13E(c)(4).
[3] Contains an allowance for administrative expenses equal to 1.25% of payroll.
[4] As a percentage of pensionable compensation

As shown in the table above, the proposed Risk Sharing Valuation Study results in a funded ratio that exceeds 90% and a City contribution rate of 23.15%, which is less than the Initial Risk Valuation Study Corridor Minimum of 26.89%. In accordance with Section 13E of Senate Bill 2190, potential changes in the actuarial value of assets, assumed rate of return, benefit levels, or the acceleration of the amortization period to payoff liability loss layers may be required.

Development of the Actuarial Value of Assets ($000)

Actuarial Investment Gain (Loss)

	Fiscal Year End June 30, 2022
Market Value of Assets at beginning of year	$ 5,256,763
Net Cash Flow	
Contributions	$ 112,293
Disbursements	275,842
Net Cash Flow	$ (163,549)
Expected Investment Return	$ 362,346
Expected Market Value of Assets at end of year	$ 5,455,560
Market Value of Assets at end of year	$ 5,093,736
Investment Gain / (Loss)	$ (361,824)

Schedule of Actuarial Investment Gains (Losses)

Plan Year Ending	Initial Actuarial Gain (Loss)	Current Year Recognized Gain (Loss)	Unrecognized Gain (Loss) As of July 1, 2022
June 30, 2018	46,641	$ 9,328	$ 0
June 30, 2019	(64,836)	(12,967)	(12,967)
June 30, 2020	(204,992)	(40,998)	(81,997)
June 30, 2021	1,057,370	211,474	634,422
June 30, 2022	(361,824)	(72,365)	(289,459)
			$ 249,999

Actuarial Value of Assets

Market Value as of July 1, 2022	$ 5,093,736
(Gain) / Loss to be Recognized in Future Years	(249,999)
Actuarial Value as of July 1, 2022	$ 4,843,737

Change in Key Results since the Prior Risk Sharing Valuation ($000)

Analysis of Change in Unfunded Liability	2021/2022
Unfunded at Beginning of Period	$ 331,140
Estimated Change Due to Normal Operation	
Normal Cost	$ 60,907
Contributions	(112,293)
Administrative Expenses	5,243
Interest	21,591
Net Change	$ (24,552)
Estimated Change due to Actuarial Experience	
Actuarial (gain) loss from asset sources	$ (143,913)
Actuarial (gain) loss from liability sources	69,104
Net change	$ (74,809)
Unfunded Actuarial Accrued Liability at End of Period	$ 231,779

Development of Liability Layer for Plan Year Ending June 30, 2022

Source	Amount ($000)
Actuarial Value of Assets (Gain)/Loss	$ (143,913)
Actuarial Accrued Liability (Gain)/Loss	69,104
Impact of Assumption Changes	0
Contributions Different than Expected	(4,853)
Total	$ (79,662)

Amortization Schedule as of July 1, 2022 ($000)

Plan Year Ending	Initial Liability Layer	Liability Layer as of July 1, 2022	Remaining Amortization Payments as of July 1, 2022	Payment for Fiscal Year 2024	As a % of Fiscal Year 2024 Payroll[2]
June 30, 2016	$ 900,223	$ 1,006,958	12	$ 102,677	37.85%
June 30, 2017	(19,325)	(21,375)	12[1]	(2,180)	(0.80)%
June 30, 2018	(32,368)	(35,441)	12[1]	(3,614)	(1.33)%
June 30, 2019	(61,676)	(66,928)	12[1]	(6,824)	(2.52)%
June 30, 2020	(190,421)	(205,049)	12[1]	(20,908)	(7.71)%
June 30, 2021	(342,733)	(366,724)	12[1]	(37,394)	(13.78)%
June 30, 2022	(79,662)	(79,662)	12[1]	(8,983)	(3.31)%
Total		$ 231,779		$ 22,774	8.40%

[1] Per SB 2190, the amortization period for a new liability gain layer is equal to the remaining amortization period on the largest remaining liability loss layer.

[2] Based on projected pensionable compensation of $271,274,000.

Actuarial Certification

We certify that the information contained in this Risk Sharing Valuation Study has been prepared in accordance with the appropriate Actuarial Standards of Practice. To the best of our knowledge, the information fairly presents the actuarial position of the Houston Firefighters' Relief & Retirement Fund as of July 1, 2022 on the basis of the actuarial assumptions, methods and Fund provisions set forth herein.

The Board of Trustees of the Fund may use this report for discussing and reaching consensus with the City of Houston on the City Contribution Rate. Use of this report for any other purpose or by anyone other than the Board or the City of Houston may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. Because of the risk of misinterpretation of actuarial results, Buck recommends requesting an advance review of any statement, document, or filing to be based on information contained in this report. Buck will accept no liability for any such statement, document or filing made without prior review by Buck.

Future actuarial measurements may differ significantly from current measurements due to Fund experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in Fund provisions or applicable law. An analysis of the potential range of such future differences is beyond the scope of this Risk Sharing Valuation Study.

Where presented, references to "funded ratio" and "unfunded accrued liability" typically are measured on an actuarial value of assets basis. It should be noted that the same measurements using market value of assets could result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the Fund if the Fund were to settle a portion or all of its liabilities.

In preparing the actuarial results, we have relied upon information provided by the Board of Trustees as of July 1, 2022 regarding Fund provisions, Fund participants, Fund assets, contribution rates and other matters used in the Risk Sharing Valuation Study. Specifically, a market value of assets equal to $5,093,736,459 has been provided by the Fund representatives. Although we did not audit the data, we reviewed the data for reasonableness and consistency with the prior year's information. The accuracy of the results of this Risk Sharing Valuation Study is dependent on the accuracy of the data.

As required under Senate Bill 2190, experience studies are performed once in every four-year period. This Risk Sharing Valuation Study was prepared on the basis of the demographic and economic assumptions that were selected on the basis of the Fiscal Year Ending June 30, 2015 through Fiscal Year Ending June 30, 2019 Experience Review and adopted by the Board of Trustees at their October 20, 2020 meeting. This experience study is conducted to determine the assumptions that will serve as the basis for the Risk Sharing Valuation Studies from July 1, 2020 – July 1, 2023.

Except as prescribed in Senate Bill 2190 (as noted in Appendix A), the Board of Trustees has sole authority to determine the actuarial assumptions and has selected the actuarial methods and assumptions used in this Risk Sharing Valuation Study. In our opinion, those actuarial assumptions selected by the Board are reasonably related to the experience of the Fund and to reasonable long-term expectations. The actuarial assumptions prescribed by Senate Bill 2190 have been reflected in this Risk Sharing Valuation Study.

A summary of the actuarial assumptions, major Fund provisions, and Fund participant data used to calculate the results of this study can be found in the appendices.

Based on the statutory requirements of Senate Bill 2190 it is our understanding that the actual City contribution rate may be established as an average of the contribution rates shown in this report and those shown in the Risk Sharing Valuation Study prepared by the City's actuary. If future contributions are established in this manner at levels below those presented in this report, the Fund may not be expected to achieve a fully funded position over the 30-year time horizon as contemplated in the statute based on the data, assumptions and methods set forth on the attached pages.

However, this proposed Risk Sharing Valuation Study results in a funded ratio that exceeds 90% and a City contribution rate of 23.15%, which is less than the Initial Risk Valuation Study Corridor Minimum of 26.89%. In accordance with Section 13E of Senate Bill 2190, potential changes in the actuarial value of assets, assumed rate of return, benefit levels, or the acceleration of the amortization period to payoff liability loss layers may be required.

I am a Fellow of the Society of Actuaries and Member of the American Academy of Actuaries. I meet the Academy's Qualification Standards to issue this Statement of Actuarial Opinion. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and I am available to answer questions about it.

If you have any questions concerning this information, please let me know.

Respectfully submitted,

Buck Global, LLC

Michael A. Ribble, FSA, EA, MAAA, FCA
Principal, Consulting Actuary

Appendix A: Summary of Actuarial Methods and Assumptions

Basis for Assumptions

The economic and demographic assumptions used in the study (except for the investment return assumption) were adopted by the Board in consultation with Buck. Senate Bill 2190 requires that an actuarial experience study be performed in order to review the experience of the Fund at least once every four years to determine if any changes to the Risk Sharing Valuation Study assumptions are warranted. In general, the assumptions used in the Risk Sharing Valuation Study are based on recommendations made and approved by the Board as part of an Experience Study covering Fiscal Year Ending June 30, 2015 through Fiscal Year Ending June 30, 2019. Senate Bill 2190 requires the use of an investment return assumption of not more than 7.00%.

Actuarial Standards of Practice 27 and 35 require the actuary to identify the economic and demographic assumptions that have a significant effect on the measurement and, for those that the actuary has not selected, to provide the information and analysis the actuary performed to determine that the assumption does not significantly differ from what the actuary deems reasonable for the purpose of the measurement.

The material demographic assumptions are disclosed in this Appendix A. All demographic assumptions were based on an Experience Review covering the period July 1, 2014 to June 30, 2019. The Board of Trustees, at their October 20, 2020 meeting, approved the use of the Experience Review's recommended demographic assumptions. We reviewed the assumptions along with recent experience and the assumptions are still reasonable for the current measurement.

The material economic assumptions include the salary scale and expected return on assets ("EROA"). The Board of Trustees, at their October 20, 2020 meeting, approved the use of the Experience Review's recommended salary scale assumption. We reviewed the salary scale assumption along with recent experience and the assumptions are still reasonable for the current measurement.

In the case of the EROA, Senate Bill 2190 requires the use of an investment return assumption of not more than 7.00%. We used economic information and tools provided by Buck's Financial Risk Management ("FRM") practice. A spreadsheet tool created by the FRM team converts averages, standard deviations, and correlations from Buck's Capital Markets Assumptions ("CMA") that are used for stochastic forecasting into approximate percentile ranges for the arithmetic and geometric average returns. It is intended to suggest possible reasonable ranges for EROA without attempting to predict or select a specific best estimate rate of return. It takes into account the duration (horizon) of investment and the target allocation of assets in the portfolio to various asset classes. Based on our analysis, including consistency with other assumptions used in the valuation and the percentiles generated by the spreadsheet described above, we believe the EROA, in our professional judgment, is reasonable for the purpose of the measurement.

Use of Models

Actuarial Standard of Practice No. 56 ("ASOP 56") provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. In addition to the EROA spreadsheet model disclosed above, Buck uses third-party software in the performance of annual actuarial valuations and projections. The model is intended to calculate the liabilities associated with the Fund provisions using data and assumptions as of the measurement date under the accounting standards specified in this report. The output from the third-party vendor software is used as input to an internally developed model that applies those accounting standards to the liabilities derived and other inputs to generate many of the exhibits found in this report. Buck has an extensive review process whereby the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other accounting outputs and internal model are similarly reviewed in detail and at a high level for accuracy, reasonability and consistency with prior results. Buck also reviews the third-party model when significant changes are made to the software. The review is performed by experts within the company who are familiar with applicable accounting rules as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed. Significant changes to the internal model that are applicable to multiple clients are generally developed, checked and reviewed by multiple experts within the company who are familiar with the details of the required changes.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Actuarial Methods

Actuarial Value of Assets

Senate Bill 2190 requires the use of an asset valuation method that recognizes gains and losses on the market value of assets (based on the difference between the actual rate of return and the assumed rate of return) over five years. Past gains and losses were fully recognized in the Actuarial Value of Assets at July 1, 2016. New gains and losses will be recognized over five years beginning July 1, 2017.

Actuarial Cost Method

Senate Bill 2190 requires the use of the Ultimate Entry Age Method with liabilities allocated from date of entry to expected payment of benefit. Under the Ultimate Entry Age Method, future normal cost for active employees is calculated based on the Fund provisions in effect for the most recently hired employees.

Senate Bill 2190 also requires the use of a 30-year, closed, level percent of payroll amortization period, in which new gain/loss amortization bases are established each year. The Unfunded Actuarial Accrued Liability at July 1, 2016 was amortized as a level percentage of payroll over a closed amortization period of 30 years with payments effective for fiscal year beginning July 1, 2017. Additional actuarial experience losses will be amortized over a closed amortization period of 30 years in future Risk Sharing Valuation Studies. If, in any given year, the Fund experiences an actuarial gain, any such gain will be used to offset the largest outstanding loss amortization base, if applicable.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Key Economic Assumptions

Investment Return

Real Rate of Return	4.50%
Price Inflation	2.50%
Total Nominal Rate	7.00%

Expected future investment returns are assumed to be net of investment expenses.

Wage Inflation

3.00%

Payroll Growth Rate

3.00%

Normal Cost Load for Administrative Expenses

1.25% of pensionable payroll[1]

Individual Pay Increase Rate

	(Nominal = Merit + Wage Inflation)	
Age	Nominal	Merit
20	7.00%	4.00%
25	6.25%	3.25%
30	5.50%	2.50%
35	5.00%	2.00%
40	4.00%	1.00%
45	3.70%	0.70%
50	3.40%	0.40%
55	3.00%	0.00%

[1] required by Senate Bill 2190

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Key Demographic Assumptions

Retirement Rates

Number of Years of Service	Probability of Retiring Within One Year
Less than 25	2.0%[1]
25	2.0%
26	5.5%
27	5.5%
28	5.5%
29	5.5%
30	13.0%
31	15.0%
32	20.0%
33	20.0%
34	20.0%
35	30.0%
36	30.0%
37	40.0%
38	40.0%
39	40.0%
40+	100.0%

DROP Duration

Duration of DROP at Retirement	Percentage of Participants Electing Retirement at the Specified Duration
0	0%
3	0
5	10
8	20
10	45
13	25

[1] participants eligible to enter the DROP in the future are not assumed to retire with less than 25 years of service before age 55

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Sample Rates

Number of Years of Service at Actual Retirement	Percentage of Participants Retiring with Specific Drop Durations				
	3 yrs.	5 yrs.	8 yrs.	10 yrs.	13 yrs.
20-24	0.0%	0.0%	0.0%	0.0%	0.0%
25-27	0.0%	100.0%	0.0%	0.0%	0.0%
28-29	0.0%	33.3%	66.7%	0.0%	0.0%
30-32	0.0%	13.3%	26.7%	60.0%	0.0%
33-40	0.0%	10.0%	20.0%	45.0%	25.0%

DROP balances for active members are assumed to be paid out over 15 years upon exiting the DROP. DROP balances of members who have left active service are assumed to be paid out over 7.5 years. Future DROP payments are discounted based on the difference between the assumed investment rate of return and the assumed DROP interest crediting rate.

Mortality Rates

Service Retirees and Contingent Annuities

SOA Public Safety (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019. The base table for males is adjusted by 97.2% to reflect credible plan experience.

Survivor Beneficiaries

SOA Public Contingent Survivor (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019. The base table for females is adjusted by 106.0% to reflect credible plan experience.

Disabled Retirees

SOA Public Safety Disabled Retiree (base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019.

All others, including active and vested terminated participants

SOA Public Safety (Below-Median, base year 2010) amount weighted tables generationally projected with Mortality Improvement Scale MP-2019.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Disability Rates

Graduated rates.

	Sample Rates per 100 Participants
Age	Disability
20	0.45
25	0.45
30	0.45
35	1.00
40	1.00
45	1.00
50	1.00
55	1.00
60	1.00

Percentage of Deaths and Disabilities in the Line of Duty

Age	Death	Disability[1]
25	80%	80%
35	80	80
45	40	80
55	20	80

Termination Rates

Age	Termination Rate
20	2.40%
25	2.40
30	2.40
35	1.50
40	0.75
45	0.75
50	0.00

For members hired prior to July 1, 2017 who are terminating with at least 10 years but less than 20 years of service:

- 80% will elect a contribution refund
- 20% will elect a deferred monthly pension benefit

[1] Percentage of disabilities in the line of duty is assumed to be a flat 80% for all ages. 50% of firefighters who become disabled in the line of duty are assumed to be incapable of performing any substantial gainful activity.

Appendix A: Summary of Actuarial Methods and Assumptions (continued)

Marital Status at Benefit Eligibility

Percentage married

82% of male participants are assumed to be married, and 85% of female participants are assumed to be married.

No beneficiaries other than the spouse assumed.

Age difference

Male participants are assumed to be two years older than wives, and female participants are assumed to be six years younger than their husbands.

Development of Risk Sharing Valuation Study Pay

The Risk Sharing Valuation Study pay is developed by increasing the prior year's pay with the nominal individual pay increase rate. For participants reported with compensation less than $10,000, their compensation is set equal to their most recent annual compensation amount in excess of $10,000.

Age at which Benefits End for Child Beneficiaries

Benefits are assumed to end once the child beneficiary reaches age 23.

Future DROP Returns

Future DROP interest crediting rates are assumed to be equal to 65% of the assumed asset return (currently 65% of 7% equals 4.55%).

Future Cost-of-Living Adjustments

COLAs are assumed to be equal to the assumed asset return less 4.75% (currently 7% minus 4.75% equals 2.25%).

Census Dates

All dates in the census used to calculate liabilities are set as July 1st in the year of the event.

Missing Data Assumptions

Pay for New Hires

None were missing.

Employee Contributions

Based on the prior year's contributions.

Benefits Not Valued

The proportional retirement program between the Houston municipal, police and fire pension funds which allows for combining service credit from two or more City of Houston pension plans was not valued because its impact is expected not to be material.

Summary of Changes from the July 1, 2021 Risk Sharing Valuation Study

None.

Appendix B: Summary of Plan Provisions

Membership

Any firefighter who has not reached the age of 36 at the time he or she first enters employment shall automatically become a participant in the Fund upon completing the training period. Before October 1, 1990, the eligibility age was age 31. Before 1984, participants entered the Fund on January 1 or July 1.

Average Salary

For members hired prior to July 1, 2017, the average of the highest 36 months of pensionable pay (or 78 pay periods). For members hired on or after July 1, 2017, the average of the final 36 months of pensionable pay (or 78 pay periods).

Pensionable Pay

Pensionable pay prior to July 1, 2017 includes base pay and overtime, before reduction for pre-tax employee contributions and salary deferrals. Pensionable pay after July 1, 2017 includes base pay, before reduction for pre-tax employee contributions and salary deferrals.

Standard Service Pension – Members hired prior to July 1, 2017

Eligibility

20 years of service

Benefit

For retirement on or after November 1, 1997 and applicable for service accrued prior to July 1, 2017, 50% of average monthly salary; plus 3% of average monthly salary per year of service in excess of 20 years. For service accrued after July 1, 2017, 2.75% of average monthly salary per year of service for the member's first 20 years of service; plus 2.00% of average monthly salary per year of service in excess of 20 years.

For retirement on or after November 1, 1996 and prior to November 1, 1997, 48.334% of average monthly salary, plus 2.834% of average monthly salary per year of service in excess of 20 years.

For retirement on or after November 1, 1995 and prior to November 1, 1996, 46.667% of average monthly salary, plus 2.667% of average monthly salary per year of service in excess of 20 years.

For retirement on or after September 1, 1991 and prior to November 1, 1995, 45% of average monthly salary, plus 2.5% of average monthly salary per year of service in excess of 20 years, up to 30 years, plus 1.0% of average monthly salary in excess of 30 years.

For retirement on or after September 1, 1989 and prior to September 1, 1991, 45% of average monthly salary, plus 2.5% of average monthly salary per year of service in excess of 20 years.

For retirement on or after September 1, 1987 and prior to September 1, 1989, 45% of average monthly salary, plus 2% of average monthly salary per year of service in excess of 20 years.

For retirement on or after July 1, 1986 and prior to September 1, 1987, 40% of average monthly salary plus 2% of average monthly salary per year of service in excess of 20 years.

For retirement on or after January 1, 1970 and prior to July 1, 1986, 35% of average monthly salary plus 3% of average monthly salary per year of service in excess of salary per year of service in excess of 25 years.

Maximum

For retirement on or after July 1, 2017, none.

For retirement on or after September 1, 1991, 80% of average monthly salary.

For retirement on or after September 1, 1989 and prior to September 1, 1991, 70% of average monthly salary.

For retirement on or after September 1, 1987 and prior to September 1, 1989, 65% of average monthly salary.

For retirements on or after January 1, 1970 and prior to September 1, 1987, 60% of average monthly salary.

In addition, a member will receive a $5,000 lump sum payment upon retirement.

Appendix B: Summary of Plan Provisions (continued)

Standard Service Pension – Members hired on or after July 1, 2017

Eligibility

Age at which the sum of the member's age and service equals 70.

Benefit

2.25% of average monthly salary per year of service for the member's first 20 years of service; plus 2.00% of average monthly salary per year of service in excess of 20 years.

Maximum

80% of average monthly salary.

In addition, a member will receive a $5,000 lump sum payment upon retirement.

Alternate Service Pension

Eligibility

Firefighters who became participants prior to September 1, 1987 and who attain age 50 with 20 years of service will receive the greater of the standard or alternate pension.

Benefit

50% of average monthly salary plus 1% of average monthly salary per year of service after becoming eligible to retire on an alternate pension.

Maximum

65% of average monthly salary.

Supplemental Bonus Check

Supplemental payments totaling up to $5 million will be payable on a prorated basis determined by the Board of Trustees to all retirees and survivors.

Deferred Retirement Option Plan (DROP)

Eligibility

20 years of service. Members hired on or after July 1, 2017 are not eligible to enter DROP.

Benefit

Effective July 1, 2000, eligible participants may elect to participate in the DROP. The member's standard or alternate service pension (whichever is greater) will be calculated based on service and earnings at the time the DROP is elected.

A notional account will be maintained for each DROP participant. This account will be credited with the following amounts while the member is a participant of the DROP:

- The member's monthly retirement pension, including applicable cost-of-living adjustments (no cost-of living adjustments will be granted while a member is a participant in DROP after July 1, 2017),
- The member's contributions to the Retirement Fund contributed prior to July 1, 2017, and
- Investment earnings/losses at the rate of the Retirement Fund's earnings/losses averaged over a five-year period. Effective July 1, 2017, investment earnings will be contributed to a member's DROP account at the rate of 65% of the Retirement Fund's earnings/losses averaged over a five-year period.

A benefit equal to the DROP account balance would be paid at the time the member leaves active service. The payment would be made as a single lump sum or as the member chooses.

Effective on July 1, 2000, a three-year back DROP is available for all eligible participants. The DROP account would be recalculated based on what the account balance would have been had the participant elected the DROP up to 3 years earlier than he/she actually did. The initial DROP entry date cannot be backdated prior to September 1, 1995, or prior to completion of 20 years of credited service, and must be on the first day of the month selected.

Appendix B: Summary of Plan Provisions (continued)

The monthly benefit at actual retirement will increase 2% for every year of DROP participation, not to exceed 10 years, for a participant who has at least 20 years of service as of July 1, 2017.

Members can remain in the DROP for 13 years. If a member remains in active service after 13 years in DROP, no further deposits other than unused leave pay will be made to the DROP account, but the DROP account will continue to accrue interest.

If a DROP participant suffers an on-duty disability resulting in the inability to perform any gainful activity or dies in the line of duty, the death or disability annuity benefit would be calculated as though the participant had not entered the DROP. In addition, the DROP account would be payable to the participant or beneficiary.

Service-Connected Disability Pension

Eligibility

No age or service requirements.

Benefit

50% of average monthly salary, or service pension if greater and eligible. Firefighters who are not capable of performing any substantial gainful activity will receive 75% of average monthly salary, or service pension, if greater and eligible.

In addition, a member will receive a $5,000 lump sum.

Non-Service-Connected Disability Pension

Eligibility

No age or service requirements.

Benefit

25% of average monthly salary, plus 2.5% of average monthly salary per year of service.

Maximum

50% of average monthly salary or service pension, if greater and eligible.

In addition, a member will receive a $5,000 lump sum.

Vested Pension

Eligibility

For members hired prior to July 1, 2017, at least 10 but less than 20 years of service.

Benefit

For members hired prior to July 1, 2017, 1.7% of average monthly salary per year of service payable beginning at age 50. Members receive a refund of contributions without interest in the event of termination before 10 years of service. Members who elect a refund of contributions after attaining 10 years of service receive interest only on contributions made prior to July 1, 2017.

Members hired on or after July 1, 2017 are entitled to a refund of contributions without interest in the event of their termination of employment for any reason other than death.

Death Benefits

Payable as specified below if survived by a spouse, dependent children, or dependent parents. Effective November 1, 1997 dependent children can continue to receive benefits between the ages of 18 and 22 if they are in college.

Non-service-connected

Monthly benefit that would have been payable had the participant retired for non-service-connected disability on the date of his or her death (or service pension if greater).

Appendix B: Summary of Plan Provisions (continued)

Postretirement

Monthly benefit payable to the participant prior to his or her death. Effective July 1, 1998, a “graded” postretirement death benefit is payable to a surviving spouse if the retiree was not married at the time of retirement. This “graded” benefit is equal to 20% of the postretirement death benefit for each year of marriage to a maximum 100% after five years of marriage.

Preretirement

In the case of the death of an active firefighter in the line of duty, eligible survivor will receive a benefit equal to 100% of the decedent’s average monthly salary. Refund of contributions made if no eligible survivors. If death occurs after 10 years of service, interest is credited on the contributions at the flat rate of 5% not compounded. If death occurs before 10 years of service, no interest is credited.

Lump sum

A one-time $5,000 lump sum death benefit for any active or retired firefighter. This benefit applies to active members, current retirees, and disabled participants.

Additional Benefit

Effective on or after July 1, 2001, an extra monthly benefit of $150 is payable for life to any retired or disabled member or to an eligible survivor of a deceased member. This benefit is not subject to the postretirement adjustment.

Excess Benefit

Benefit equal to the excess of any members’ standard service pension benefit over the limit imposed by Section 415 of the code.

Postretirement Adjustment

Prior to October 1, 1990

Pensions adjusted each year based on changes in the CPI-U, but not below original amount or above original amount increased 3% each year, not compounded.

Pension adjustments for participants who retire after March 1, 1982 begin at age 55.

Pension adjustments begin immediately for participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service.

On or after October 1, 1990 and prior to November 1, 1997

Pensions adjusted each year based on changes in the CPI-U. The adjustment is based on the amount of benefits payable at the time of adjustment. The maximum annual increase shall be 3% of the benefits payable at the time of adjustment.

Pension adjustments begin immediately for participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service.

On or after November 1, 1997 and prior to October 1, 2017

Pensions adjusted each year at a fixed rate of 3%. The adjustment is based on the amount of benefits payable at the time of adjustment.

Pension adjustments for participants who retire or terminate with a vested benefit after March 1, 1982 begin at age 48. Pension adjustments begin immediately for participants who become disabled and cannot perform any substantial gainful activity (current and future) and qualify for general on-duty disability benefits. Participants whose benefits become payable on or after July 1, 1986 and are based upon 30 or more years of service are also eligible for pension adjustments to begin immediately.

On or after October 1, 2017 and prior to October 1, 2019

Pensions adjusted each year at a rate equal to the Fund’s most recent five fiscal years’ smoothed return minus 5% (but not less than 0% nor greater than 4%). The adjustment is based on the amount of benefits payable at the time of adjustment. Pension adjustments only paid to members who are at least 70 years old.

Appendix B: Summary of Plan Provisions (continued)

On or after October 1, 2019

Pensions adjusted each year at a rate equal to the Fund's most recent five fiscal years' smoothed return minus 4.75% (but not less than 0% nor greater than 4%). The adjustment is based on the amount of benefits payable at the time of adjustment. Pension adjustments only paid to members who are at least 70 years old in October 2019. Pension adjustments only paid to members who are at least 55 years old after October 2019.

Contribution Rates

Members

10.5% of salary effective July 1, 2017.

City

Effective for fiscal year ending 2018, city contribution rates will be made in accordance with the annual Risk Sharing Valuation Study. The city contribution rate in any fiscal year will not be greater than the city contribution rate projected in the initial Risk Sharing Valuation Study for that fiscal year plus 5%. The city contribution rate in any fiscal year will not be less than the city contribution rate projected in the initial Risk Sharing Valuation Study for that fiscal year minus 5%.

Appendix C: Participant Information

Summary of Active Participants as of July 1, 2022

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	20	37	1	-	-	-	-	-	-	-	58
Avg. Pay	47,306	48,544	56,471	-	-	-	-	-	-	-	48,253
25 to 29	34	105	79	-	-	-	-	-	-	-	218
Avg. Pay	47,876	51,691	61,359	-	-	-	-	-	-	-	54,599
30 to 34	24	112	304	60	-	-	-	-	-	-	500
Avg. Pay	48,234	53,307	64,662	70,203	-	-	-	-	-	-	61,995
35 to 39	3	49	275	218	80	-	-	-	-	-	625
Avg. Pay	48,681	54,000	62,895	71,512	76,794	-	-	-	-	-	66,914
40 to 44	-	-	90	157	372	64	-	-	-	-	683
Avg. Pay	-	-	63,056	70,939	77,176	82,695	-	-	-	-	74,399
45 to 49	-	-	2	78	333	199	9	-	-	-	621
Avg. Pay	-	-	62,256	69,163	76,397	79,973	93,019	-	-	-	76,830
50 to 54	-	-	-	1	146	128	3	-	-	-	278
Avg. Pay	-	-	-	74,491	75,125	80,100	73,028	-	-	-	77,391
55 to 59	-	-	-	-	7	37	1	-	1	-	46
Avg. Pay	-	-	-	-	74,070	75,825	71,125	-	100,940	-	76,002
60 to 64	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
65 to 69	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
70 & up	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
Total	81	303	751	514	938	428	13	-	1	-	3,029
Avg. Pay	47,871	52,277	63,458	70,834	76,525	80,059	86,722	-	100,940	-	69,679
		Average Age:	39.99			Average Service:	12.52				

Appendix C: Participant Information (continued)

Summary of DROP Participants as of July 1, 2022

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
25 to 29	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
30 to 34	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
35 to 39	-	-	-	-	-	-	-	-	-	-	-
Avg. Pay	-	-	-	-	-	-	-	-	-	-	-
40 to 44	-	-	-	-	-	4	-	-	-	-	4
Avg. Pay	-	-	-	-	-	80,744	-	-	-	-	80,744
45 to 49	-	-	-	-	-	30	38	-	-	-	68
Avg. Pay	-	-	-	-	-	76,693	86,439	-	-	-	82,139
50 to 54	-	-	-	-	-	63	183	31	-	-	277
Avg. Pay	-	-	-	-	-	80,871	84,500	87,452	-	-	84,005
55 to 59	-	-	-	-	-	28	115	45	14	-	202
Avg. Pay	-	-	-	-	-	77,674	80,213	85,440	85,864	-	81,417
60 to 64	-	-	-	-	-	1	34	14	20	3	72
Avg. Pay	-	-	-	-	-	74,160	81,037	81,959	88,168	97,163	83,773
65 to 69	-	-	-	-	-	-	2	1	1	3	7
Avg. Pay	-	-	-	-	-	-	80,855	112,270	74,160	76,907	82,694
70 & up	-	-	-	-	-	-	-	-	-	1	1
Avg. Pay	-	-	-	-	-	-	-	-	-	81,370	81,370
Total	-	-	-	-	-	126	372	91	35	7	631
Avg. Pay	-	-	-	-	-	79,109	83,037	85,885	86,846	86,226	82,910
			Average Age:	54.41			Average Service:	27.59			

Appendix C: Participant Information (continued)

Summary of Active and DROP Participants as of July 1, 2022

Attained Age	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total
Under 25	20	37	1	-	-	-	-	-	-	-	58
Avg. Pay	47,306	48,544	56,471	-	-	-	-	-	-	-	48,253
25 to 29	34	105	79	-	-	-	-	-	-	-	218
Avg. Pay	47,876	51,691	61,359	-	-	-	-	-	-	-	54,599
30 to 34	24	112	304	60	-	-	-	-	-	-	500
Avg. Pay	48,234	53,307	64,662	70,203	-	-	-	-	-	-	61,995
35 to 39	3	49	275	218	80	-	-	-	-	-	625
Avg. Pay	48,681	54,000	62,895	71,512	76,794	-	-	-	-	-	66,914
40 to 44	-	-	90	157	372	68	-	-	-	-	687
Avg. Pay	-	-	63,056	70,939	77,176	82,580	-	-	-	-	74,436
45 to 49	-	-	2	78	333	229	47	-	-	-	689
Avg. Pay	-	-	62,256	69,163	76,397	79,543	87,699	-	-	-	77,354
50 to 54	-	-	-	1	146	191	186	31	-	-	555
Avg. Pay	-	-	-	74,491	75,125	80,354	84,315	87,452	-	-	80,692
55 to 59	-	-	-	-	7	65	116	45	15	-	248
Avg. Pay	-	-	-	-	74,070	76,621	80,135	85,440	86,869	-	80,413
60 to 64	-	-	-	-	-	1	34	14	20	3	72
Avg. Pay	-	-	-	-	-	74,160	81,037	81,959	88,168	97,163	83,773
65 to 69	-	-	-	-	-	-	2	1	1	3	7
Avg. Pay	-	-	-	-	-	-	80,855	112,270	74,160	76,907	82,694
70 & up	-	-	-	-	-	-	-	-	-	1	1
Avg. Pay	-	-	-	-	-	-	-	-	-	81,370	81,370
Total	81	303	751	514	938	554	385	91	36	7	3,660
Avg. Pay	47,871	52,277	63,458	70,834	76,525	79,843	83,161	85,885	87,238	86,226	71,960
Average Age: 42.48						Average Service: 15.12					

Appendix C: Participant Information (continued)

Summary of Inactive Participants as of July 1, 2022

	Number	Average Age	Annual Benefits ($000)	Average Annual Benefits
Benefits in Pay Status				
Retirees	2,521	68.4	$ 143,517	$ 56,929
Beneficiaries	671	70.1	32,679	48,702
Disabled Participants	298	65.6	16,677	55,962
Total	3,490		$ 192,873	$ 55,265
Deferred Benefits				
Vested Terminated Participants	144	38.2	$ 409[1]	$ 13,208[2]
Beneficiaries	N/A	N/A	N/A	N/A
Disabled Participants	N/A	N/A	N/A	N/A
Total	144		$ 409	$ 13,208

[1] Does not include $3,336,326 in pending refunds.

[2] Average is over 31 members not due pending refunds

Appendix C: Participant Information (continued)

Participant Data Reconciliation

	Active	DROP	Deferred Vested	Retired	Total
Number of members as of July 1, 2021	3,048	623	156	3,441	7,268
Change in status during the plan year:					
Actives who retired	(13)	(72)		85	0
Actives who terminated	(23)		23		0
Actives who entered DROP	(83)	83			0
Inactives who returned to service	1		(1)		0
Inactives who retired			(4)	4	0
Participants who became disabled	(6)	(2)		8	0
No longer members due to:					
Death	(4)	(1)		(86)	(91)
Non-vested terminations					0
Child attained cut-off age				(2)	(2)
Benefits no longer due	(33)		(30)		(63)
New member due to:					
Initial membership	142			3	145
Death of another member				36	36
Correction				1	1
Number of members as of July 1, 2022	3,029	631	144	3,490	7,294

Appendix C: Participant Information (continued)

Retiree and Beneficiaries Added to and Removed from Rolls

Period Ended	Added to Rolls		Removed from Rolls		Rolls at the End of the Year			
	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Percentage Increase in Annual Benefits	Average Annual Benefit
December 31, 1978	72	719	23	76	794	4,294	15.8%	5,408
December 31, 1979	67	719	21	83	840	5,008	16.6	5,962
December 31, 1980	33	473	23	84	850	5,498	9.8	6,468
December 31, 1981	61	862	38	159	873	6,097	10.9	6,983
December 31, 1982	63	644	26	171	910	6,772	11.1	7,442
December 31, 1983	54	605	39	207	925	7,403	9.3	8,003
June 30, 1984[1]	41	619	17	98	949	3,952	6.8	8,328
June 30, 1985	75	968	53	290	971	8,432	6.7	8,684
June 30, 1986	54	752	38	243	987	9,550	13.3	9,676
June 30, 1987	76	1,101	33	235	1,030	10,522	10.2	10,215
June 30, 1988	121	2,002	38	311	1,113	12,754	21.2	11,459
June 30, 1989	74	1,306	42	299	1,145	14,032	10.0	12,255
June 30, 1990	111	1,996	37	288	1,219	16,428	17.1	13,477
June 30, 1991	129	1,784	38	401	1,310	17,888	8.9	13,665
June 30, 1992	78	1,588	44	401	1,344	19,866	11.1	14,781
June 30, 1993	82	1,717	48	585	1,378	21,516	8.3	15,614
June 30, 1994	112	2,006	58	660	1,432	23,297	8.3	16,269
June 30, 1995	87	1,728	28	353	1,491	25,142	7.9	16,863
June 30, 1996	67	1,402	56	660	1,502	26,379	4.9	17,563
June 30, 1997	56	1,050	37	487	1,521	27,581	4.6	18,133

[1] Six-month period

Appendix C: Participant Information (continued)

Retirees and Beneficiaries Added to and Removed from Rolls (continued)

	Added to Rolls		Removed from Rolls		Rolls at the End of the Year			
Period Ended	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Number	Annual Benefits ($000)	Percentage Increase in Annual Benefits	Average Annual Benefit
June 30, 1998	54	1,064	43	477	1,532	28,675	4.0	18,717
June 30, 1999	64	1,840	28	551	1,568	30,233	5.4	19,281
June 30, 2000	95	2,364	71	1,167	1,592	34,583	14.4	21,723
June 30, 2001	127	3,581	47	775	1,672	38,347	10.9	22,935
June 30, 2002	172	5,493	61	998	1,783	44,300	15.5	24,846
June 30, 2004[1]	377	N/A	109	N/A	2,051	57,676	30.2	28,121
June 30, 2005	135	4,353	53	1,107	2,133	62,882	9.0	29,481
June 30, 2006	195	7,231	60	1,437	2,268	70,420	12.0	31,050
June 30, 2007	106	3,822	59	1,407	2,315	74,948	6.4	32,375
June 30, 2008	166	9,334	21	828	2,460	98,216	31.0	39,925
June 30, 2009	133	3,369	43	2,081	2,550	94,536	-3.7	37,073
June 30, 2010	162	7,159	103	2,886	2,609	96,580	2.2	37,018
June 30, 2011	181	8,905	64	1,489	2,726	106,832	10.6	39,190
June 30, 2012	141	7,042	77	2,398	2,790	114,176	6.8	40,923
June 30, 2013	170	8,286	54	1,837	2,906	124,080	8.7	42,698
June 30, 2014	162	7,772	70	1,401	2,998	132,749	7.0	44,279
June 30, 2015	147	7,273	85	383	3,060	140,629	5.9	45,957
June 30, 2016	138	7,496	60	2,302	3,138	150,005	6.7	47,803
June 30, 2017	207	11,829	95	3,667	3,250	162,671	8.4	50,053
June 30, 2018	150	8,353	88	2,546	3,312	169,601	4.3	51,208
June 30, 2019	114	6,432	81	3,818	3,345	173,433	2.3	51,848
June 30, 2020	148	8,388	83	3,821	3,410	179,050	3.2	52,508
June 30, 2021	127	6,730	96	4,510	3,441	182,964	2.2	53,172
June 30, 2022	137	7,716	88	4,286	3,490	192,873	5.4	55,265

[1] Two-year period

Appendix D: ASOP 51

Actuarial Standard of Practice No. 51 Disclosures

Funding future retirement benefits prior to when those benefits become due involves assumptions regarding future economic and demographic experience. These assumptions are applied to calculate actuarial liabilities and the corresponding funded status of the Fund. However, to the extent future experience deviates from the assumptions used, variations will occur in these calculated values. These variations create risk to the Fund. Understanding the risks to the funding of the Fund is important. Therefore, an Actuarial Standard of Practice (ASOP) has been adopted. Actuarial Standard of Practice No. 51 (ASOP 51) requires certain disclosures of potential risks to the Fund and provides useful information for intended users of actuarial reports that determine Fund contributions or evaluate the adequacy of specified contribution levels to support benefit provisions.

Under ASOP 51, risk is defined as the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience.

It is important to note that not all risk is negative but all risk should be understood and accepted based on knowledge, judgment and educated decisions. Future measurements may deviate in ways that produce positive or negative financial impacts to the Fund.

In the actuary's professional judgment, the following risks may reasonably be anticipated to significantly affect the plan's future financial condition:

- Investment risk – the risk that assets will have a lower return than expected
- Contribution risk – the risk that the actual contribution made will be different than the recommended contribution in the Risk Sharing Valuation Study
- Salary increase risk – the risk that actual salary increases will be higher than expected
- Longevity and other demographic risk – the risk that mortality or other demographic experience will be different from expected

The following information is provided to comply with ASOP 51 and furnish beneficial information on potential risks to the Fund. This list is not all-inclusive; it is an attempt to identify the most significant risks and how those risks might affect the results shown in this report.

Note that ASOP 51 does not require the actuary to evaluate the ability or willingness of the Fund sponsor to make contributions to the Fund. In addition, this Risk Sharing Valuation Study report in not intended to provide investment advice or to provide guidance on the management or reduction of risk. Buck welcomes the opportunity to assist in such matters as part of a separate project or projects utilizing the appropriate staff and resources for those objectives.

Appendix D: ASOP 51 (continued)

Assessment of Risks

- Investment return - One type of investment risk is that assets materially underperform expected return.

    - Lower assets mean higher unfunded liability and larger contribution amounts. For example, if returns on assets at market value were 1% less than actual, this would reduce the actuarial value of assets by approximately $10,400,000, which would increase the estimated City Contribution for Fiscal Year 2024 contribution by $1,166,000.

    - The five-year smoothing method used for the actuarial value of assets defers a portion of investment gain/loss in each of the previous five years. If the assumed return on assets consistently overestimates the actual return on assets, the actuarial value of assets will be consistently higher than the true market value. Consistent underestimation of the unfunded liability can prevent the Fund from achieving anticipated funding goals even when all minimum required contributions are made timely.

- Asset growth does not keep pace with liability increases over time - Another type of investment risk is that asset returns do not keep pace with liability growth over time. Fund liabilities are based on the discounted present value of anticipated future benefit payments. That present value grows at the discount rate as time passes and the future payouts move closer. If investment returns are lower than the rates used to discount liabilities, Fund liabilities will increase more rapidly than Fund assets. Over extended periods of time, such as those involved in pension obligations, these discrepancies can accumulate to significant shortfalls.

- Market shocks or regime changes - Invested assets are subject to significant disruptions from market shocks, such as the financial crisis of 2008/2009, or as a result of systemic regime changes that persist for years, such as historically low interest rates over the recent decade. These shocks or changes will increase the risk that investments will underperform the expected return. They may also lead to a need to lower the long-term return on assets assumption. Since the long-term return on asset assumption is also used for discounting liabilities a lower assumption will increase liabilities and recommended contributions. Currently the investment return assumption used for funding is set by Senate Bill 2190.

- Salary increases - Fund costs are sensitive to salary increases, with higher rates leading to higher obligations. This is because benefits at retirement are pay related, meaning that higher pay generates higher benefit levels at retirement. Compensation increases greater than assumed lead to actuarial losses since projected benefits are higher than predicted by assumed rates.

- The Fund provides certain eligible members to enter the Deferred Retirement Option Program (DROP). It allows members who elect DROP the option to continue to work beyond their standard or alternative service eligibility date and convert part of their retirement benefit into a lump sum.

Appendix D: ASOP 51 (continued)

- A DROP presents a risk due to large lump sums paid, particularly during economic downturns. Another investment consideration is the need for liquid assets to pay DROP lump sums as employees and retirees may elect to receive their DROP account at any time creating either the necessity to maintain larger allocations of cash to pay these large lump sum benefits or force the Fund to sell securities or other illiquid investments at inopportune times. These payments are less predictable than monthly retirement benefits and may cause some losses.

- The DROP provided by the Fund also presents risk due to investment return provided to the DROP account. The Fund provides DROP investment return at the rate of 65% of the Fund's earnings/losses averaged over a five-year period. When the average is a loss, the DROP account is only decreased by 65% of the loss rate and the Fund has to absorb the remaining 35%. However, this risk is also mitigated by the 65% factor - when the average is an earning, the Fund gets to keep the extra 35% earnings.

- Longevity and other demographic risks - Potential that mortality or other demographic experience (retirement, turnover, disability) may be different than expected. As the Fund matures and the majority of participants reach (or have reached) retirement eligibility, risks associated when participants retire can become significant. The Fund provides for unreduced early retirement benefits after meeting certain age and service conditions. These benefits are highly subsidized and thus can be significantly more valuable than normal retirement benefits and regular early retirement benefits. The demographic assumptions used to determine the Risk Sharing Valuation Study attempt to account for unreduced early retirement based on historical plan experience. However, due to the unpredictable nature of such benefits, future experience could differ significantly from past experience.

  In addition to the risk that participants will not retire as expected, the Fund is subject to longevity risk - the risk that participants will live longer (or shorter) than expected. Cost of living adjustments (COLA) provided by the Fund increase longevity risk because if a participant lives longer than expected more COLA will be provided.

- Declining active workforce - since the City's contributions are based on a percentage of participant's salaries, a declining active workforce will have the impact of the Fund potentially receiving lower contributions. In addition, if the required dollar amount of contributions remain level or increase, a declining active workforce will result in higher contribution rates in order to meet required contribution levels.

- Contribution risk – risk of not contributing an actuarially determined contribution. Based on the statutory requirements of Senate Bill 2190 it is our understanding that the actual City contribution rate may be established as an average of the contribution rates shown in this report and those shown in the Risk Sharing Valuation Study prepared by the City's actuary. If future contributions are established in this manner at levels below those presented in this report, the Fund may not be expected to achieve a fully funded position over the 30-year time horizon as contemplated in the statute based on the data, assumptions and methods set forth in this report.

- Ultimate Entry Age Normal Cost Method (Ultimate EANC) - The Ultimate EANC method is a variation of EANC, where the normal cost is calculated for each active member based on the Fund provisions applicable to new members of the Fund. As the Fund has a lower annual cost for new members hired on or after July 1, 2017, use of the Ultimate EANC method lowers the normal cost and increases the actuarial accrued liability, as compared to EANC.

Appendix D: ASOP 51 (continued)

Historical Results

The following table shows selected historical values of key Risk Sharing Valuation Study measures. These items illustrate how actual volatility has impacted the Fund in recent years and gives additional context to the risks described above. Further information can be found in the RSVS reports for each year.

($1,000) RSVS Date	07/01/18	07/01/19	07/01/20	07/01/21	Current RSVS 07/01/22
Liabilities and Assets at Valuation Date					
• Actuarial Accrued Liability (AAL)	4,948,133	5,057,759	4,932,307	4,881,608	5,075,516
- Normal Cost	69,741	70,345	61,078	60,907	63,222
• Actuarial Value of Assets (AVA)	4,027,079	4,190,934	4,251,851	4,550,468	4,843,737
- Funded Percent (AVA)	81%	83%	86%	93%	95%
• Market Value of Assets (MVA)	4,170,354	4,237,692	4,102,932	5,256,763	5,093,736
- Funded Percent (MVA)	84%	84%	83%	108%	100%
Contributions and Disbursements for Plan Year Ended	2018	2019	2020	2021	2022
• Actuarially Determined Contribution (ADC)	96,530	99,676	96,332	88,104	78,571
• Actual Contribution	83,010	89,897	83,837	77,495	81,351
• Disbursements	295,674	278,615	336,153	291,767	275,842
Rates of Return for Plan Year Ended	2018	2019	2020	2021	2022
• Assumed	7.00%	7.00%	7.00%	7.00%	7.00%
• AVA	8.40%	8.10%	6.90%	11.60%	10.20%
• MVA	8.20%	5.40%	2.00%	33.40%	0.00%
Maturity Measures at Valuation Date					
• Payroll	260,345	272,498	259,235	243,045	255,100
- Asset Volatility Ratio (AVA / Payroll)	15.5	15.4	16.4	18.7	19.0
- Liability Volatilty Ratio (AAL / Payroll)	19.0	18.6	19.0	20.1	19.9
• Retiree and Beneficiary (In-pay) Liability	3,381,597	3,445,240	3,428,579	3,454,553	3,618,126
- Percent of Total Liability	68%	68%	70%	71%	71%
• Contributions minus Disbursements in Prior Year	(212,664)	(188,718)	(252,316)	(214,272)	(194,491)
- Percent Market Value of Assets	-5.1%	-4.5%	-6.1%	-4.1%	-3.8%

Appendix D: ASOP 51 (continued)

Commentary on Plan Maturity Measures

The ratio of retired life actuarial accrued liability to total actuarial accrued liability

A mature plan will often have a ratio above 60 - 65 percent. A higher percentage will generally indicate an increased need for asset / liability matching due to inability to absorb volatility in future returns. Also, an increasing percentage may indicate a need for a less risky asset allocation which may lead to a lower long-term return on assets assumption and increased costs.

The ratio of cashflow to market value of assets

The cashflow as a percentage of assets means the Fund may need to invest in more liquid assets to cover the benefit payments. More liquid assets may not garner the same returns as less liquid assets and therefore increase the investment risk. However, there may already be enough liquid assets to cover the benefit payments, less investment return is needed to cover the shortfall, or only a small portion of assets will need to be converted to cash. Therefore, the investment risk is likely not amplified at this time. This maturity measure should be monitored for continual upward trend with greater magnitude.

The ratio of actuarial value of assets to participant payroll

Plans that have higher asset-to-payroll ratios experience *more* volatile employer contributions (as a percentage of payroll) due to investment return. For example, if lower than expected asset return increases the unfunded liability of two plans by the same percent the plan with a higher assets-to-payroll ratio may experience higher contribution volatility than a plan with a lower asset-to-payroll ratio.

City of Houston
HFRRF
Proposed Risk Sharing Valuation Study
As of July 1, 2022

November 23, 2022

DEFINITI

2201 Timberloch Place, Suite 150
The Woodlands, TX 77380

(281) 296-1107
definiti.com

November 23, 2022

Mr. William Jones
Director, Finance Department
City of Houston
611 Walker
Houston, TX 77002

Re: HFRRF Proposed Risk Sharing Valuation Study as of July 1, 2022

Dear Will:

Texas Revised Statutes article 6243e.2(1) (the Article) sets forth requirements for a Risk Sharing Valuation Study (RSVS) of the Houston Firefighters' Relief and Retirement Fund (HFRRF). The purpose of this study is to determine the City Contribution Rate for the following fiscal year. Definiti LLC was engaged by the City of Houston to perform this Risk Sharing Valuation Study as of July 1, 2022 as the Municipal Actuary. This report provides the results of the Study and is organized as follows:

- Section 1 – Risk Sharing Valuation Study Results
- Section 2 – Actuarial Exhibits
- Section 3 – Summary of Plan Provisions
- Section 4 – Actuarial Methods and Assumptions
- Section 5 – Summary of Valuation Data
- Section 6 – Data Sources
- Section 7 – ASOP 51 Assessment and Disclosure of Risk

Definiti received Actuarial Data as defined in Section 1-a of the Article and required by Section 13C(b) of the Article. Definiti conducted the RSVS using the Actuarial Data provided and plan provisions as summarized in this report. The analysis presented in this report is based on the interest rate assumption and actuarial cost and asset methods prescribed by the Article. All other actuarial methods and assumptions summarized in this report were adopted in conjunction with the 2021 HFRRF Experience Study per the Article.

As described in the Article, results of the Risk Sharing Valuation Study performed by the HFRRF actuary will be compared to the results in this report. If the results are greater than two percentage points different, then we will attempt to reconcile the results with the HFRRF actuary, or a mathematical average will be used. If the results are within two percentage points, then the HFRRF actuary's results will be used.

Mr. William Jones
November 23, 2022

Based on the results of the prior year's RSVS and §13E(b)(2)(B) of the Article, the City Contribution Rate for fiscal year ending June 30, 2023, determined in the prior year's RSVS, equals the Corridor Minimum rate of 26.89% of payroll. Per §13E(c)4 of the Article, the amortization bases in the prior year's RSVS were accelerated as needed to raise the prior year's calculated City Contribution Rate up to the Corridor Minimum. These adjustments are required to be made after the original RSVS report is published. For this reason, the accelerated bases created in prior years, shown in this year's RSVS report, do not align with the amounts expected based on the prior year's RSVS report.

The actual costs, City Contribution Rates, and other results could be materially different from those described in this report in the future if actual plan experience differs significantly from the underlying valuation basis. Differences could occur for a number of reasons such as plan experience differing from the underlying demographic and economic assumptions or changes in plan provisions. Due to the limited scope of this report, analysis of the potential range of such future measurements has not been performed.

The results in this report and any measures of funded status are predicated on the notion of the Fund's ongoing operation and should not be relied upon for assessing the sufficiency of plan assets for settlement of plan termination liabilities.

The information contained in this report was prepared as requested by the City of Houston and solely for the purpose of satisfying the RSVS requirements of the Article, and should not be used for any other purpose. As significantly different results from those contained in this report may be needed for other purposes, this report should only be provided to other parties in its entirety.

The signing actuary for this report is a member of the Society of Actuaries and other professional actuarial organizations and meets the "Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion." The undersigned is available to answer questions regarding the information contained in this report or to provide further explanations or details as needed.

Respectfully submitted by Definiti LLC

David A. Sawyer, FSA EA MAAA
Senior Consulting Actuary

Risk Sharing Valuation Study Results

Corridor Midpoint

The table below contains the Corridor Midpoint, along with the corresponding Minimum and Maximum Contribution Rates using a 5% Corridor Margin as specified in the Article. Based on Definiti's proposed RSVS results, the City Contribution Rate for FY 2024 would be 22.96% of pensionable payroll, which is below the Corridor Minimum. The Final City Contribution Rate will be determined after consideration of the results of the Fund Actuary's RSVS.

FY	Corridor Midpoint	Corridor Minimum	Corridor Maximum	Definiti Calculated City Contribution Rate	Final City Contribution Rate *
2018	31.89%	26.89%	36.89%	26.98%	31.89%
2019	31.89%	26.89%	36.89%	28.33%	32.99%
2020	31.89%	26.89%	36.89%	27.52%	32.34%
2021	31.89%	26.89%	36.89%	26.19%	31.89%
2022	31.89%	26.89%	36.89%	25.18%	31.89%
2023	31.89%	26.89%	36.89%	22.29%	26.89%
2024	31.89%	26.89%	36.89%	22.96%	
2025	31.89%	26.89%	36.89%		
2026	31.89%	26.89%	36.89%		
2027	31.89%	26.89%	36.89%		
2028	31.89%	26.89%	36.89%		
2029	31.89%	26.89%	36.89%		
2030	31.89%	26.89%	36.89%		
2031	31.89%	26.89%	36.89%		
2032	31.89%	26.89%	36.89%		
2033	31.89%	26.89%	36.89%		
2034	31.89%	26.89%	36.89%		
2035	31.89%	26.89%	36.89%		
2036	31.89%	26.89%	36.89%		
2037	31.89%	26.89%	36.89%		
2038	31.89%	26.89%	36.89%		
2039	31.89%	26.89%	36.89%		
2040-2047	31.89%	26.89%	36.89%		
2048	15.92%	10.92%	20.92%		

* Final City Contribution Rates for FY 2018 – 2023 were based on an average of Municipal and Fund Actuaries' RSVS and then subjected to the Article's corridor. Please note that the amortization bases were accelerated after the July 1, 2021 RSVS report was published, as required by the Article, to raise the 2023 FY Final City Contribution Rate to the corridor minimum.

Risk Sharing Valuation Study Results

City Contribution Rate

The City Contribution Rate is equal to the sum of the Employer Normal Cost Rate and the Amortization Rate from any Liability Layers. The Employer Normal Cost Rate is equal to the Gross Normal Cost Rate plus Administrative Expense Rate less the Member Contribution Rate.

FY	Employer Normal Cost Rate	Liability Layer Amortization Rate *	Estimated City Contribution Rate
2018	14.74%	12.24%	26.98%
2019	14.72%	13.61%	28.33%
2020	14.68%	12.84%	27.52%
2021	14.67%	11.52%	26.19%
2022	15.10%	10.08%	25.18%
2023	15.58%	11.31%	26.89%
2024	15.31%	7.65%	22.96%
2025			
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
2035			
2036			
2037			
2038			
2039			
2040			
2041			
2042			
2043			
2044			
2045			
2046			
2047			
2048			

* The FY 2023 liability layer amortization rate was 6.71% in the prior year's RSVS report. After accelerating the amortization bases as required by the Article, this amount increased to 11.31% of payroll.

Actuarial Exhibits

2.1. Fair Value of Assets

	July 1, 2021	July 1, 2022
A. Fair Value of Plan Assets		
1. Cash & Short Term Investments	$ 166,518,037	$ 186,629,043
2. Fixed Income	825,201,524	585,130,674
3. Equity Securities	2,062,328,427	1,656,933,545
4. Alternative Investments	1,927,600,928	2,199,731,823
5. Real Estate	266,573,705	341,345,504
6. Land, Building, Etc.	3,975,583	3,711,416
7. Accrued Interest & Dividends	2,461,880	3,496,723
8. Accrued City Contributions	5,924,407	6,241,794
9. Accrued Member Contributions	2,081,198	2,310,227
10. Other	(5,902,881)	108,205,710
11. Total Fair Value	$ 5,256,762,808	$ 5,093,736,459

B. Change in Fair Value	Change
1. Contributions	
a. Members	$ 30,941,552
b. City	81,351,512
c. Total	$ 112,293,064
2. Disbursements	
a. Benefit Payments	$ (270,598,726)
b. Administrative Expenses	(5,243,204)
c. Total	$ (275,841,930)
3. Investment Return	
a. Interest and Dividends	$ 6,799,913
b. Realized and Unrealized Gain/(Loss)	1,863,447
c. Plan Investment Expenses	(8,140,843)
d. Total Return	$ 522,517
4. Net Change	$ (163,026,349)
5. Average Rate of Return	
a. Average Asset Value	$ 5,174,988,375
b. Income Net of Investment Expenses	$ 522,517
c. Annual Rate of Return - Net of Investment Expenses	0.01%
d. Annual Rate of Return - Gross	0.17%

2.2. Actuarial Value of Assets

1. Market Value of Assets at beginning of year	$ 5,256,762,808
2. Net Cash Flow	
a. Contributions	$ 112,293,064
b. Benefit Disbursements	(270,598,726)
c. Administrative Expenses	(5,243,204)
d. Net Cash Flow [2.a. + 2.b. + 2.c.]	$ (163,548,866)
3. Expected Investment Return [1. x 0.07] + [2.d. x ((1.07)^.5-1)]	$ 362,346,000
4. Expected Market Value of Assets at end of year [1. + 2.d. + 3.]	$ 5,455,559,942
5. Market Value of Assets at end of year	$ 5,093,736,459
6. Investment Gain/(Loss) [5. - 4.]	$ (361,823,483)

7. Schedule of Actuarial Investment Gains (Losses)

Fiscal Year End	Initial Actuarial Gain (Loss)	Five-Year Recognition	Deferred Gain (Loss) As of July 1, 2022
2019	$ (64,835,689)	$ (51,868,551)	$ (12,967,138)
2020	$ (204,992,393)	$ (122,995,436)	$ (81,996,957)
2021	$ 1,057,369,547	$ 422,947,819	$ 634,421,728
2022	$ (361,823,483)	$ (72,364,697)	$ (289,458,786)
Total	$ 425,717,982	$ 175,719,135	$ 249,998,847

8. Market Value as of July 1, 2022	$ 5,093,736,459
(Gain) Loss to be Recognized in Future Years	(249,998,847)
Actuarial Value as of July 1, 2022 [5. - 7.]	$ 4,843,737,612
9. Actuarial Value of Assets, Prior Year	$ 4,550,468,498
10. Rate of Return on Actuarial Value of Assets (Net of Investment Expenses)	10.2%

Actuarial Exhibits

2.3. Actuarial Accrued Liability

	July 1, 2021		July 1, 2022
A. Discount Rate	7.0%		7.0%
B. Actuarial Accrued Liability			
1. Active	$1,431,265,162		$1,465,486,678
2. Terminated Vested	$3,706,000		$7,871,265
3. Disabled	$224,367,229		$234,250,307
4. Retired	$3,165,745,086		$3,328,874,359
5. Total	$4,825,083,477		$5,036,482,609
C. Change in Actuarial Accrued Liability		2022 Fiscal Year	
1. Benefits Accumulated		$64,693,570	
2. Benefits Paid		($270,598,726)	
3. Decrease in Discount Period		$330,671,050	
4. Plan Experience		$86,633,238	
5. Net Change		$211,399,132	
D. Actuarial Value of Assets	$ 4,550,468,498		$ 4,843,737,612
E. Unfunded Actuarial Liability	$274,614,979		$192,744,997
F. Total Normal Cost % of Payroll[1]	26.08%		25.81%
G. Member Contribution % of Payroll	10.50%		10.50%
H. Employer Normal Cost Rate [F - G]	15.58%		15.31%

[1] Includes administrative expense load

Actuarial Exhibits

2.4. Liability Layers

Valuation Date Base Established	Initial Amount of Liability Layer (BOY)	Remaining Liability to be Amortized as of 7/1/2022	Remaining Amortization Period as of 7/1/2022	Amortization Amount for FY 2024
07/01/2016	$601,731,984	$608,304,037	10	$73,320,343
07/01/2017	$47,533,433	$53,235,613	25	$3,249,864
07/01/2018	($47,351,521)	($52,144,762)	10	($6,272,176)
07/01/2019	($71,518,992)	($77,900,787)	10	($9,371,278)
07/01/2020	($98,576,898)	($106,344,760)	10	($12,794,427)
07/01/2021	($148,110,442)	($158,478,173)	10	($17,965,843)
07/01/2022	($73,926,171)	($73,926,171)	10	($9,412,137)
Total		$192,744,997		$20,754,346
Projected Payroll for Fiscal Year +1				$271,273,843
Amortization Payments as a % of Projected Payroll				7.65%

Please note the Initial Liability Layer was accelerated, as required by §13E(c)4 of the Article, to raise the prior year's calculated Final City Contribution Rate to the corridor minimum. Because all subsequent gain layers are required to be treated the same as the Initial Liability Layer, those bases were accelerated as well. This process is done after the RSVS reports for a particular year are issued, so the adjusted bases shown above for years prior to July 1, 2022 differ from the amounts expected from the 2021 RSVS report. Similarly, because the City Contribution Rate is again less than the Corridor Minimum and the funded status is between 90% - 100%, the bases shown above may be accelerated prior to the next RSVS.

Summary of Plan Provisions

Eligibility and Participation	Any firefighter shall automatically become a participant in the plan upon completing the training period, as long as he or she has not reached age 36.
Final Average Pay (FAP)	For members hired prior to July 1, 2017, the average of the highest 78 bi-weekly payroll periods of salary, before reduction for pre-tax employee contributions and salary deferrals. Overtime and any excess of the salary earned on the basis of the member's appointed position over the salary of the member's highest tested rank are excluded for pay periods after July 1, 2017. For members hired after July 1, 2017, the average of the final 78 bi-weekly payroll periods of salary, before reduction for pre-tax employee contributions and salary deferrals, and excluding overtime and any excess of the salary earned on the basis of the member's appointed position over the salary of the member's highest tested rank.
Credited Service	Elapsed time from date of hire, for all periods of service classified as full-time, fully paid, active duty employment with the City of Houston Fire Department.
Retirement Benefit	
Eligibility	20 years of service if hired prior to July 1, 2017. Attainment of age plus service of at least seventy (Rule of 70) for those hired on or after July 1, 2017.
Amount	Prior to July 1, 2017, 2.5% of FAP times credited service up to 20 years of service, plus 3.0% of FAP for credited service in excess of 20 years, up to a maximum pension of 80% of FAP. In addition, the member will receive a $5,000 lump sum. On or after July 1, 2017, 2.75% per year prior to 20 years of service and 2.00% thereafter for those hired prior to July 1, 2017 (no maximum). For those hired on or after that date, 2.25% per year up to 20 years of service and 2.00% thereafter, up to a maximum of 80% of FAP. Percentages earned prior to July 1, 2017 are retained. $5,000 lump sum payable upon retirement if member has completed 20 years of service, regardless of date of hire.

Termination Benefit

Eligibility	Termination of employment prior to satisfying the retirement eligibility requirements.
Amount	Hired prior to July 1, 2017 with less than 10 years of service: Lump sum refund of member contributions without interest. Hired prior to July 1, 2017 with at least 10 but less than 20 years of service: Choice of • Refund of contributions (with 5% interest, not compounded, on contributions made prior to July 1, 2017), or • Monthly benefit of 1.7% of final average pay per year of service, payable at age 50 Hired on or after July 1, 2017: Lump sum refund of member contributions without interest.

On-Duty Disability

Eligibility	No age or service requirements.
Amount	Firefighters who are not capable of performing their normal and customary firefighter duties receive the greater of their accrued retirement benefit or 50% of FAP (75% of FAP for firefighters not capable of performing any substantial gainful activity). In addition, the member will receive a $5,000 lump sum. This benefit was assumed to be payable immediately, even if the member does not yet meet retirement eligibility.

Off-Duty Disability

Eligibility	No age or service requirements.
Benefit	Firefighters who are not capable of performing their normal and customary firefighter duties receive the greater of their accrued retirement benefit or 25% of FAP plus 2.5% of FAP per year of service (up to a maximum of 50% of FAP). In addition, the member will receive a $5,000 lump sum. This benefit was assumed to be payable immediately, even if the member does not yet meet retirement eligibility.

Active Member Death

Eligibility	No age or service requirements.
Duty Related Benefit	100% of FAP. In addition, the beneficiary will receive a $5,000 lump sum.
Non-Duty Related Benefit	Greater of the accrued retirement benefit or Off-Duty Disability benefit. In addition, the beneficiary will receive a $5,000 lump sum.
Allocation to Beneficiaries	The benefit amount above is payable to a surviving spouse, or allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or if no surviving spouse divided equally among any eligible children, or otherwise paid to any eligible parents if no surviving spouse or eligible children. An eligible child enrolled in college must be unmarried.

Please Note: Members who become disabled or die from heart or lung disease or cancer must have at least six years of service to receive a disability or death benefit. They must also have passed a physical upon beginning employment or prior to the claimed disability or death which did not reveal evidence of the condition.

Retired Member Death

Eligibility	Retired and receiving monthly pension.
Benefit	100% of monthly pension the retired member was receiving plus a $5,000 lump sum death benefit.
Allocation to Beneficiaries	The annuity benefit above is payable to a surviving spouse, or allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or if no surviving spouse divided equally among any eligible children, or otherwise paid to any eligible parents if no surviving spouse or eligible children. An eligible child enrolled in college must be unmarried.

Supplemental Annuity

An extra monthly benefit of $150 is payable for life to any retired or disabled member or to an eligible survivor of a deceased member.

Supplemental Bonus Checks

Annual payments of up to $5 million are provided to retirees and beneficiaries.

Cost of Living Adjustment

Beginning at age 55, a retired member or beneficiary will receive an adjustment reflecting the Fund's 5-year average investment return less 4.75%, with a floor of 0% and a cap of 4%. Prior to July 1, 2020, no COLA is provided to members under age 70. Notwithstanding the foregoing, prior to July 1, 2019, COLA provided to members who are at least 70 years of age is the Fund's 5-year average investment return less 5%, with a floor of 0% and a cap of 4%.

DROP

Hired prior to July 1, 2017: Upon reaching retirement eligibility, members may enter the Deferred Retirement Option Plan (DROP). The member's monthly annuity is added to a notional account. Interest is credited on the account using 65% of the 5-year average of the Fund's rate of return, with a minimum of 2.5%. COLAs are not applied to the monthly benefit until the member exits DROP, and member contributions are not credited to the DROP account.

For those eligible to retire prior to July 1, 2017, upon exiting the DROP for retirement, the member's monthly benefit is increased by 2% of the original monthly benefit for each year the member remained in DROP, up to 10 years.

Please note: for accumulation to July 1, 2017, DROP accounts include the value of COLAs after age 48 at 3.0% per year, as well as member contributions of 9% of total pay.

Hired on or after July 1, 2017: not available.

PROP

Prior to July 1, 2017, a member could elect to have all or a portion of his or her monthly annuity credited to the Post Retirement Option Plan (PROP) account, along with interest. On and after July 1, 2017, the interest credit is 65% of the 5-year average of the Fund's rate of return, with a minimum of 2.5% (same as DROP crediting rate). Additionally, no new amounts are eligible for deferral into the PROP.

Contribution Rates

Members	10.50% of pensionable pay.
City	The City Contribution Rate from the RSVS applied to pensionable payroll.

Actuarial Methods and Assumptions

Actuarial Cost Methods

Measurement Date	Census data as of July 1, 2022. Impact of plan changes measured on future accruals only; no impact to accruals through the valuation date, including for back-DROP accruals based on dates before the valuation date.
Actuarial Value of Assets	Five-year smoothing of future gains and losses. 20% of each gain or loss will be recognized each year. Gains and losses are based on the difference between the actual and expected fair market value each year. The expected value is based on the assumed rate of return on investments and is net of investment expenses.
Actuarial Cost Method	The Ultimate Entry Age Normal Actuarial Cost Method As used in the City Funding Policy, a method under which the actuarial present value of all potential future projected benefits of each individual included in the valuation is calculated, assuming continued service and pay increases. The *normal cost* is calculated as the average uniform percentage of payroll which, if applied to the compensation of each participant during the entire period of anticipated covered service, would meet the cost of all benefits payable based on benefits provisions for new hires. The portion of the actuarial present value of future benefits not provided for at the valuation date by the present value of future normal costs is called the *actuarial accrued liability*.

Key Economic Assumptions

Interest Rate	7.0%, as required by Senate Bill 2190
Inflation	2.50%
Wage Inflation	3.00%
Payroll Growth	3.00%
Cost of Living Adjustment	2.25%
Administrative Expenses	1.25% of payroll

Individual Pay Increase Rate

Age	*Assumed Increase*
20	7.00%
25	6.25%
30	5.50%
35	5.00%
40	4.00%
45	3.70%
50	3.40%
55	3.00%

DROP Interest Crediting Rate 4.55%.

Demographic Assumptions

Mortality Rates:

Active and Vested Terminated Members — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019.

Retired Members — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019. The base table for males is adjusted 97.2% to reflect credible plan experience.

Survivor Beneficiaries — SOA Public Safety below-median amount weighted tables with longevity improvement projected using Scale MP-2019. The base table for females is adjusted 106.0% to reflect credible plan experience.

Disabled Pensioners — SOA Public Safety Disabled Retiree amount weighted tables with longevity improvement projected using Scale MP-2019.

Retirement Rates

Years of Service	*Probability of Retiring Within One Year*
20 – 25	2.0%
26 - 29	5.5%
30	13.0%
31	15.0%
32 – 34	20.0%
35 - 36	30.0%
37 – 39	40.0%
40+	100.0%

DROP eligible members are assumed not to retire with less than 25 years of service.

Members currently in DROP are assumed to retire according to the retirement rates, with 100% retirement assumed after thirteen years in DROP.

The following table shows, for sample years of service, the assumed probability of the active members not currently in DROP having been in the DROP for a certain number of years at retirement:

	Percent Electing Specified DROP Period at Retirement				
Years of Service at Retirement	**3 Years**	**5 Years**	**8 Years**	**10 Years**	**13 Years**
20 – 24	0.0%	0.0%	0.0%	0.0%	0.0%
25 – 27	0.0%	100.0%	0.0%	0.0%	0.0%
28 -29	0.0%	33.3%	66.7%	0.0%	0.0%
30 – 32	0.0%	13.3%	26.7%	60.0%	0.0%
33 - 40	0.0%	10.0%	20.0%	45.0%	25.0%

Actuarial Methods and Assumptions

Disability Rates

Disability per 100	
Age	**All**
20	0.45
25	0.45
30	0.45
35	1.00
40	1.00
45	1.00
50	1.00
55	1.00
60	1.00

Percentage of Deaths and Disabilities in the Line of Duty

Age	Death	Disability *
25	80%	80%
35	80%	80%
45	40%	80%
55	20%	80%

* 50% of Line of Duty Disabilities are assumed to result in members being incapable of performing any substantial gainful activity.

Termination Rates

Sample Rates

Age	Termination Rate
20	2.40%
25	2.40%
30	2.40%
35	1.50%
40	0.75%
45	0.75%
50	0.00%

For participants hired prior to July 1, 2017 with at least 10 years of service but not yet eligible to retire, 80% are assumed to elect a contribution refund, and 20% are assumed to elect a deferred monthly benefit payable at age 50.

Actuarial Methods and Assumptions

Percentage married	82% of male and 85% of female participants are assumed to be married. No beneficiaries other than the spouse assumed.
Age difference	Female spouses are assumed to be two years younger than the retired male member and male spouses are assumed to be six years older than the retired female member.
Child Benefits	For children under the age of 23, the benefit was assumed to cease at age 23. Children over the age of 23 were assumed to be disabled and were measured assuming a lifetime annuity.
Development of Valuation Pay	Valuation pay is projected by increasing the prior year's pay with the individual pay increase rate.
Payment of DROP Balances	Installments over 15 years for active members and 7.5 years for inactive members.
Funding Policy	The City is assumed to contribute the City Contribution Rate, subject to the Corridor, from the prior year. The actuarially determined City Contribution Rate is measured as the normal cost rate, plus the administrative expenses rate, plus 30-year amortization rate of the Unfunded Actuarial Accrued Liability (UAAL) from the initial RSVS, plus the amortization rates of all subsequently-determined Liability Layers, less the member contribution rate, adjusted with interest to mid-year. The closed amortization rates for the Liability Layers are calculated as a level percent of pay. The initial amortization period for a Liability Loss Layer is 30 years. The initial amortization period for a Liability Gain Layer is equal to the remaining amortization period for the largest Liability Loss Layer.
Benefits Not Valued	Due to limitations of the data received, no adjustment has been made for the difference between pay based on the appointed position and pay based on the highest tested rank. Additionally, no marital status was provided for child beneficiaries, so the provision against married children in college receiving a survivor benefit was not valued.
Change in Assumptions	There were no changes to the assumptions since the prior year.

Summary of Valuation Data

	July 1, 2021	July 1, 2022
A. Active Members Not in DROP		
1. Number	3,048	3,029
2. Valuation payroll	$201,988,333	$211,056,630
3. Average pay	$66,269	$69,679
4. Average age	39.8	40.0
5. Average service	12.3	12.5
B. Active Members in DROP		
1. Number	623	631
2. Valuation payroll	$49,366,645	$52,316,033
3. Average pay	$79,240	$82,910
4. Average age	54.2	54.4
5. Average service	27.8	27.6
C. Terminated Vested		
1. Number	29	31
2. Total benefits	$372,000	$409,000
3. Average Annual benefits	$12,828	$13,194
D. Disabled		
1. Number	296	298
2. Total benefits	$15,864,000	$16,656,000
3. Average Annual benefits	$53,595	$55,893
E. Retired		
1. Number	2,482	2,521
2. Total benefits	$136,226,000	$143,594,000
3. Average Annual benefits	$54,886	$56,959
F. Beneficiaries		
1. Number	663	671
2. Total benefits	$30,888,000	$32,668,500
3. Average Annual benefits	$46,588	$48,686

Notes:

1. DROP Balance values not shown.
2. Terminated Vested count does not include 127 members due refunds totaling $3,981,281 for July 1, 2021 and 113 members due refunds totaling $3,338,000 for July 1, 2022.
3. Payroll and Pay values exclude overtime.
4. Date fields provided to Definiti by HFRRF only included the year (no month or day).

Data Sources

Data and inputs used in this report were provided from the following sources:

- Census data for all members was provided on September 30, 2022. It is our understanding that this data is substantially the same as that used by the HFRRF actuary for their Risk Sharing Valuation Study. As the data provided to Definiti does not contain the month for any dates, we have assumed all dates are July 1st of the respective year. Because the benefit provisions differ by the date of hire, some members may be measured under the wrong provisions. Definiti is following the provisions of the Article, but we are unable to determine the magnitude of this difference without more precise data.

- The DROP balances for active members were provided in the Actuarial Data. The aggregate DROP/PROP balance for inactive members was provided by the Fund Actuary on November 1, 2022.

- The fair value of assets of $5,093,736,459 as of June 30, 2022 was provided in the HFRRF financial statements. The financial statements were provided to Definiti by HFRRF on October 27, 2022.

- The Fiscal Year 2023 payroll used was $263,372,663, which was based on the census data as of June 30, 2022 increased with one year of salary scale. The Fiscal Year 2024 payroll is equal to the Fiscal Year 2023 payroll increased with one year of payroll growth.

- The provisions of the Article are contained in the enrolled text of Senate Bill 2190, which was signed by the Governor on May 31, 2017.

ASOP 51 Assessment and Disclosure of Risk

The measurement of Pension Obligations and Actuarially Determined Contributions requires assumptions about future economic and demographic variables. The events and outcomes identified below are some of the risks associated with these measurements and how they may impact the pension obligations, funded status, and the adequacy of the funding policy. The assessment and disclosure of these risks and the actual future results may reasonably be expected to differ.

Investment Risk - As the return on the plan trust assets is subject to market return, should the actual rate of return be lower than the expected return the cost of the plan will rise and vice versa.

Asset/Liability Mismatch Risk - The changes in assets are not directly tied to the changes in the value of liabilities in magnitude or direction.

Longevity and other Demographic Risks - Cessation from employment due to termination, disability, death, or retirement may not directly align with the assumptions used to value the Actuarial Accrued Liability (AAL). Actual demographic experience of the plan population may increase or decrease the future measurement of the AAL.

Payroll Risk – The funded status and future Actuarially Determined Contributions Rates (ADCR) are subject to payroll risk. Payroll lower than expected can result in future increases in the ADCR required to amortize the Unfunded Actuarial Accrued Liability and vice versa.

Contribution Risk - The City and members are assumed to make the statutorily required contributions and this valuation has not considered the possibility of unpaid contributions. If contributions are less than expected, the funded status will likely decrease over time. Due to the all the risks mentioned above, even making the statutorily required contributions does not fully guarantee the benefit security.

Understand that the above risks may not be independent of one another. Thus, it is important to discuss any known upcoming changes in the City's financials and the impact on the Fund to better identify associated risks. Any impending changes should be discussed as soon as possible, so corresponding measures may be taken to align the pension plan liabilities with these variations.

Also understand that this valuation did not assess the likelihood or consequences of potential future changes in applicable law that would impact future benefits or funding of the plan. Should applicable law be changed, these changes will be addressed in separate actuarial communications.

ASOP 51 Assessment and Disclosure of Risk

Historical Results

The following information summarizes some of the historical RSVS measurements. This information may be helpful in better understanding the risks of sponsoring this defined benefit pension plan.

Actuarial Liabilities and Assets
The numerical results in this section provides funded status progress since July 1, 2017. Over this period, the favorable investment returns exceeded any unexpected growth in the Actuarial Accrued Liability (AAL) due to experience and assumption changes resulting in a reduction in the Unfunded AAL over this period.

Cash Flows
Negative cash flows indicate benefit payments and expenses exceed the contributions coming into the trust. Negative cash flows are common for mature plans like HFRRF, but this may require liquidation of higher returning investments at inopportune times impacting the investment return. As noted on the next page, the cash flows have been negative in each of the last four years.

Rates of Return
The trust assets are invested in a diversified portfolio. The results of the RSVS assume the trust earns 7% per year over the long-term future, but actual annual returns will differ from the 7% assumption. The historical returns provide information on how these returns have differed from the assumption in recent years. As noted above, returns above the 7% assumption reduce the long-term cost and vice versa.

Maturity Measures
The last section summarizes several maturity measures related to payroll and the inactive members. The ratio of the asset measure to payroll provides information on contribution volatility as it relates to asset returns. The higher the ratio, the larger the increase/decrease in contributions (as a % of payroll) are for unfavorable/favorable investment experience compared to the 7% return assumption.

The ratio of the number of active members to the number of inactive members is an important measure of the plan maturity. This ratio will typically decrease as the plan matures over time. As the ratio of active to inactive members decreases, larger increases in contribution rates (as a % of payroll) are typically required to amortize the same percentage increase in UAAL. The ratio of inactive AAL to total AAL is a similar measure of the plan maturity. As the percentage of the inactive member AAL increases, larger increases in contribution rates are typically required to amortize the same percentage increase in UAAL. As plans mature, the contribution volatility for these mature plans becomes more dependent on the investment returns than contribution amounts.

ASOP 51 Assessment and Disclosure of Risk

Historical Results

The table below shows historical measures from the prior Risk Sharing Valuation Studies. This information demonstrates trends in the Plan's funded status, information on the cash flows, volatility of the asset returns and several maturity measures.

($1,000)

Actuarial Liabilities and Assets (BOY - 7/1)	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Fair Value of Assets (FVA)	$ 4,025,090	$ 4,170,354	$ 4,237,692	$ 4,102,932	$ 5,256,763	$ 5,093,736
Actuarial Value of Assets (AVA)	$ 3,883,807	$ 4,027,078	$ 4,190,934	$ 4,251,850	$ 4,550,468	$ 4,843,738
Actuarial Accrued Liability (AAL)	$ 4,513,234	$ 4,619,041	$ 4,714,719	$ 4,677,483	$ 4,825,083	$ 5,036,483
Funded Status (AVA/AAL)	86.1%	87.2%	88.9%	90.9%	94.3%	96.2%
Unfunded AAL (AAL - AVA)	$ 629,427	$ 591,963	$ 523,785	$ 425,633	$ 274,615	$ 192,745
Total Normal Cost as % of Payroll	25.22%	25.18%	25.17%	25.60%	26.08%	25.81%
Cash Flows (EOY - 6/30)						
Contributions (City + Member)	$ 119,061	$ 118,632	$ 124,178	$ 117,278	$ 107,368	$ 112,293
Disbursements	$ (256,590)	$ (295,674)	$ (278,615)	$ (336,153)	$ (291,767)	$ (275,842)
Positive/(Negative) Cash Flows	$ (137,529)	$ (177,042)	$ (154,437)	$ (218,875)	$ (184,399)	$ (163,549)
- as % of Fair Value of Assets	-3.4%	-4.2%	-3.6%	-5.3%	-3.5%	-3.2%
Rates of Return (EOY - 6/30)						
Assumed Rate	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
AVA	8.0%	8.4%	8.1%	6.9%	11.6%	10.2%
FVA	11.8%	8.2%	5.4%	2.0%	33.4%	0.0%
Maturity Measures (BOY - 7/1)						
Payroll	$ 289,947	$ 260,345	$ 272,498	$ 259,235	$ 243,008	$ 255,100
- FVA/Payroll	13.9	16.0	15.6	15.8	21.6	20.0
- AVA/Payroll	13.4	15.5	15.4	16.4	18.7	19.0
- AAL/Payroll	15.6	17.7	17.3	18.0	19.9	19.7
- UAAL/Payroll	2.2	2.3	1.9	1.6	1.1	0.8
Inactive Member Measures						
- # of Actives/# of Inactives	125.5%	119.2%	116.8%	107.7%	105.8%	103.9%
- Inactive AAL/Total AAL	68.5%	69.4%	69.3%	72.0%	70.3%	70.9%