Killeen Firefighter's Relief and Retirement Fund

Actuarial Valuation
as of September 30, 2018

May 14, 2019

Rudd and Wisdom, Inc.
CONSULTING ACTUARIES

Rudd and Wisdom, Inc.

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May 14, 2019

Board of Trustees
Killeen Firefighter's Relief and
Retirement Fund
c/o Ms. Jennifer Hanna, Administrator
Post Office Box 497
Conroe, Texas 77305

Members of the Board of Trustees:

At the request of the Board of Trustees of the Killeen Firefighter's Relief and Retirement Fund, we have prepared this report of the results of the actuarial valuation of the fund as of September 30, 2018. This valuation was prepared to determine whether the fund has an adequate contribution arrangement.

In a separate report dated April 16, 2019, we provided the necessary disclosures for the fund's compliance with the Governmental Accounting Standards Board (GASB) Statement No. 67 for the plan year ending September 30, 2018. Similarly, we provided a separate report dated December 31, 2018 containing the pension expense, net pension liability, and disclosure information for the city's compliance with GASB 68 for the fiscal year ending September 30, 2018. GASB 68 prescribes the city's accounting for your fund, while this actuarial valuation report reflects the assumed continuation of the current funding policy.

We certify that we are members of the American Academy of Actuaries who meet Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report.

Sincerely,

Mark R. Fenlaw

Mark R. Fenlaw, F.S.A.

Rebecca B. Morris

Rebecca B. Morris, A.S.A.

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Section I

Valuation Summary

An actuarial valuation of the assets and liabilities of the Killeen Firefighter's Relief and Retirement Fund as of September 30, 2018 has been completed. The valuation was based on the Present Plan (plan effective January 1, 2019) and the provisions of the Texas Local Fire Fighters' Retirement Act (TLFFRA) which were in effect on September 30, 2018. Section II shows the summary of key results of the actuarial valuation as of September 30, 2018 and discusses the significant changes since the prior valuation that we prepared as of September 30, 2016.

This valuation reflects an actuarially assumed total contribution rate of 24%, comprised of 11% by the firefighters and 13% by the city. The total contribution rate of 24% exceeds the normal cost rate of 17.02%, leaving 6.98% available to amortize the unfunded actuarial accrued liability (UAAL) of $18,990,872. Assuming that the total payroll increases at the rate of 3% per year in the future, the contributions in excess of the normal cost **will amortize the UAAL in 39.8 years.**

In order for a retirement plan to have an adequate contribution arrangement, contributions must be made that are sufficient to pay the plan's normal cost and to amortize the plan's UAAL over a reasonable period of time. Based on the Texas Pension Review Board guidelines for pension funding, our professional judgment, and the actuarial assumptions and methods used in making this valuation, we consider periods of 10 years to 25 years to be preferable and 40 years to be the current maximum acceptable period. The PRB guidelines will be changing to a maximum of 30 years allowing for phase in through 2025. Since the total contributions are sufficient to pay the fund's normal cost and to amortize the fund's UAAL within the maximum acceptable period, we are of the opinion that the fund, based on present levels of benefits and contributions, **has an adequate contribution arrangement. Section III presents considerations for future benefit improvements.**

Projected Actuarial Valuation Results

In addition to completing this actuarial valuation, we estimated the amortization periods as of September 30, 2020 and as of September 30, 2022 by making projections from the September 30, 2018 actuarial valuation. These projections examine the effect on the amortization period in the next two actuarial valuations of the actuarial investment gains and losses that the fund experienced in the four years prior to the valuation date (gains in 2016, 2017, and 2018 and a loss in 2015) that have been only partially recognized as of September 30, 2018. As shown in Exhibit 6, a smoothing method is used to determine the actuarial value of assets (AVA) for this valuation. This method phases in over a five-year period any investment gains or losses (net actual investment return greater or less

than the actuarially assumed investment return) that the fund has had. The AVA used in this current valuation is deferring recognition of various portions of the gains and the loss in 2015-2018 that the fund experienced. The AVA used in this valuation is $42,970,465. The market value of assets (MVA) is $43,947,221. The $976,756 difference between the MVA and the AVA is the net of the deferred gains and loss that will be recognized in the next two actuarial valuations.

The theory behind the AVA method is to allow time for investment gains and losses to partially offset each other and thereby dampen the volatility associated with the progression of the MVA over time. In practice, the timing and amounts of investment gains and losses can result in irregular effects on the AVA in a given year. However, as intended, the pattern of the AVA is smoother over time than the pattern of the market value of assets, as seen in Exhibit 7.

For the purpose of projecting the amortization period through 2022 we used several scenarios of various assumed annual rates of investment return, net of investment-related expenses, over the 2019-2022 projection period. The projected amortization periods will not be the same as the actual amortization periods from completed future actuarial valuations but are projected future actuarial valuation results based on the completed September 30, 2018 actuarial valuation. These projections show the expected effects over the next four years after the valuation date (1) of the recognition of the portions of the past investment gains and loss over the past four years that are deferred as of September 30, 2018, and (2) of investment returns over the next four years different from the 7.5% assumption used in this valuation.

	Scenario					
	1	2	3	4	5	6
Assumed Investment Return for Fiscal Year						
2018-2019	7.5%	10.0%	4.0%	0.0%	0.0%	4.0%
2019-2020	7.5	10.0	14.0	7.5	7.5	4.0
2020-2021	7.5	7.5	12.0	7.5	13.0	7.5
2021-2022	7.5	7.5	10.0	7.5	7.5	7.5
2022-2023 and later	7.5	7.5	7.5	7.5	7.5	7.5
Amortization Period in Years as of September 30:						
2018 (actual)	39.8	39.8	39.8	39.8	39.8	39.8
2020 (projected)	35.3	32.2	35.8	43.2	43.2	40.3
2022 (projected)	31.0	24.8	24.8	47.0	39.8	43.2

The projected future September 30, 2022 valuation in Scenario 1 reveals that instead of decreasing by the expected four years from 39.8 years to 35.8 years, the amortization period is projected to decrease to 31.0 years, primarily due to more deferred gains than

deferred losses that will be recognized as of September 30, 2022. The primary conclusion from Scenario 1 is that the net deferred gains as of September 30, 2018 will accelerate the reduction in the amortization period. This is not surprising when you consider that if the AVA were set equal to the MVA, recognizing all of the past gains and losses in the September 30, 2018 actuarial valuation, the amortization period would have been 35.0 years instead of 39.8 years.

What market value rates of return in the next four years would be high enough to lower the amortization period below 25 years to get into the preferred range of the PRB guidelines? Scenarios 2 and 3 show two different patterns of return that would result in an amortization period under 25 years as of September 30, 2022.

Scenarios 4, 5 and 6 show three different examples of some adverse investment experience. In each scenario, the September 30, 2020 amortization period is projected to increase to over 40 years. These scenarios show the sensitivity of the amortization period to adverse investment experience, even with the smoothing method used.

We do not know what the investment experience will be for each of the next four plan years. Variations in experience from the underlying assumptions, other than investment return, will cause the actual amortization periods to be different from the periods shown above. In addition, the future investment experience in each of the next four years could be better or worse than the assumed rates shown. These scenarios present a range of plausible investment experience scenarios for the next two valuations assuming no changes in benefits or contribution rates. The key items that could have a positive effect, in addition to favorable investment experience, would be an increase in the number of firefighters and an increase in the total contribution rate.

The primary conclusion from the scenarios, influenced by the changes in the market since September 30, 2018, is that it is unlikely the amortization period in the next two actuarial valuations will be significantly below 25 years without some significant investment gains in the next four years or an increase in the number of firefighters or an increase in the contribution rate or some combination of those.

Participant and Asset Data

We have relied on and based our valuation on the active firefighter data, pensioner data, and asset data provided on behalf of the board of trustees by Ms. Jennifer Hanna, plan administrator for the board. We have not audited the data provided but have reviewed it for reasonableness and consistency relative to the data provided for the September 30, 2016 actuarial valuation. Exhibit 1 is a distribution of the active firefighters by age and service. The salaries used for projecting future contributions and benefits in the valuation were based on the actual pay for the 2018 plan year increased 2.6% to reflect the general pay increase in October 2018. The total of these salaries is our assumed annual covered payroll for the plan year beginning October 1, 2018 and is used in the valuation to

determine the UAAL amortization period. The averages of the assumed salaries for the 2018-2019 plan year are shown in Exhibit 1.

Exhibit 2 contains summary information on the pensioners. The monthly benefit payments are generally based on the amounts paid October 31, 2018. Exhibit 2A is a reconciliation of firefighters and pensioners from September 30, 2016 to September 30, 2018. Exhibit 3 shows a breakdown of the dollar level of the monthly benefits for retirees and surviving spouses. Exhibit 4 shows a historical comparison of the actuarial accrued liability and the actuarial value of assets.

The summary of assets contained in Exhibit 5 is based on the September 30, 2018 audited market value of assets shown in the fund's financial statements. This exhibit also shows a comparison of the market values and actuarial values of assets as of September 30, 2016 and September 30, 2018. Exhibit 5A contains the statement of changes in assets for fiscal years ending September 30, 2018 and September 30, 2017. Exhibit 6 shows the development of the actuarial value of assets. Exhibit 7 shows a historical comparison between the market value and actuarial value of assets. A comparison of the market value asset allocation by asset class as of September 30, 2016 and September 30, 2018 is shown in Exhibit 8.

Assumptions

As a part of each actuarial valuation, we review the actuarial assumptions used in the prior actuarial valuation. As a result of our review, we have selected actuarial assumptions we consider to be reasonable and appropriate estimates of future experience for the fund for the long-term future. Their selection complies with the applicable actuarial standards of practice. Significant actuarial assumptions used in the valuation are:

1. 7.5% annual investment return net of investment-related expenses;
2. 3% annual general compensation increase plus an average of 1.97% per year for pay increases due to promotions and longevity over a 30-year career;
3. Retirement rates which result in an average expected age at retirement of 55.1; and
4. PubS-2010 below-median income mortality tables projected for mortality improvement using scale MP-2018.

The following actuarial assumption changes have been made, and the new assumptions are compared to those used in the September 30, 2016 valuation:

1. The investment return assumption was changed from 7.75% net of investment-related expenses to 7.5% net of investment-related expenses. We made this change by lowering the assumed inflation component of the investment return assumption rate from 3.25% to 3%.

2. We changed the assumed general compensation increase from 3.25% per year to 3%, making it the same as the underlying price inflation assumption. As a result, we also changed the aggregate payroll increase assumption from 3.25% per year to 3%. We think that reducing the long-term assumed rate of inflation is appropriate. See our review of the inflation assumption in Appendix A.

3. We lowered the assumed administrative expenses paid from the fund from 1.0% of payroll to 0.85% of payroll based on the average of the last four plan years as shown in Appendix A.

4. The mortality assumption was changed from the RP-2000 Combined Healthy Mortality Tables projected to 2024 with Scale AA to the PubS-2010 (safety employees) below-median income mortality tables for employees and for retirees, projected for mortality improvement generationally using the projection scale MP-2018. The rationale for the change is to use the results of a new, first-ever study of the mortality of public employee pension plan participants by the Society of Actuaries. The new mortality assumption is more appropriate for the fund for the long-term future than the prior assumption.

5. The assumed pay increases due to promotion, step, and longevity increases were reviewed and revised to better fit the current pay structure for Killeen firefighters. The 30-year career average of 1.97% per year is somewhat higher than in the prior valuation (1.73% per year), with the new assumed annual increases 1.0% higher with six to ten years of service and 0.5% higher with 11 to 15 years of service compared to the prior valuation.

6. The experience of the fund in the election of RETRO DROP has been somewhat different than we have been assuming the prior two actuarial valuations (75% electing). In the last six years, 13 retirees have been eligible for RETRO DROP, and 12 of them elected it. As a result, for the retiring firefighters eligible for RETRO DROP, we have changed the assumed percent electing RETRO DROP from 75% to 90%.

7. Due to the combination of (a) the definition of average salary and (b) some large amounts of deployment pay for disaster response services from April 2016 through October 2018, we increased the projected average salary for ten firefighters.

The effects of these changes in assumptions on the UAAL amortization period are identified in Section II. A summary of all the assumptions and methods used in the valuation is shown in Exhibits 9 and 10. In our opinion, the assumptions used, both in the aggregate and individually, are reasonably related to the experience of the fund and to reasonable expectations. The assumptions represent a reasonable estimate of anticipated experience of the fund over the long-term future, and their selection complies with the applicable actuarial standards of practice.

Plan Provisions

The only substantive change in the Present Plan (plan effective January 1, 2019) is the exclusion of deployment pay received after January 1, 2019 for disaster response services

outside of the City of Killeen for determining benefits and contributions. Exhibit 12 summarizes the plan provisions of the Present Plan.

Actuarially Determined Contributions by the City

GASB 68 is all about accounting for pensions and did away with the concept of annually required contributions, referred to as the ARC. The GASB made a point of separating their new accounting standard for public employee defined benefit plans from the actual funding of those plans. In other words, the city's GASB 68 pension expense will usually be very different from its actual contributions. That is why separate reports are needed each year to provide the required GASB 68 actuarial information.

As a result of GASB getting out of the business of providing a funding standard, the PRB recommended in their report to the Texas Legislature at the end of 2014 that actuarial valuation reports for fixed contribution rate plans should disclose contribution levels required for a variety of appropriate amortization periods. Since the preferred range for the UAAL amortization period is 10 to 25 years in the PRB's pension funding guidelines, we have shown the city contribution rate that would be required beginning October 1, 2019 for amortization periods of 20, 25, and 30 years based on this September 30, 2018 actuarial valuation.

UAAL Amortization Period	Actuarially Determined Contribution Rate by the City	Firefighter Contribution Rate	Total Contribution Rate
20 Years	16.18%	11.00%	27.18%
25 Years	14.83%	11.00%	25.83%
30 Years	13.98%	11.00%	24.98%

In 2015, the Legislature passed HB 3310 which amended Sections 801 and 802 of the Government Code. It includes a new sentence in Section 802.101(a) which requires an actuarial valuation to include a recommended rate needed to have an amortization period for the UAAL that does not exceed 30 years. The city currently contributes 13% of pay and has for a number of years. Since our assumed continuation of this funding policy results in an actuarially determined amortization period of more than 30 years, we must recommend an increase in the city's contribution rate to 14% beginning October 1, 2019 for a 30-year amortization period or 15% for a 25-year amortization period.

Variability in Future Actuarial Measurement

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as: plan experience differing from that anticipated by the current economic or demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these

measurements, changes in economic or demographic assumptions, and changes in plan provisions. Analysis of the potential range of such future measurements resulting from the possible sources of measurement variability is typically outside the scope of an actuarial valuation. However, we provided projected amortization periods for the next two biennial actuarial valuations under six scenarios. Additional or other sensitivity analysis could be performed in a subsequent report if desired by the board of trustees.

Respectfully submitted,
RUDD AND WISDOM, INC.

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Fellow, Society of Actuaries
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Section II

Key Results of the Actuarial Valuation

	September 30, 2016[1]	September 30, 2018
1. Actuarial present value of future benefits		
a. Those now receiving benefits or former firefighters entitled to receive benefits	$ 21,632,787	$ 29,393,624
b. Firefighters	56,480,390	60,546,635
c. Total	$ 78,113,177	$ 89,940,259
2. Actuarial present value of future normal cost contributions	$ 24,460,400	$ 27,978,922
3. Actuarial accrued liability (Item 1c – Item 2)	$ 53,652,777	$ 61,961,337
4. Actuarial value of assets	$ 37,418,102	$ 42,970,465
5. Unfunded actuarial accrued liability (UAAL) (Item 3 - Item 4)	$ 16,234,675	$ 18,990,872
6. Contributions (percent of payroll)		
a. Firefighters	11.00%	11.00%
b. City of Killeen	13.00%	13.00%
c. Total	24.00%	24.00%
7. Normal cost (percent of payroll)	16.00%	17.02%
8. Percent of payroll available to amortize the UAAL (Item 6c - Item 7)	8.00%	6.98%
9. Annualized covered payroll	$ 14,180,561	$ 14,453,300
10. Present annual amount available to amortize the UAAL (Item 8 x Item 9)	$ 1,134,445	$ 1,008,840
11. Years to amortize the UAAL	22.8	39.8
12. Funded ratio (Item 4 ÷ Item 3)[2]	69.7%	69.4%

[1] All items are from the September 30, 2016 actuarial valuation and reflect the Present Plan.

[2] The funded ratio is not appropriate for assessing either the need for or the amount of future contributions or the adequacy of the assumed contribution rates. Using the market value of assets instead of the actuarial value of assets for Item 12 would have resulted in funded ratios of 65.9% as of September 30, 2016 and 70.9% as of September 30, 2018. **The best indicator of the fund's health is item 11.**

Change in Amortization Period

The amortization period, based on the Present Plan provisions, was determined in the actuarial valuation as of September 30, 2016 to be 22.8 years. Since two years have passed since that valuation date, a 20.8-year amortization period would be expected if all actuarial assumptions had been exactly met, no changes had occurred (other than those expected) in the firefighter and pensioner data, and no changes in assumptions or contribution rates had been made. The amortization period is now 39.8 years based on the same plan provisions. The actual experience occurring between September 30, 2016 and September 30, 2018 differed from the expected experience, and in combination with the changes in assumptions, the resulting amortization period is 39.8 years, which is 19.0 years more than the expected 20.8-year period for the following reasons:

1. The average annual rate of investment return, net of investment-related expenses, on the market value of assets during the two fiscal years ending in 2017 and 2018 was 10.92%. However, the actuarial value of assets (AVA) used in the valuation and the determination of the amortization period is based on an adjusted market value. The average annual rate of return on the AVA, net of investment-related expenses, for fiscal years 2017 and 2018 was 6.61%, below the assumed rate of return for those years of 7.75%. This resulted in an **increase** in the amortization period of 1.9 years.

2. The aggregate payroll increased at an average rate of 1.0% per year instead of the assumed 3.25% per year rate, which caused the amortization period to **increase** by 1.8 years.

3. The net result of all experience other than the investment experience and the aggregate payroll experience had the combined effect of **decreasing** the amortization period by 1.0 year. This was primarily the net result of lower than assumed compensation increases and more than expected terminations and retirements in the last two years.

4. The net effect of the changes in the economic assumptions due to lowering the assumed annual price inflation component from 3.25% to 3% (investment return from 7.75% to 7.5%, general compensation increase from 3.25% to 3%, and aggregate payroll increase from 3.25% to 3%) and lowering the assumed administrative expenses as a percent of payroll from 1.0% to 0.85% had the effect of **increasing** the amortization period by 6.0 years.

5. The change in the assumed compensation increases for promotion, step, and longevity increases; the new assumption to reflect the projected effect on future benefits of deployment pay for 10 firefighters in the three years before the Present Plan was changed to exclude deployment pay; and the change in the percent of eligible retiring firefighters assumed to elect RETRO DROP had the combined effect of **increasing** the amortization period by 4.7 years.

6. The result of the change in the mortality assumption resulted in an **increase** in the amortization period of 5.6 years.

Section III

Benefit Improvements

The results of this actuarial valuation as of September 30, 2018 reveal that the fund, based on the Present Plan of benefits, has an adequate contribution arrangement. As disclosed in both Sections I and II, the amortization period of the UAAL is 39.8 years. We cannot approve any benefit improvement at this time due to the level of the amortization period in this actuarial valuation. In order for benefit improvements to be made to the plan, they must be made in accordance with Section 7 of TLFFRA, which includes approval by the board's actuarial firm.

Because of the relatively high amortization period, we recommend that the board consider increased contribution rates. On page 6, we recommended increased contribution rates. For example, for a 25-year amortization period, we recommended 15% by the city effective October 1, 2019, a 2% increase. Alternatively, the 2% increase could be 1% by the firefighters to 12% and 1% by the city to 14%, both effective October 1, 2019.

Without some increase in the total contribution rate, the time horizon for considering benefit improvements in the future is much longer due to the 39.8-year UAAL amortization period in this actuarial valuation. We also propose a long-term strategy for injecting caution in future benefit improvements. The idea is to coordinate periodic benefit improvements with a gradual lowering of the benefit improvement threshold on the UAAL amortization period to a long-term goal such as 15 years. In the past, our threshold for improving benefits had been 30 years. Then in 2003, we lowered it to 25 years. The PRB changed its preferred range from 25-to-30 years to 15-to-25 years in 2011 and to 10-to-25 years in 2017. In 2015, we began encouraging our TLFFRA clients to think about an even lower threshold for benefit improvements. We are presenting this strategy again for your long-term planning primarily for the following reasons:

1. The current Texas Pension Review Board (PRB) guidelines for pension funding,
2. The change that the PRB made in 2017 to decrease the maximum acceptable number of years to amortize the UAAL from 40 years to 30 years effective in 2025, and
3. The increasing scrutiny of public employee pension plans.

We propose that the maximum threshold for future benefit improvements be lowered below 25 years in increments of two years until a long-term goal of a maximum threshold of 15 years is reached. This approach would both strengthen the actuarial condition of the fund and better prepare for the possibility of adverse experience to the fund in the future. The stronger actuarial condition of the fund would be demonstrated by the progressively lower UAAL amortization period until reaching below the middle of the current preferred range in the PRB guidelines (10 to 25 years).

One of the challenges the board faces is balancing the goals of providing periodic benefit improvements and of managing all your responsibilities in a way that considers the long-term sustainability of the fund. There are a number of stakeholders with different points of view. Firefighters approaching retirement would like to see increases in the benefit formula before they retire. Younger firefighters who hear about the level of the benefits that new retirees are receiving may wonder if the fund will be able to pay benefits like that when they retire. Pensioners may wonder if they will get any kind of ad hoc increase in their monthly benefit. The city has a vested interest in providing benefits that are well funded, at a level that is attractive for hiring and retaining good firefighters, and also affordable for the long term.

The city may take the position that it already contributes a higher rate to your fund than to its plan in TMRS for all the other city employees. A reason for the need for an even higher total contribution rate to your fund is that firefighters have much lower turnover than other city employees. So a higher percent of newly hired firefighters will ultimately qualify for a retirement benefit than will newly hired other city employees. As a result, the cost of firefighter retirement benefits is higher than the cost of comparable retirement benefits for other city employees. A second reason for a higher total contribution rate is that firefighters tend to retire at earlier ages than other city employees because of the physical demands of the job. This also increases the cost of firefighter retirement benefits compared to the cost for other city employees because of a longer period for benefits to be paid.

Because of these two work characteristic differences, a reasonable funding policy would be for the city to contribute a fixed rate to the fund that is greater than the current TMRS contribution rate. The firefighters already contribute 4% of pay more to the fund (11%) than the other city employees contribute to the TMRS plan (7%). Perhaps the city would consider paying at least 4% of pay more to your fund than they pay to the TMRS plan (10.08% in 2019).

Exhibit 1

Distribution of Firefighters by Age and Service on September 30, 2018 with Average Annual Salary

Years of Service	Age									Total	Average Salary
	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60 or Over		
0	5	9	1	1	0	0	0	0	0	16	$44,000
1	8	8	6	1	0	0	0	0	0	23	46,027
2	6	13	10	2	0	0	0	0	0	31	50,224
3	1	1	3	1	0	0	0	0	0	6	55,188
4	0	5	1	4	0	0	0	0	0	10	57,049
5	0	2	0	1	1	0	0	0	0	4	59,267
6	0	2	3	2	0	0	0	0	0	7	61,399
7	0	1	2	4	2	0	0	0	0	9	64,922
8	0	1	0	0	0	0	0	0	0	1	64,230
9	0	0	3	3	2	0	0	0	0	8	64,959
10	0	0	2	3	0	0	0	0	0	5	65,318
11	0	0	6	7	3	1	0	0	0	17	69,956
12	0	0	7	6	4	2	0	0	0	19	71,060
13	0	0	4	7	3	0	0	0	0	14	73,502
14	0	0	2	5	1	0	0	0	0	8	71,952
15	0	0	1	1	2	0	0	0	0	4	75,358
16	0	0	0	3	3	0	0	0	0	6	76,673
17	0	0	0	1	2	2	1	0	0	6	75,060
18	0	0	0	0	1	2	1	0	0	4	86,931
19	0	0	0	2	3	1	0	0	0	6	84,374
20-24	0	0	0	0	3	8	4	1	0	16	86,791
25-29	0	0	0	0	0	2	0	0	0	2	88,529
30-34	0	0	0	0	0	0	2	0	0	2	81,788
35+	0	0	0	0	0	0	0	1	0	1	131,357
Totals	20	42	51	54	30	18	8	2	0	225	$64,237

Average Salary	$46,876	$62,444	$73,339	$81,067	
	$50,725	$66,936	$84,773	$105,741	$64,237

Average age	34.7
Average years of service	9.1
Average age at hire	25.6

Exhibit 2

Summary of Pensioner Data

Type of Benefit	Pensioner Data Used in September 30, 2018 Valuation	
	Number of Recipients	Total Monthly Benefit Payments
Paid Firefighter Pensioners		
Service Retirement	57	$ 191,506
Disability Retirement	0	0
Vested Terminated (Deferred)	10	19,243
Surviving Spouse	9	16,308
Surviving Child	0	0
Total	76	$227,057
Volunteer Firefighter Pensioners		
Service Retirement	3	$ 465
Disability Retirement	0	0
Vested Terminated (Deferred)	0	0
Surviving Spouse	3	323
Surviving Child	0	0
Total	6	$ 788
Total Pensioners	82	$ 227,845

Type of Benefit	Comparison of Pensioner Count by Type as of The Prior and Current Actuarial Valuations			
	September 30, 2016	New	Ceased	September 30, 2018
Paid Firefighter Pensioners				
Service Retirement	45 [1]	+12 [2]	0	57 [3]
Disability Retirement	1	0	-1	0
Vested Terminated (Deferred)	8	+3	-1	10
Surviving Spouse	9	0	0	9
Surviving Child	0	0	0	0
Total	63	+15	-2	76
Volunteer Firefighter Pensioners				
Service Retirement	2	+1	0	3
Disability Retirement	0	0	0	0
Vested Terminated (Deferred)	1	0	-1	0
Surviving Spouse	4	0	-1	3
Surviving Child	0	0	0	0
Total	7	+1	-2	6
Total Pensioners	70	+16	-4	82

[1] Includes three alternate payees according to the terms of a QDRO for a retired member.
[2] Includes an alternate payee according to the terms of a QDRO for a retired member.
[3] Includes four alternate payees according to the terms of a QDRO for a retired member.

Exhibit 2A

Firefighter and Pensioner Reconciliation

	Firefighters	Current Payment Status	Vested Terminated Firefighters	Total
1. As of September 30, 2016	224	61 [1]	9	294
2. Change of status				
a. retirement	(10)	12 [2]	(2)	0
b. disability	0	(1)	0	(1)
c. death	0	(1)	0	(1)
d. survivor payment begins	0	0	0	0
e. withdrawal	(33)	0	0	(33)
f. vested termination	(3)	0	3	0
g. new QDRO	0	1	0	1
h. net changes	(46)	11	1	(34)
3. New firefighters	47 [3]	0	0	47
4. As of September 30, 2018	225	72 [4]	10	307

[1] Includes three alternate payees according to the terms of a QDRO for a retired member.
[2] Includes an alternate payee.
[3] Includes five John Does to bring the number of firefighters to 225, the average expected staffing during the year following the valuation date..
[4] Includes four alternate payees according to the terms of a QDRO for a retired member.

Exhibit 3

Breakdown of Paid Firefighters Pensioners by Monthly Benefit Amounts as of September 30, 2018

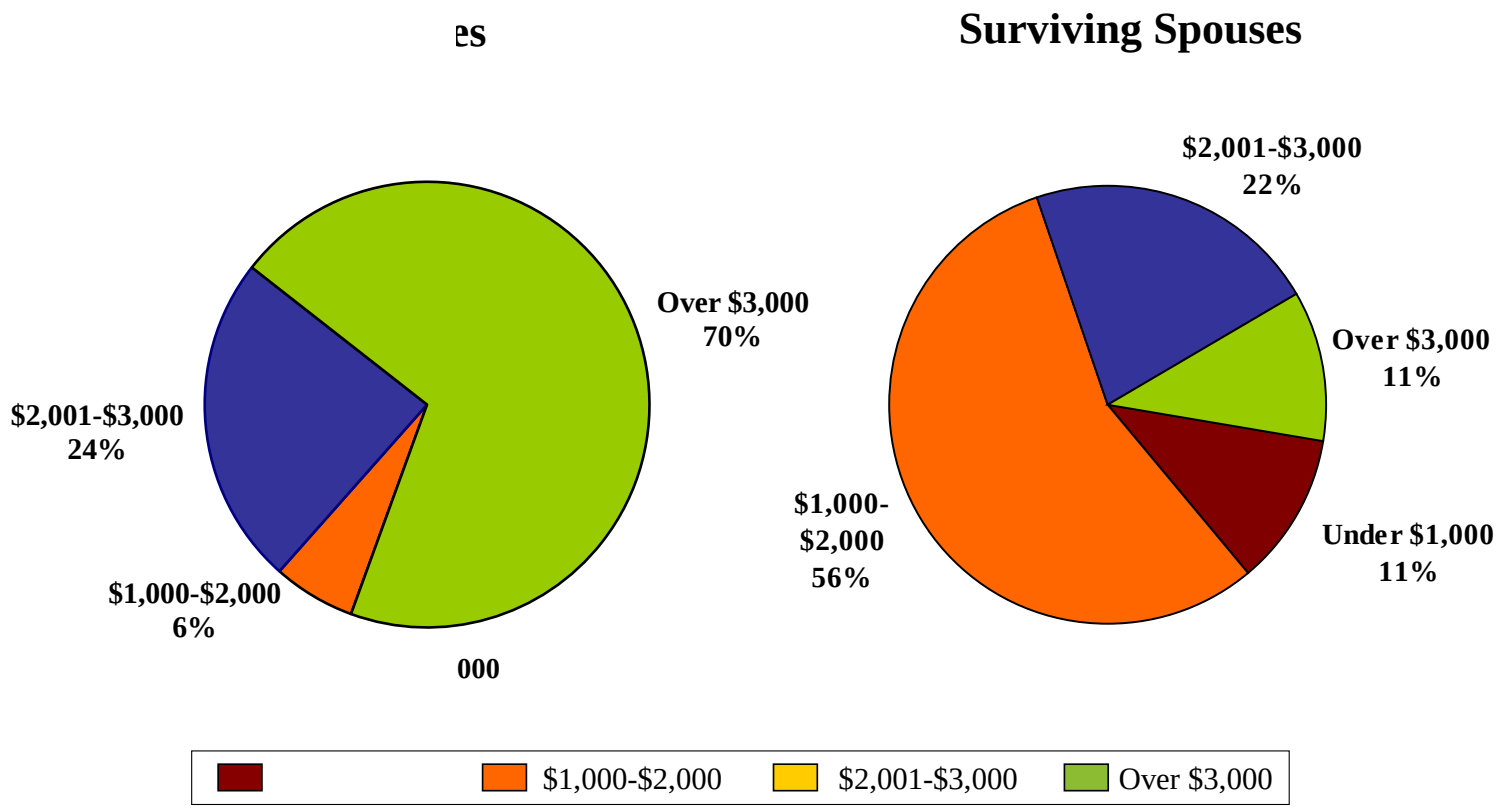


Exhibit 4

Historical Comparison of Actuarial Accrued Liability for Active Firefighters and Pensioners (Present Plan Valuations as of September 30)

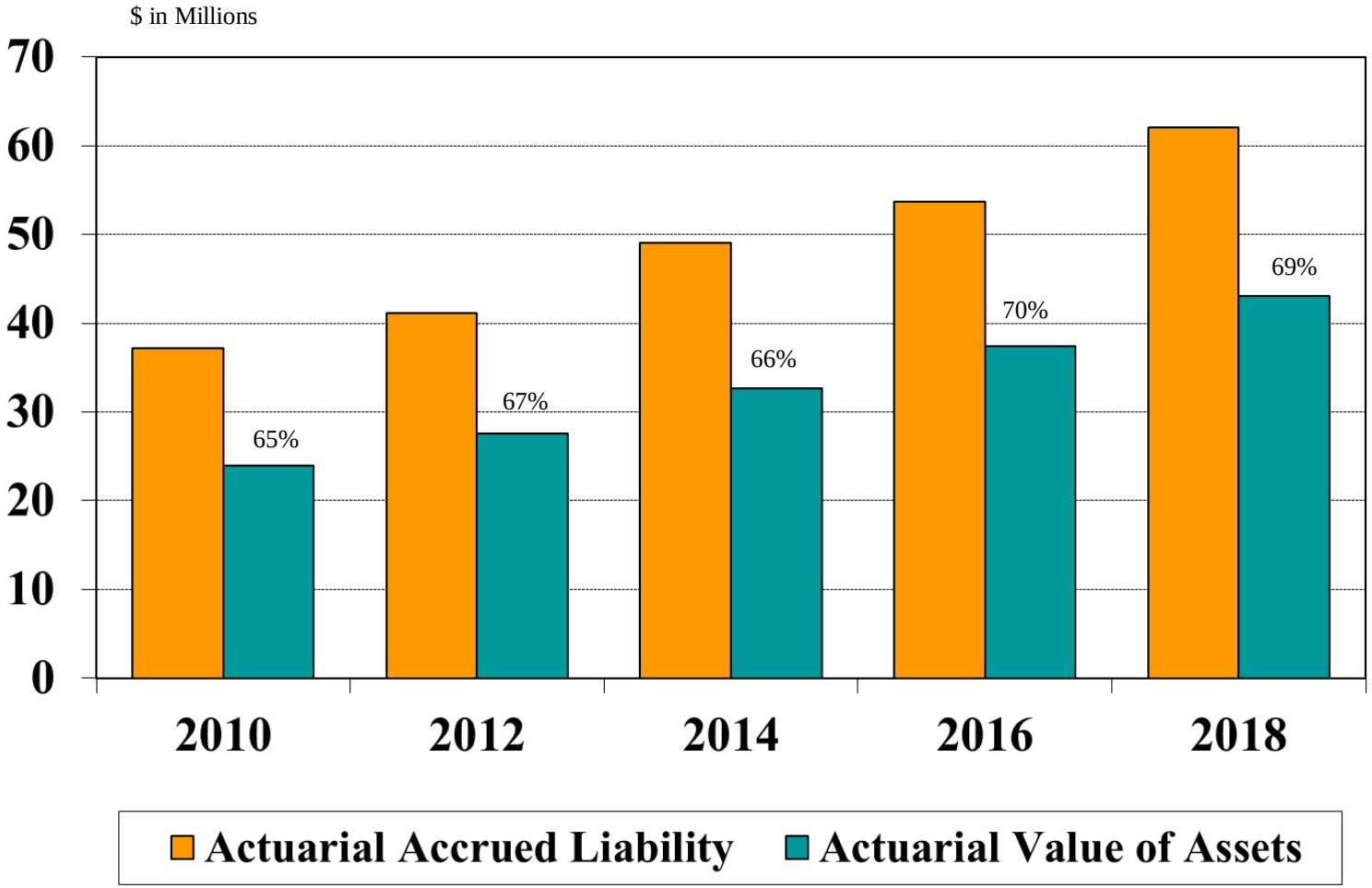


Exhibit 5

Summary of Asset Data

Asset Type	Market Value of Assets as of September 30, 2018	Allocation as a Percent of Grand Total
Domestic Equities		
Large Cap	$ 16,111,436	36.7%
Small/Mid Cap	2,855,777	6.5
Total	18,967,213	43.2
International Equities	6,590,517	15.0
Fixed Income		
Core	8,473,299	19.3
Global	1,800,631	4.1
Direct Lending	1,572,728	3.6
Total	11,846,658	27.0
Alternatives		
Balanced Fund	1,933,455	4.4
Real Estate	1,690,424	3.8
Tactical	1,148,782	2.6
Total	4,772,661	10.8
Cash, Payables, Receivables	1,770,172	4.0
Grand Total	$ 43,947,221 [1]	100.0%

[1]The grand total is the audited amount. All of the investment amounts except "cash, payables, receivables" are from the September 30, 2018 report from the investment consultant. Cash is the balancing item.

Comparison of Asset Values as of the Prior and Current Actuarial Valuation Dates		
	September 30, 2016	September 30, 2018
Market Value	$35,342,830	$43,947,221
Actuarial Value	$37,418,102	$42,970,465
Actuarial Value as a Percent of Market Value	105.9%	97.8%

Exhibit 5A

Statement of Changes in Audited Assets for the Years Ended September 30, 2018 and 2017

	9/30/2018	9/30/2017
Additions		
1. Contributions		
a. Employer	$ 1,817,845	$ 1,873,368
b. Employees	1,538,179	1,585,161
c. Total	$ 3,356,024	$ 3,458,529
2. Investment Income		
a. Interest and dividends	$ 1,518,118	$ 1,005,865
b. Net appreciation in fair value	2,122,016	3,652,144
c. Total	$ 3,640,134	$ 4,658,009
3. Other Additions	0	0
Total Additions	**$ 6,996,158**	**$ 8,116,538**
Deductions		
4. Benefit Payments		
a. Monthly benefits	$ 2,587,476	$ 2,788,162
b. Contribution refunds	195,488	197,360
c. RETRO DROP lump sums	0	398,139
d. Total	$ 2,782,964	$ 3,383,661
5. Expenses		
a. Direct investment-related	$ 54,185	$ 54,234
b. General administrative	96,351	136,910
c. Total	$ 150,536	$ 191,144
Total Deductions	**$ 2,933,500**	**$ 3,574,805**
Net Increase in Assets	**$ 4,062,658**	**$ 4,541,733**
Market Value of Assets (Plan Net Position)		
Beginning of Year	$ 39,884,563	$ 35,342,830
End of Year	$ 43,947,221	$ 39,884,563
Rate of Return		
Net of All Expenses	8.69%	12.63%
Net of Investment-Related Expenses	8.94%	13.04%
Gross	9.08%	13.20%
Direct Investment-Related Expenses	0.14%	0.16%

Exhibit 6

Development of Actuarial Value of Assets

Calculation of Actuarial Investment Gain/(Loss) Based on Market Value for Plan Years Ending September 30				
	2018	2017	2016	2015
1. Market Value of Assets as of Beginning of Year	$ 39,884,563	$ 35,342,830	$ 31,072,702	$ 31,844,201
2. Firefighter Contributions	1,538,179	1,585,161	1,483,972	1,419,132
3. City Contributions	1,817,845	1,873,368	1,770,872	1,696,664
4. Benefit Payments and Administrative Expenses[1]	(2,879,315)	(3,520,571)	(2,095,650)	(2,442,318)
5. Expected Investment Return[2]	3,109,526	2,736,665	2,453,053	2,494,023
6. Expected Market Value of Assets as of End of Year	$ 43,470,798	$ 38,017,453	$ 34,684,949	35,011,702
7. Actual Market Value of Assets as of End of Year	43,947,221	39,884,563	35,342,830	31,072,702
8. Actuarial Investment Gain/(Loss)	$ 476,423	$ 1,867,110	$ 657,881	$ (3,939,000)
9. Market Value Rate of Return Net of Expenses	8.94%	13.04%	9.83%	(4.49)%
10. Rate of Actuarial Investment Gain/(Loss)	1.19%	5.29%	2.08%	(12.24)%

[1] Administrative expenses are included because the investment return assumption was net of investment-related expenses for all four years.
[2] Assuming uniform distribution of contributions and payments during the plan years; actuarially assumed investment return of 7.75%.

Plan Year	Investment Gain/(Loss)	Deferral Percentage	Deferred Gain/(Loss) as of 9/30/2018
2018	$ 476,423	80%	$ 381,138
2017	1,867,110	60%	1,120,266
2016	657,881	40%	263,152
2015	(3,939,000)	20%	(787,800)
Total			$ 976,756

Actuarial Value of Assets as of September 30, 2018	
11. Market Value of Assets as of September 30, 2018	$ 43,947,221
12. Deferred Gain/(Loss) to be Recognized in Future	976,756
13. Preliminary Value (Item 11 – Item 12)	$ 42,970,465
14. Corridor for Actuarial Value of Assets	
a. 80% of Market Value as of September 30, 2018 (minimum)	$ 35,157,777
b. 120% of Market Value as of September 30, 2018 (maximum)	$ 52,736,665
15. Actuarial Value as of September 30, 2018	$ 42,970,465
16. Write Up/(Down) of Assets (Item 15 – Item 11)	$ (976,756)

Exhibit 7

Historical Comparison of Market and Actuarial Value of Assets (Valuation as of September 30)

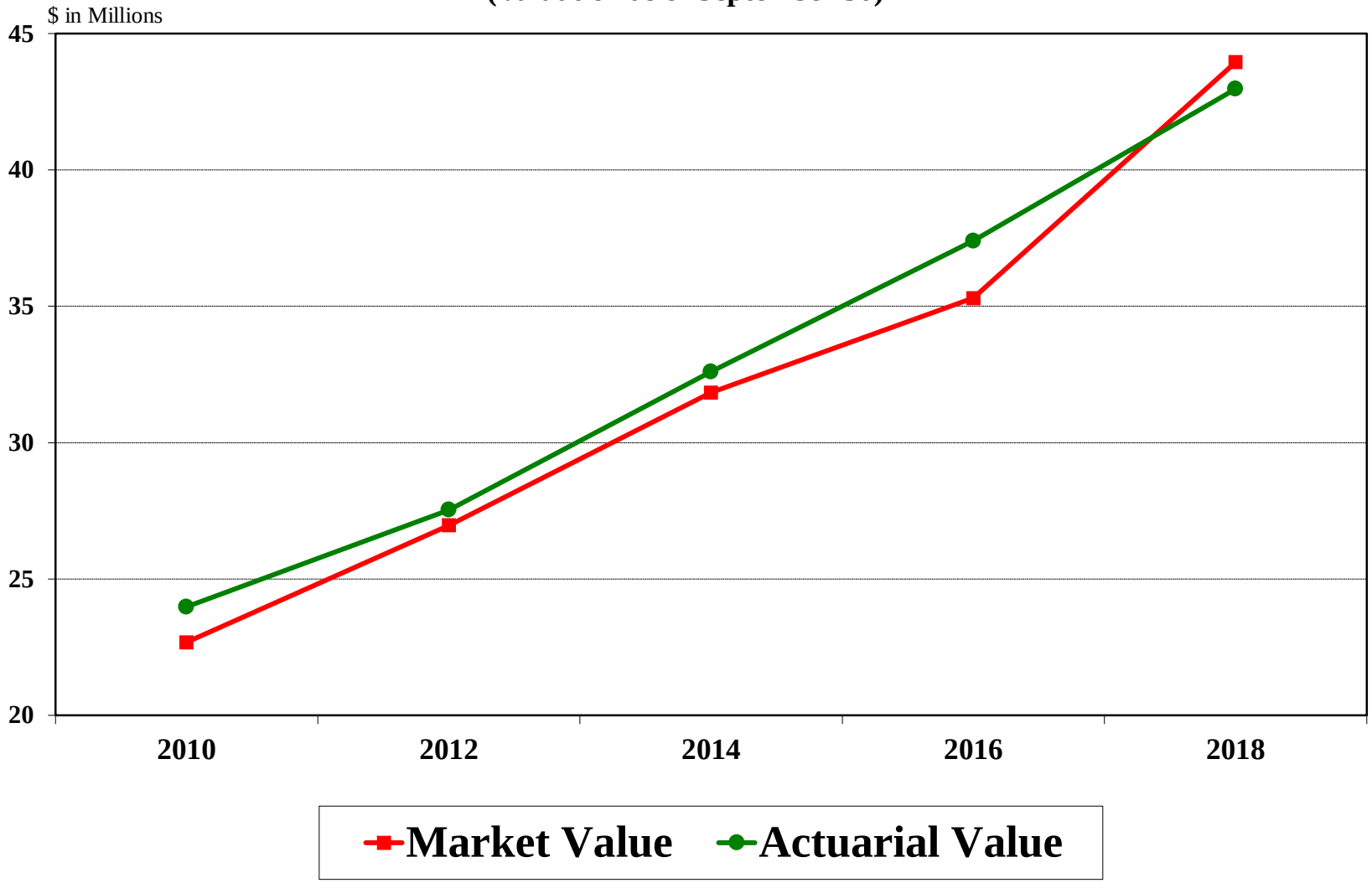
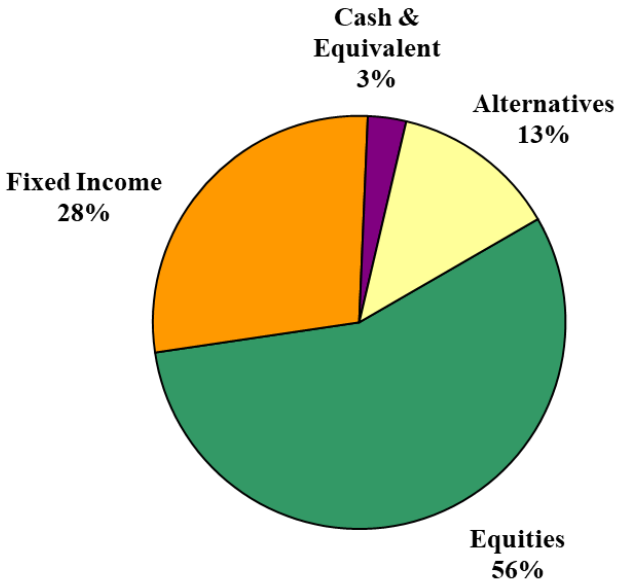


Exhibit 8

Comparison of Market Value Asset Investment Allocation as of the Prior and Current Actuarial Valuation Dates

September 30, 2016



September 30, 2018

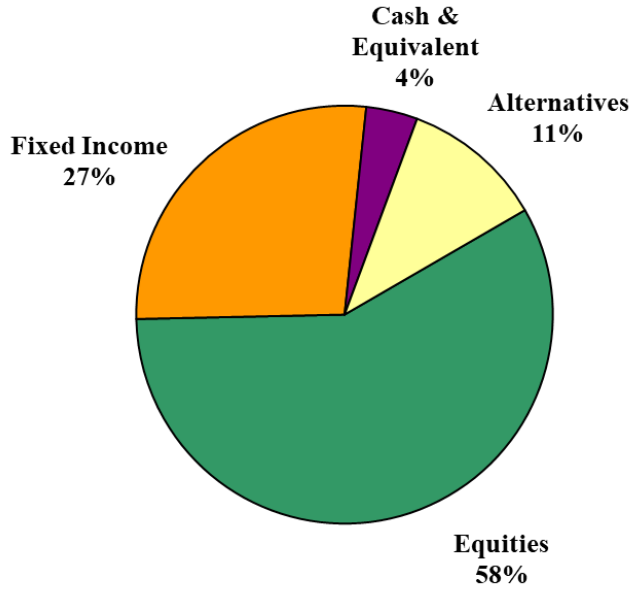


Exhibit 9

Actuarial Methods and Assumptions

A. Actuarial Methods

1. Actuarial Cost Method

The Entry Age Actuarial Cost Method is an actuarial cost method in which the actuarial present value of projected benefits of each active firefighter included in the valuation is allocated as a level percentage of compensation between age at hire and assumed termination. Each active firefighter's normal cost is the current annual contribution in a series of annual contributions which, if made throughout the firefighter's total period of employment, would fund his expected benefits. Each firefighter's normal cost is calculated to be a constant percentage of his expected compensation in each year of employment. The normal cost for the fund is the sum of the normal costs for each active firefighter for the year following the valuation date. The normal cost as a percent of payroll reflects that contributions are made biweekly.

The fund's actuarial accrued liability is the excess of the actuarial present value of projected benefits over the actuarial present value of all future remaining normal cost contributions. The unfunded actuarial accrued liability (UAAL) is the amount by which the actuarial accrued liability exceeds the actuarial value of assets. The UAAL is recalculated each time a valuation is performed. Experience gains and losses, which represent deviations of the UAAL from its expected value based on the prior valuation, are determined at each valuation and are amortized as part of the newly calculated UAAL.

2. Amortization Method

The UAAL is assumed to be amortized with level percentage of payroll contributions (total assumed contribution rate less normal cost contribution rate) based on assumed payroll growth of 3% per year. The actuarial determination of the amortization period reflects that contributions are made biweekly.

3. Actuarial Value of Assets Method

All assets are valued at market value with an adjustment made to uniformly spread actuarial gains or losses (as measured by actual market value investment return vs. expected market value investment return) over a five-year period. The total adjustment amount shall be limited as necessary such that the actuarial value of assets shall not be less than 80% of market value nor greater than 120% of market value. See Exhibit 6.

B. Actuarial Assumptions

As a part of each actuarial valuation, we review the actuarial assumptions used in the prior actuarial valuation. The investment return assumption is reviewed using the building block approach that includes one or more asset allocations, assumed real rates of return for each asset class, an assumed rate of investment-related expenses, and an assumed rate of inflation, with all assumptions for the long-term future. Our economic assumptions are influenced both by long-term historical experience and by future expectations of investment consultants and economists, but we select the economic assumptions and usually discuss them with the board before completing the actuarial valuation.

We review the termination and retirement experience since the prior valuation and periodically look back more than two years. We also periodically review the average salaries by years of service to get insights into the promotion, step, and longevity compensation patterns for the purpose of reviewing our compensation increase assumption. For the mortality assumptions, we use an appropriate published mortality table with projections for improvement beyond the valuation date. We are guided in our review and selection of assumptions by the relevant actuarial standards of practice. As a result of our review, we have selected actuarial assumptions we consider to be reasonable and appropriate estimates of future experience for the system for the long-term future.

1. Investment Return

   7.5% per year net of investment-related expenses.

2. Inflation

   3% per year included in compensation increases and investment return assumptions.

3. Mortality Rates

   PubS-2010 (safety employees) below-median income tables for employees and for retirees, projected for mortality improvement generationally using the projection scale MP-2018.

4. Compensation Increases

   General increases of 3% per year in addition promotion, step, and longevity increases that average 1.97% per year over a 30-year career. See Exhibit 10.

5. Retirement Rates

Age	Rate per Year for Paid Firefighters Eligible to Retire
50-51	30%
52-55	15
56-69	25
70	100

The average expected retirement age for firefighters not yet eligible to retire based on these rates is 55.1.

6. RETRO DROP Election

a. Percent of firefighters eligible electing RETRO DROP: 90% of service retirements eligible to elect at least a 12-month lump sum.

b. Months assumed for lump sum: Maximum they are eligible for, up to 24 months.

7. Withdrawal Rates

See Exhibit 10.

8. Disability Rates

See Exhibit 10. The on-duty and off-duty rates are each 50% of the total rate at each age.

9. Reduction in Benefit after 2½ Years of Disability Retirement

15% weighted average reduction in benefit.

10. Percent Married

80% of the firefighters are assumed to be married at retirement, disability, or death while employed, with male firefighters having a spouse three years younger and female firefighters having a spouse three years older.

11. Payment Form for Retirement Benefits Due to Service Retirement, Disability Retirement, or Vested Termination

    - Joint and 2/3 to surviving spouse for the 80% assumed to be married
    - Life annuity for the 20% assumed to be single

    To the extent optional forms of payment are elected and the amounts are determined under an actuarial basis which differs from the basis used in the valuation, actuarial gains or losses will occur. These gains or losses are expected to be very small and will be recognized through the valuation process for those retiring since the prior valuation who made an optional election.

12. Surviving Child's Death Benefit

    None are assumed as a result of future deaths.

13. Firefighters' Contribution Rate

    11% of covered pay.

14. City's Assumed Contributions

    13% of covered payroll for firefighters.

15. Covered Payroll for First Year Following Valuation Date

    Actual (or annualized) pay for 2018 increased by 2.6% for each firefighter to reflect the pay increase effective in October 2018.

16. General Administrative Expenses

    The expenses paid by fund assets for other than investment-related expenses are assumed to be 0.85% of payroll. The normal cost rate as a percent of payroll is assumed to be 0.85% of payroll higher to reflect these expenses.

17. Increase in Future Pay-Related Benefits Due to Definition of Average Salary

    - 0.50%
    - an additional increase in projected average salary for ten firefighters based on deployment pay received from April 2016 through October 2018

Exhibit 10

Disability and Withdrawal Rates per 1,000 Active Members
Compensation Increases by Years of Service

Disability Rates[1]		Withdrawal Rates		Compensation Increases	
Attained Age	Rate per 1,000	Years of Service	Rate per 1,000	Years of Service	Increase Percent
20	0.14	0	89	1	9.18%
21	0.15	1	80	2	9.18
22	0.16	2	71	3	9.18
23	0.17	3	63	4	9.18
24	0.18	4	55	5	9.18
25	0.19	5	47	6	7.12
26	0.21	6	41	7	7.12
27	0.23	7	36	8	7.12
28	0.25	8	32	9	7.12
29	0.28	9	29	10	7.12
30	0.31	10	25	11	5.06
31	0.35	11	21	12	5.06
32	0.40	12	18	13	5.06
33	0.45	13	16	14	5.06
34	0.49	14	14	15	5.06
35	0.52	15	14	16	3.00
36	0.54	16	14	17	3.00
37	0.57	17	12	18	3.00
38	0.62	18	11	19	3.00
39	0.73	19	11	20	3.00
40	0.92	20 & Over	0	21	3.00
41	1.14			22	3.00
42	1.32			23	3.00
43	1.48			24	3.00
44	1.73			25	3.00
45	2.09			26	3.00
46	2.55			27	3.00
47	2.98			28	3.00
48	3.34			29	3.00
49	3.62			30	3.00
50	3.79			31	3.00
51	3.92			32	3.00
52	4.04			33	3.00
53	4.24			34	3.00
54	4.56			35	3.00
55	0.00			36	3.00
56	0.00			37	3.00
57	0.00			38	3.00
58	0.00			39	3.00
59	0.00			40	3.00

[1] The on-duty and off-duty rates are each 50% of the total rate shown at each age.

Exhibit 11

Definitions

1. Actuarial Accrued Liability	That portion, as determined by the particular actuarial cost method used, of the Actuarial Present Value of future pension plan benefits as of the Valuation Date that is not provided for by the Actuarial Present Value of future Normal Costs.
2. Actuarial Assumptions	Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, termination, disablement and retirement; changes in compensation; rates of investment earnings and asset appreciation; and other relevant items.
3. Actuarially Equivalent	Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.
4. Actuarial Gain (Loss)	A measure of the difference between actual experience and that expected based on the Actuarial Assumptions during the period between two Actuarial Valuation dates, as determined in accordance with the particular actuarial cost method used.
5. Actuarial Present Value	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date (the Valuation Date) by the application of the Actuarial Assumptions.
6. Actuarial Valuation	The determination, as of a Valuation Date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets and related Actuarial Present Values for a pension plan.
7. Actuarial Value of Assets	The value of cash, investments and other property belonging to a pension plan, as determined by a method and used by the actuary for the purpose of an Actuarial Valuation.

8. Entry Age Actuarial Cost Method	An actuarial cost method under which the Actuarial Present Value of the Projected Benefits of each individual included in the Actuarial Valuation is allocated as a level percentage of earnings between entry age and assumed termination. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a Valuation Date by the Actuarial Present Value of future Normal Costs is called the Actuarial Accrued Liability. Under this method, Actuarial Gains (Losses), as they occur, reduce (increase) the Unfunded Actuarial Accrued Liability.
9. Plan Year	A 12-month period beginning October 1 and ending September 30.
10. Normal Cost	That portion of the Actuarial Present Value of pension plan benefits that is allocated to a valuation year by the actuarial cost method.
11. Projected Benefits	Those pension plan benefit amounts that are expected to be paid at various future times according to the Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future qualified service.
12. Overfunded Actuarial Accrued Liability	The excess, if any, of the Actuarial Value of Assets over the Actuarial Accrued Liability.
13. Unfunded Actuarial Accrued Liability	The excess, if any, of the Actuarial Accrued Liability over the Actuarial Value of Assets.
14. Valuation Date	The date upon which the Normal Cost, Actuarial Accrued Liability and Actuarial Value of Assets are determined. Generally, the Valuation Date will coincide with the end of a Plan Year, but it does not have to coincide.
15. Years to Amortize the Unfunded Actuarial Accrued Liability	The period is determined in each Actuarial Valuation as the number of years, beginning with the Valuation Date, to amortize the Unfunded Actuarial Accrued Liability with a level percent of payroll that is the difference between the expected total contribution rate and the Normal Cost contribution rate.

Exhibit 12

Summary of Present Plan

1.	Monthly Retirement Benefit for Firefighters as a Percentage of Highest 60-Month Average Salary	
	(a) For service and duty-related disability retirement benefit	58.40%
	(b) For duty-related death benefit to surviving spouse	38.93%
2.	Additional Monthly Retirement Benefit for Firefighters as a Percentage of Highest 60-Month Average Salary for Each Year of Service in Excess of 20 Years of Service	
	(a) For service and duty-related disability retirement benefit	2.275%
	(b) For duty-related death benefit to surviving spouse	1.517%
3.	Service Retirement Eligibility for Firefighters	Age 50 and 25 Years or Age 55 and 20 Years
4.	Retroactive Deferred Retirement Option Plan (RETRO DROP) provides a reduced monthly benefit and a lump sum	
	(a) Earliest RETRO DROP benefit calculation date	3.5 Years after Service Retirement Eligibility
	(b) Maximum RETRO DROP benefit accumulation period	24 Months
	(c) Earliest employment termination date with maximum RETRO DROP benefit accumulation period	Age 55.5 and 30.5 Years or Age 60.5 and 25.5 Years
	(d) RETRO DROP lump sum includes	
	(i) monthly benefits that would have been received between RETRO DROP benefit calculation date and termination of employment,	
	(ii) accumulated contributions made by the firefighter after the RETRO DROP benefit calculation date, and	
	(iii) no interest	
5.	Vested Termination Benefit	
	(a) Eligibility for firefighters	10 years
	(b) Percent vested with 10 years	50%
	(c) Additional percent vested for each year above 10 years	5%
	(d) Percent vested with 20 or more years	100%
	(e) Benefit is deferred to date person would have satisfied service retirement eligibility date	
	(f) Benefit is percent vested times service retirement benefit	

6. Disability Retirement Monthly Benefit for Firefighters Who Become Totally Disabled as a Result of Duties as a Firefighter
   (a) The benefit is (i) plus (ii) for the initial 30-month period if not able to perform job in fire department with equal or greater pay than before becoming disabled
      (i) Minimum monthly amount based on 20 years in 1(a)
      (ii) Additional monthly amount per year of service in excess of 20 years in 2(a)
   (b) Following the initial 30-month period, the status is periodically reviewed, and the benefit may be continued in full, reduced by half, or terminated, depending upon whether the member is able to perform any work for which he is reasonably suited by education, training, and experience.
   (c) Upon attaining eligibility for normal retirement, the member's vested retirement benefit becomes payable if the disability benefit has been reduced or terminated

7. Monthly Duty-Related Death Benefit for Children of Firefighters as a Percentage of Highest 60-Month Average Salary

(a) Where the spouse is receiving a benefit	7.79%
(b) Where the spouse is not receiving a benefit or there is no spouse	38.93%

8. Contributions As a Percentage of Pay by:

(a) Firefighters	11.00%
(b) City of Killeen	13.00%

9. Monthly Benefits for Volunteer Firefighters[1]

(a) Service retirement benefit	$155.00
(b) Duty-related disability retirement benefit	$155.00
(c) Duty-related spouse survivor benefit	$105.00
(d) Duty-related child survivor benefit:	
i. Where the spouse is receiving a benefit	$37.20
ii. Where the spouse is not receiving a benefit	$105.00

10. Service Retirement Eligibility for Volunteer Firefighters[1] — Age 55 and 20 Years

11. Vested Terminated Benefit Eligibility for Volunteer Firefighters[1] (Benefit Deferred to Age 55) — 20 Years

12. A prorated benefit is provided for firefighters with both paid and volunteer service.[1]

13. The normal form of annuity payment at retirement is a Joint and Two-Thirds to Surviving Spouse, and payment is the last day of each month. A Joint and 75% to Surviving Spouse Option and Joint and 100% to Surviving Spouse Option are available as optional forms of a service retirement benefit. A Social Security Leveling Option is also available.

14. Off-duty death benefits are provided for paid firefighters with more than 20 years of service with the same formula as for a duty-related death [Items 1(b) and 2(b)].

[1] The city discontinued using volunteers beginning in the second half of 2016.

15. Salary used to determine the Highest 60-Month Average Salary for paid firefighters includes regular pay, longevity and overtime pay and excludes (a) a lump sum distribution upon termination for unused sick leave or vacation and (b) deployment pay after January 1, 2019 for disaster response services outside of the City of Killeen. The average is based on the highest 130 biweekly pay periods during active participation in the fund or before the RETRO DROP benefit calculation date.

16. Refund of firefighters' accumulated contributions without interest will be made to firefighters who terminate employment and either are not eligible for any other benefit from the fund or request a refund from the fund.

Appendix A

Review of the Actuarial Economic Assumptions for the September 30, 2018 Actuarial Valuation

Asset Allocation and Investment Return Assumption Development

	Gross Annual Real Rate of Investment Return (ROR)[1]	Estimated Investment Expenses[2]	Net Real ROR	Asset Allocation 9/30/18 Actual[3]	Asset Allocation Current Target
Equities					
Domestic large cap blend	6.5%	0.21%	6.29	21.0%	15.0%
Domestic large cap value	6.5	0.81	5.69	8.1	7.5
Domestic large cap growth	6.5	0.81	5.69	8.4	7.5
Domestic small/mid cap	7.0	0.26	6.74	6.6	10.0
International developed value	7.0	0.60	6.40	7.7	7.5
International developed growth	7.0	0.65	6.35	7.6	7.5
				59.4	55.0
Fixed Income					
Domestic core	2.0	0.59	1.41	19.7	18.5
Global	2.5	0.82	1.68	4.2	5.0
Direct lending	3.0	1.51	1.49	3.7	6.5
				27.6	30.0
Alternatives					
Real estate	5.0	1.41	3.59	3.9	5.0
Balanced fund	3.5	0.69	2.81	4.5	5.0
Tactical strategies	8.5	1.41	7.09	2.7	5.0
				11.1	15.0
Cash	0.5	0.26	0.24	1.9	0.0
				100.0%	100.0%
Weighted Average Net Real ROR Assumption				4.55%	4.54%
Possible Theoretical Annual Investment Return Assumption (Total Net Annual ROR) – Net Real ROR Plus Assumed Annual Rate of Inflation					
Assumed 3.25% Inflation				7.80%	7.79%
Assumed 3.00% Inflation				7.55%	7.54%

[1] A gross annual real rate of investment return is the total annual rate of investment return, before any expenses, that is in excess of the assumed annual inflation rate. These are long-term assumptions made by Rudd and Wisdom, Inc.

[2] These assumed investment-related expenses are primarily based on information from AndCo Consulting as of September 30, 2018 for both direct and indirect expenses, with an addition of 0.16% for bank and investment consultant fees.

[3] This allocation is from AndCo Consulting's September 30, 2018 performance review and report.

Appendix A (continued)

Price Inflation in the USA - Average Annual Rates of Increase in the CPI-U

Years (Dec. to Dec.)	Number of Years	Average Annual Increase
1953 – 2018	65	3.50%
1958 – 2018	60	3.67
1963 – 2018	55	3.88
1968 – 2018	50	3.99
1973 – 2018	45	3.83
1978 – 2018	40	3.33
1983 – 2018	35	2.63
1988 – 2018	30	2.48
1993 – 2018	25	2.20
1998 – 2018	20	2.16

Most inflation forecasts are for 10 years or less. For example, the average 10-year forecast in the December 2018 Livingston Survey published by the Federal Reserve Bank of Philadelphia was 2.23%. Similarly, the 2019 Wall Street Consensus Survey for the next decade included an average inflation forecast of 2.2%. However, 10 years is much too short a forecast period for a public employee defined benefit pension plan. In the 2018 annual report of the OASDI Trust Funds (Social Security), the ultimate inflation assumptions for their 75-year projections are 3.2%, 2.6%, and 2.0% for the low-cost, intermediate, and high-cost assumptions, respectively. Looking at the average annual increase in the CPI-U over historical periods of 30 to 65 years above and considering the Social Security forecasts, **we believe that reasonable assumed rates of inflation for the long-term future would range from 2.5% to 3.5%. Shorter term considerations make the bottom half of that range more desirable.**

General Administrative Expenses Paid by the Fund

Plan Year Ending 9/30 (1)	General Administrative (GA) Expenses Paid by the Fund (2)	Estimated Payroll (3)	% of Payroll (2) ÷ (3) (4)
2018	$ 96,351	$13,983,445	0.69%
2017	136,910	14,410,555	0.95
2016	94,483	13,490,655	0.70
2015	135,909	12,901,200	1.05
2014	130,049	11,678,964	1.11
2013	118,799	11,273,360	1.05
2015-2018	$463,653	$54,785,855	0.85%

The general administrative expenses are not reflected in the investment return assumption but are reflected as a percent of payroll that is added to the normal cost contribution rate. For the September 30, 2018 actuarial valuation, we recommend 0.85%, which is the average developed above for the last four plan years. This is somewhat lower than the assumption of 1.00% used in the September 30, 2016 actuarial valuation. (The estimated payroll was determined as the firefighter contributions for the plan year divided by the firefighter contribution rate during the plan year.)

Appendix A (continued)

Comparison of 9/30/2016 Actuarial Economic Assumptions with 9/30/2018 Actuarial Economic Assumptions

Actuarial Assumption[1]	9/30/2016 Actuarial Economic Assumptions	9/30/2018 Actuarial Economic Assumptions
Inflation (Price)	3.25%	3.00%
Net real rate of return[2]	4.50	4.50
Net total investment return[2]	7.75%	7.50%
Firefighter pay increase[3]	4.98%	4.97%
Aggregate payroll increase	3.25%	3.00%
GA expenses (% of payroll)	1.00%	0.85%

[1] All assumptions are annual rates.
[2] Net of all investment-related expenses.
[3] For 9/30/2016, a 3.25% annual general pay increase plus 1.73% average annual promotion, step, and longevity pay increase over a 30-year career. For 9/30/2018, a 3% annual general pay increase plus 1.97% average annual promotion, step, and longevity pay increase over a 30-year career.