Fire and Police Pension Association

Statewide Defined Benefit Plan

Actuarial Valuation Report
for the Year Beginning January 1, 2018

GRS Retirement Consulting
P: 720.274.7270 | F: 303.694.0633 | www.grsconsulting.com

June 30, 2018

Board of Directors
Fire and Police Pension Association
5290 DTC Parkway, Suite 100
Greenwood Village, Colorado 80111

Re: Actuarial Valuation of the FPPA Statewide Defined Benefit Plan (the Plan) as of January 1, 2018

Dear Members of the Board:

We are pleased to present our Report on the actuarial valuation of the Statewide Defined Benefit Plan for the Fire and Police Pension Association (FPPA) as of January 1, 2018.

We certify that the information included herein and contained in our 2018 Actuarial Valuation Report is accurate and fairly presents the actuarial position of the FPPA Statewide Defined Benefit Plan as of January 1, 2018.

Our Report presents the results of the January 1, 2018 actuarial valuation of the FPPA Statewide Defined Benefit Plan (SWDB). The Report describes the current actuarial condition of the SWDB, determines actuarially appropriate contribution rates, and analyzes changes in these required rates. The results presented herein may not be applicable for other purposes. In addition, the Report provides various summaries of the data.

Valuations are prepared annually, as of January 1st, the first day of the FPPA plan year.

Financing Objectives

Contribution rates are established by law as a percentage of payroll. The valuation process verifies that the employer contributions, when combined with the contributions made by members, are intended to provide for the Normal Cost and to amortize any Unfunded Actuarial Accrued Liability (UAAL) as a level percentage of payroll over a single amortization period not to exceed 30 years. This 30–year contribution amount is defined as the Actuarially Determined Contribution (ADC) in this report.

Progress toward Realization of Financing Objectives

In 2014, the members elected to increase the member contribution rate to the Plan beginning in 2015. For fiscal year 2018, the member contribution rate for the standard SWDB plan is 10.00% of base salary. Member contribution rates will increase 0.50% annually through 2022 to a total of

12.00% of base salary. Appendix B outlines the member contribution rates for the 3 components of the SWDB plan.

The UAAL/(surplus) and the funded ratio (ratio of the actuarial value of assets to the actuarial accrued liability) illustrate the progress toward the realization of certain financing objectives. Based on our actuarial valuation as of January 1, 2018, the Plan now has assets of $83.8 million more than current liabilities assuming no allowance for future discretionary benefit adjustments. The prior year this difference was $28.6 million.

As listed in the Executive Summary under Section I of our Report, the normal cost rate of the Plan is 14.65% of payroll as of January 1, 2018. Since the employer contribution rate plus the member contribution rate totals 18.00% of payroll for 2018, an additional amount of 3.35% of payroll is available to amortize any UAAL that exists or to provide some level of future discretionary benefit adjustments. The Plan is currently in a fully funded position and no contributions are needed to amortize the UAAL at this time.

The contribution rate required to fund the benefits (assuming no future discretionary benefit adjustments) is 14.40%. This rate is the normal cost rate, which is 14.65% of payroll, plus 0.55% of payroll to cover administrative expenses, plus a credit is applied for the 30-year amortization of the amount assets exceed liabilities, which is (0.80%) of payroll.

The recommended annual Stabilization Reserve Account contribution is 0.00% effective July 1, 2018. This recommendation is made in light of the FPPA Board's "Statewide Defined Benefit Plan Benefits Policy", adopted June 12, 2015, to prioritize funding for benefit adjustments rather than provide allocations to the Stabilization Reserve Account.

Benefit provisions

All of the benefit provisions reflected in this valuation are those which were in effect on January 1, 2018. Except for the increased member contributions, there were no changes to the benefit provisions since the prior valuation. The benefit provisions are summarized in Appendix B of our Report.

Assumptions and methods

The current actuarial methods and assumptions were adopted by the Board of Directors of FPPA for first use in the actuarial valuation as of January 1, 2016, based upon the actuary's analysis and recommendations from the 2015 Experience Study. For information regarding the rationale for the assumptions chosen, please see the experience study report dated June 1, 2015.

The assumptions and methods are detailed in Appendix A of our Report. The Board of Directors has sole authority to determine the actuarial assumptions used for the Plan. The assumptions that are based upon the actuary's recommendations are internally consistent and are reasonably based on the actual past experience of the Plan.

The actuarial assumptions represent estimates of future experience and are not market measures. The results of any actuarial valuation are dependent upon the actuarial assumptions used. Actual results (and future measures) can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods. The actuarial calculations presented in this Report are intended to provide information for rational decision making.

Data

FPPA supplied data for retired, active and inactive members as of January 1, 2018. We did not audit this data, but we did apply a number of tests to the data, and we have concluded that the data is reasonable and consistent with the prior year's data. FPPA also supplied asset data as of January 1, 2018.

GASB Accounting

The Governmental Accounting Standards Board (GASB) Statement No. 67, Financial Reporting for Pension Plans (Issued 6/2012), has replaced the requirements under GASB Statement No. 25, Financial Reporting for Defined Benefit Pension Plans and Note Disclosures for Defined Contribution Plans (Issued 11/1994), effective for financial statements for fiscal years beginning after June 15, 2013. GASB Statement No. 68, Accounting and Financial Reporting for Pensions (Issued 6/2012), has replaced GASB Statement No. 27, Accounting for Pensions by State and Local Governmental Employers (Issued 11/1994), effective for fiscal years beginning after June 15, 2014. Plan reporting information for GASB Statement No. 67 can be found in the FPPA Comprehensive Annual Financial Report at FPPA's website - FPPAco.org. Employer reporting information for GASB Statement No. 68 is provided in a separate report to the employer.

Projected Actuarial Results

The following table shows the Funded Ratio (FR) and Actuarially Determined Contribution (ADC) projected over the next five years given alternative investment returns on the market value of assets. With the exception of the market value investment returns, the projections beyond 2018 are based on the same assumptions, methods and provisions used for the January 1, 2018 valuation. The projections assume the Board will grant benefit adjustments according to their current breakeven policy. For additional information see the “Discretionary Benefit Adjustments” portion of the Discussion Section.

5-Year Deterministic Projection						
January 1,	Market Value Investment Return					
	3.50%		7.50%		11.50%	
	FR	ADC	FR	ADC	FR	ADC
2018	103.7%	14.40%	103.7%	14.40%	103.7%	14.40%
2019	104.0%	14.31%	104.7%	14.15%	105.3%	14.01%
2020	103.6%	14.38%	105.8%	13.87%	107.8%	13.40%
2021	102.6%	14.61%	107.0%	13.57%	111.2%	12.57%
2022	101.0%	14.98%	108.2%	13.24%	115.3%	11.49%
2023	98.8%	15.51%	109.0%	13.00%	119.8%	10.26%

Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future actuarial measurements other than that shown above.

Certification

All of our work conforms with generally accepted actuarial principles and practices, and to the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of Colorado state law and, where applicable, the Internal Revenue Code and ERISA.

The undersigned are independent actuaries and consultants. Joseph Newton and Dana Woolfrey are Enrolled Actuaries and are Members of the American Academy of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries. Finally, all of the undersigned are experienced in performing valuations for large public retirement systems.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Joseph P. Newton, FSA, EA, MAAA
Pension Market Leader and Actuary

Dana Woolfrey, FSA, EA, MAAA
Consultant and Actuary

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SECTION I

EXECUTIVE SUMMARY

Executive Summary

Item	January 1, 2018	January 1, 2017
Membership		
• Number of:		
- Active members	7,602	6,900
- Retirees	1,079	943
- DROP Retirees	294	304
- Beneficiaries	62	54
- Inactive members	1,066	939
- Total	10,103	9,140
• Annualized payroll supplied by FPPA	$ 577,624	$ 513,837
Assets		
• Market value	$ 2,413,276	$ 1,985,393
• Actuarial value	$ 2,353,242	$ 2,050,114
• Rate of return on market value	14.6%	5.4%
• Rate of return on actuarial value	8.2%	6.5%
• Contribution for prior year	$ 200,793	$ 100,379
• Ratio of actuarial value to market value	97.5%	103.3%
Actuarial Information		
• Total normal cost %	14.65%	14.63%
• Unfunded actuarial accrued liability/(surplus)	$ (83,831)	$ (28,587)
• Amortization rate	(0.80%)	(0.30%)
• Total required contribution %	14.40%	14.98%
• Funded ratio	103.7%	101.4%

Note: Dollar amounts in $000

Executive Summary

1. The Actuarially Determined Contribution (ADC) rate (with no future benefit adjustments) decreased from 14.98% to 14.40% as of January 1, 2018. The majority of this reduction was due to recognition of investment gains during 2017 and salary increases that were less than anticipated.

2. Assets earned 14.55% on a market basis and 8.21% on an actuarial, smoothed, basis in 2017, producing an actuarial gain of $15.0 million.

3. The funded ratio increased from 101.40% to 103.70% as of January 1, 2018. This was due to recognition of investment gains during 2017 and salary increases that were less than anticipated.

4. Based on the FPPA Board's "Statewide Defined Benefit Plan Benefits Policy", adopted June 12, 2015, to prioritize funding for benefit adjustments, we recommend a Stabilization Reserve Account (SRA) contribution of 0.00% for the year beginning July 1, 2018.

5. Given the plan's contribution policy, if all actuarial assumptions are met (including the assumption of the plan earning 7.50% on the actuarial valuation of assets), it is expected that:

    a. The employer normal cost as a percentage of pay will remain level over time,

    b. The surplus will continue to increase slowly,

    c. The amortization credit as a percentage of pay will decrease very slowly the increasing surplus, and

    d. The funded status of the plan will increase gradually.

SECTION II

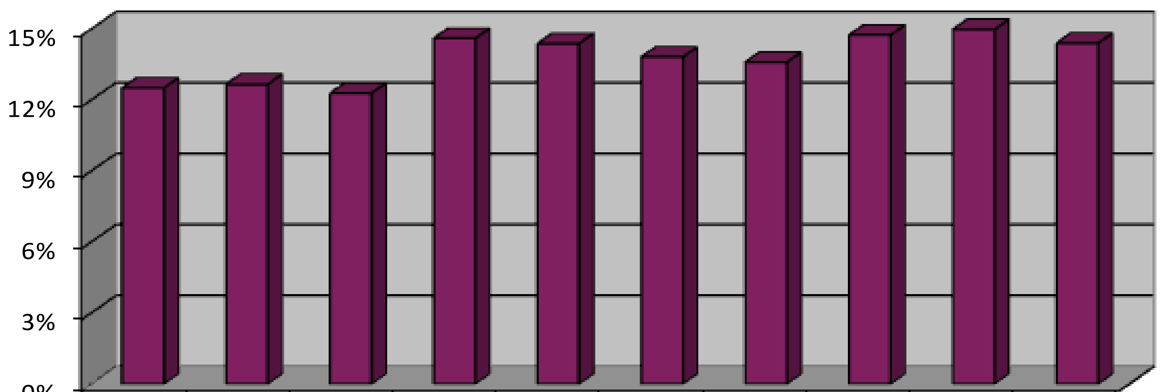
DISCUSSION

Contribution Requirements

The valuation of the Fire and Police Pension Association Statewide Defined Benefit Plan (SWDB) as of January 1, 2018, reflects a combined employer and member contribution rate for 2018 of 18.00% for the standard plan. Member contribution rates will increase 0.50% annually through 2022 to a total of 12.00% of base salary, making a total contribution rate of 20.00%. The Actuarially Determined Contribution ("ADC") decreased from 14.98% to 14.40% as of January 1, 2018. The majority of this increase was due to recognition of investment gains during 2017 and salary increases that were less than anticipated.

The following graph shows the historical costs of providing benefits as a percentage of payroll.

Actuarial Cost of Base Benefits as stated in the Valuation as of January 1,



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
■	12.51%	12.66%	12.28%	14.60%	14.38%	13.82%	13.59%	14.74%	14.98%	14.40%

The computed contribution rate shown above may be considered as a minimum contribution rate that complies with the Board's funding policy.

Effective January 1, 2007, members currently covered under social security were transferred into the new FPPA supplemental social security program. The new plan is designed to give half the benefit when compared to the SWDB for half the cost. Beginning in 2015, the member contribution rate will increase 0.25% annually through 2022 to a total of 6% of base salary. Employer contributions will remain at 4% resulting in a combined contribution rate of 10% in 2022.

The plan membership also includes a group of employers whose contribution rates differ from the main section of the populations due to reentry in the SWDB plan. This valuation calculates what the contribution rate for those members needs to be for next fiscal year. Beginning in 2015, the member contribution rate will increase 0.5% annually through 2022 for a total combined member and employer contribution rate of 24%.

These employers reentered FPPA as a whole after the membership had matured. No prior service was granted for benefit purposes but prior service was granted for eligibility purposes. The membership does have the opportunity to purchase their prior service at an actuarially equivalent price. This group has a higher average entry age than the rest of the population and therefore a higher normal cost even though this difference has been decreasing over time. The appropriate contribution rate for this group is the 18.00% plus the difference in the normal cost when compared to the general population. Therefore, the cost of benefits for this group is 18.30%. Because the combined employer/member contribution rate of this group is 22.00%, the recommended reentry SRA contribution for this group is 3.70%. This amount is necessary in order to properly reflect that the equivalent contribution rate for this group is not 22.00%, but 18.30%.

The following table presents the various costs for the two groups of SWDB participants:

	Ordinary Members	Members whose departments reentered	Difference
Normal Cost assuming no future benefit adjustments	15.20%	15.44%	0.24%
Total Contribution	18.00%	18.30%	0.30%

Discretionary Benefit Adjustments

On October 1st of each year, annuitants may receive a benefit increase at the discretion of the Board of Directors. The increase can range from 0% to the higher of 3% or the change in CPI. Because the increases are purely discretionary, the valuation results in the report are shown assuming no further benefit adjustments are granted. Historically (until 2009), the Board granted benefit adjustments that reflected an increase similar to the change in CPI-W. In 2009, the Board began granting benefit adjustments based on an actuarial calculation which determined the permanent benefit adjustment supported by the total contribution rate. In 2015, the Board adopted a new formal policy summarized below which largely determines the permanent benefit adjustment which can be supported on an actuarial basis using only current surplus assets.

The average benefit adjustment granted by the Board since 1981 has been 2.2%. The chart on the following page shows the benefit adjustments granted by the Board during the last 10 years and the change in CPI-W during that period. The cost of providing a one-time increase of the historical average of 2.2% at October 1, 2018 is $15.2 million, which translates to an actuarial contribution rate increase of 0.14% of payroll. However, the cost of providing a permanent 2.2% benefit adjustment would be well in excess of the current 18.0% contribution rate.

The current valuation results indicate that the plan can sustain some level of permanent annual benefit adjustment.

1. The assumed permanent adjustment rate which produces a 30-year ADC equal to a 16.0% contribution is 0.39% per year. The cost of a one-time 0.39% benefit adjustment for current retirees is $2.7 million. The $2.7 million cost represents the present value of

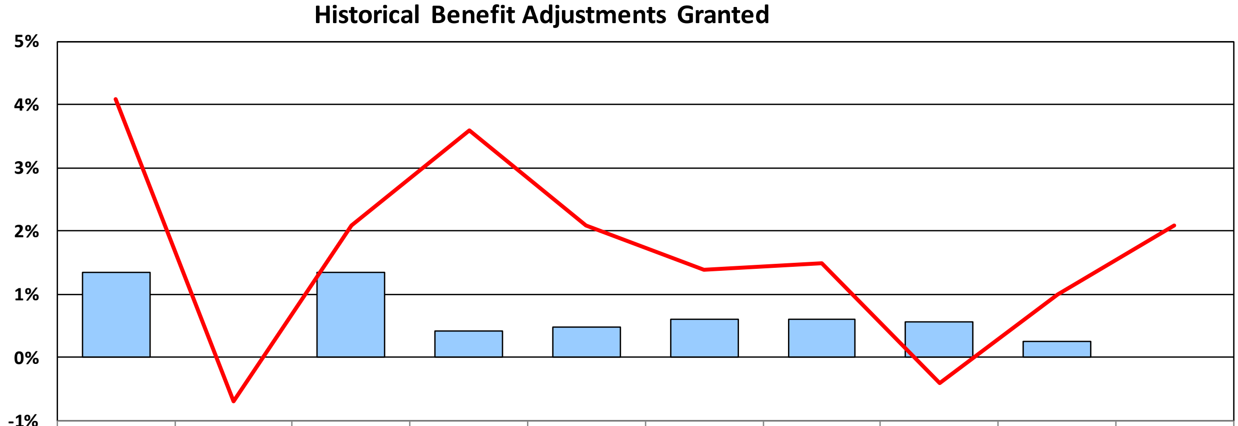
additional benefits that would be payable for the remaining lifetime of the current retirees due to the one-time increase.

2. The assumed permanent adjustment rate which produces a funded ratio of 100% is 0.33% per year. The cost of a one-year 0.33% benefit adjustment for current retirees is $2.3 million.

3. The transitional benefit adjustment level set by the Board is 0.60%. This amount is to be granted until the increased contribution rates are able to improve the Plan's funded level, unless the 30-year ADC method would provide a lower adjustment. If the Board were to grant a benefit adjustment of 0.60%, the cost of the one-time increase, payable for the remaining lifetime of the current retirees, is $4.1 million.

The FPPA Board's "Statewide Defined Benefit Plan Benefits Policy", adopted June 12, 2015, regarding benefit adjustments is to grant the maximum under Methods 2 and 3, but not more than Method 1. The current result of this policy is a benefit adjustment of 0.39%.

Historical Benefit Adjustments Granted



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
Granted Adjustment	1.35%	0.00%	1.34%	0.43%	0.48%	0.61%	0.60%	0.56%	0.25%	
CPI-W	4.10%	-0.70%	2.10%	3.60%	2.10%	1.40%	1.50%	-0.40%	1.00%	2.10%

**2018 amount still to be determined.*

Stabilization Reserve Account (SRA)

Amounts set aside in the SRA are allocated to individual accounts for each active plan member. A member may receive the amounts in the individual account only upon death or the election of normal, early, disability or vested retirement. If the cost of the defined benefit plan exceeds the combined member/employer contribution rate, funds from the SRA can be used to make up the shortfall. Based on the FPPA Board's "Statewide Defined Benefit Plan Benefits Policy", adopted June 12, 2015, to advance fund future benefit adjustments before providing a Stabilization Reserve Account contribution, the recommended annual Stabilization Reserve Account contribution is 0.00% effective July 1, 2018. The recommended annual Stabilization Reserve Account contribution has been 0.00% since July 1, 2008.

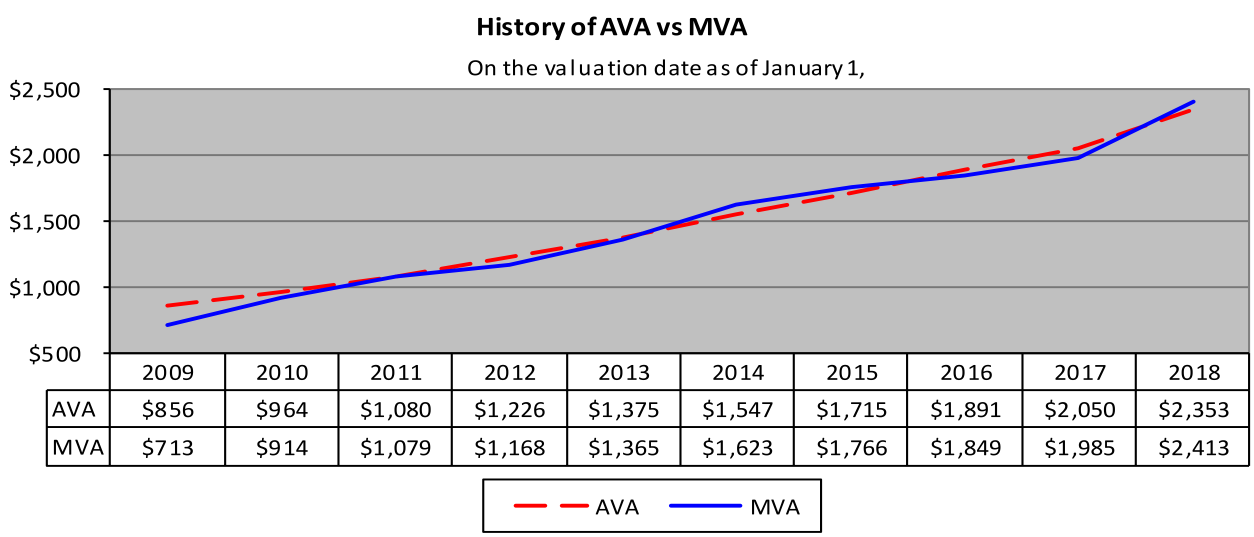
Financial Data and Experience

This section provides an analysis of the change in Plan Net Assets during the year and an estimate of the yield on mean assets of the SWDB. FPPA provided GRS with a summary of Plan assets as of January 1, 2018. The market value of assets (MVA) reported was $2,413.28 million as of January 1, 2018, as compared to $1,985.39 million as of January 1, 2017. Table 7 shows data from some of the tables included in the annual financial statements of the Plan. Table 9 shows the estimated yield on a market value basis and on the actuarial asset valuation method.

The asset valuation method uses a five-year phase in of the excess (shortfall) between expected investment return and actual income. Expected earnings used to project the actuarial value are determined using the assumed investment return rate and the beginning of year actuarial value of assets (adjusted for receipts and disbursements during the year). Historically, returns have been computed net of administrative and investment expenses.

Table 8 shows the development of the actuarial value of assets. The actuarial value of assets increased from $2,050.11 million to $2,353.24 million since the prior valuation. This increase was more than expected and produced a gain of approximately $15.0 million.

Effective January 1, 2012, the valuation assumed investment return was reduced from 8.0% to 7.5% per year. As indicated by item 8b of Table 9, the estimated return on mean market value was 14.55% in 2017, higher than the 7.5% assumption. The return on the actuarial value of assets was 8.21%, higher than the 7.5% assumption. This difference in the estimated return on market value and actuarial value illustrates the smoothing effect of the asset valuation method.



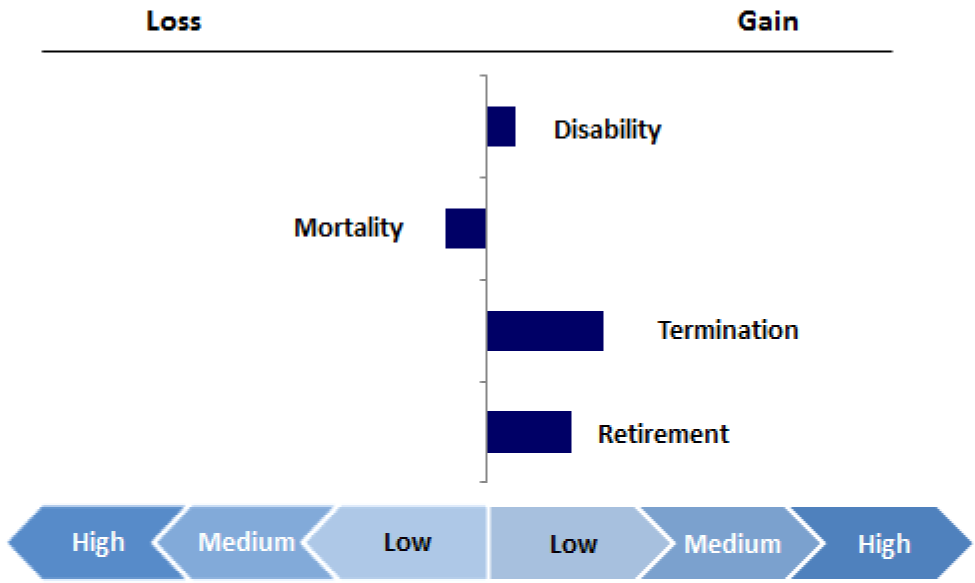
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AVA	$856	$964	$1,080	$1,226	$1,375	$1,547	$1,715	$1,891	$2,050	$2,353
MVA	$713	$914	$1,079	$1,168	$1,365	$1,623	$1,766	$1,849	$1,985	$2,413

$ in millions

AVA: Actuarial (Smoothed) Value of Assets; MVA: Market Value of Assets

Demographic Experience

During the year, the plan had overall liability gains due to demographic experience. There were more disabilities than expected, more terminations than expected, and less retirements than expected. This was slightly offset by less retiree deaths than expected.



Member Data

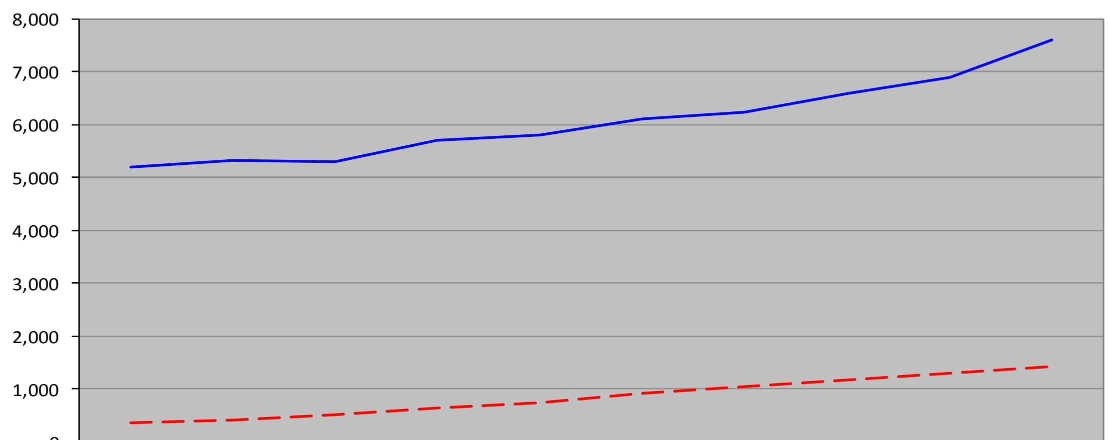
FPPA supplied member data as of January 1, 2018. While we did not audit this data, we did perform various tests to ensure that it was internally consistent, consistent with the prior year's data, and was reasonable overall. Information provided for active members includes: name, member ID, sex, a code indicating whether the member was active or inactive, date of birth, service, salary, accumulated member contribution, and the accumulated stabilization reserve account. For retired members, data includes: name, member ID, sex, date of birth, date of retirement, amount of benefit, a code indicating the option elected and the type of retiree (normal retiree, vested retiree, beneficiary), and if applicable, the joint pensioner's date of birth and sex.

Table 15 shows the number of members by category (active, inactive, retired, etc.). Table 16 shows a historical summary of active member statistics, and Table 17 shows the distribution of active members by age and service.

The total payroll shown on the statistical tables is the amount that was supplied by FPPA. For the cost calculations, the pays were adjusted in accordance with the actuarial assumptions to reflect one year's salary increase.

History of Counts: Active vs In Payment

On the valuation date as of January 1,



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Actives	5,197	5,331	5,314	5,717	5,807	6,110	6,245	6,602	6,900	7,602
In Payment	353	424	513	641	755	908	1,049	1,175	1,301	1,435

Actives — In Payment

The active population has historically increased at a rapid rate due to reentry groups. There are a limited number of reentry groups and we do not anticipate that the historical trend in the active population will continue.

Benefit Provisions

Appendix B in Section IV includes a summary of the benefit provisions for the SWDB Plan. Highlights include:

- Normal Retirement
    - Eligibility: Age 55 and 25 years of service
    - Annual Benefit: 2% of the average of the member's highest three years base salary for first 10 years of service credit and 2.5% for each year after 10. Members of the Supplemental Social Security component accrued benefits at half this rate.
    - Payment Form: Benefits are paid as a monthly life annuity. Optional forms of payment are available.
- Contributions: Employers currently contribute 8.0% of payroll. Members of this fund and are currently contributing at the rate of 10.0% of base salary in 2018. This rate is scheduled to increase by 0.5% per year until reaching 12.0% in 2022. Members who were active at the time of a department reentry have an additional 4.0% of base salary contributed, split between members and employers as determined by that department. Members of the Supplemental Social Security component contribute half the non-reentry member rate and their employers contribute at the rate of 4.0% of base salary.
- Benefit adjustments are granted periodically at the discretion of the FPPA Board.

Actuarial Methods and Assumptions

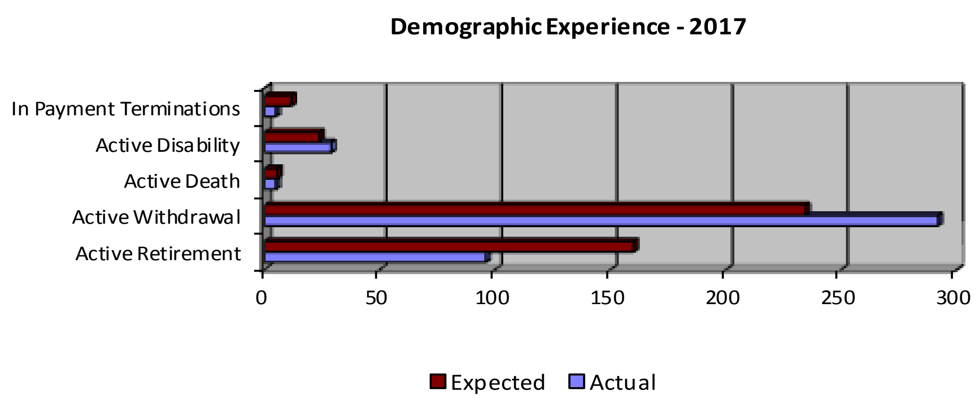
The valuation was prepared using the Entry Age Normal Method. This is the same funding method that has been used in prior years. The asset valuation method uses a five-year phase in of the excess/(shortfall) between expected investment return and actual income. See Appendix A for a complete description of this method.

The actuarial value of future benefits from the plan is based on several economic and non-economic assumptions. These are summarized in Appendix A. The economic assumptions include investment return and salary increases. Non-economic assumptions include rates of mortality, disability, and separation.

There have been no changes to the assumptions and methods since the prior valuation.

The results of the actuarial valuation are dependent on the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions.

For FY 2017, the actual salary increases were 99.1% of expected. The following charts provide a comparison of the actual experience versus the expected experience for selected demographic assumptions.



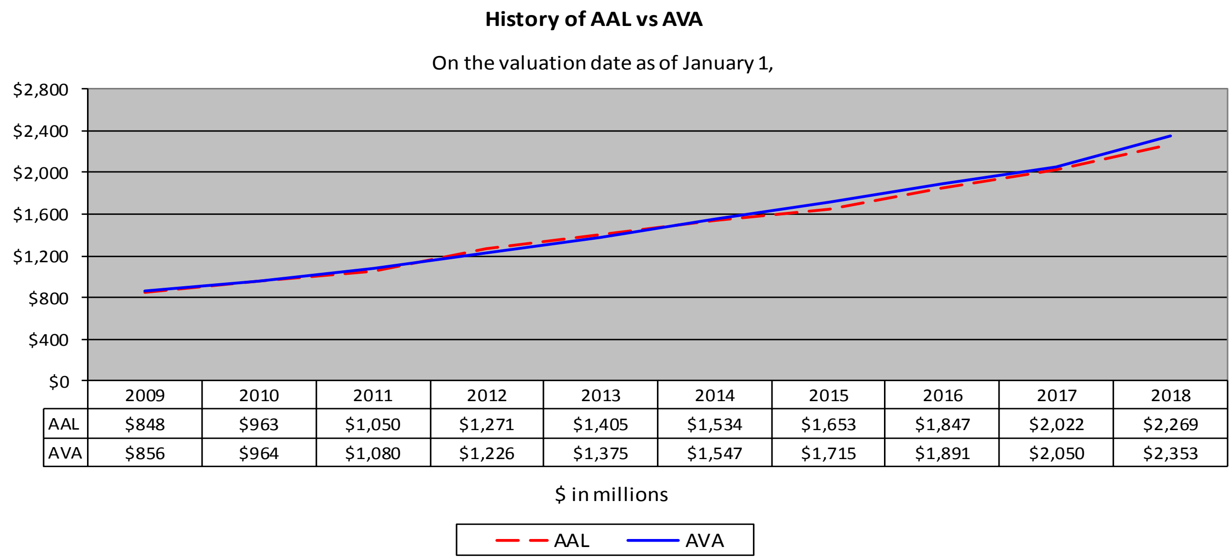
The In Payment Terminations above include deaths and benefits that were canceled for other reasons.

GASB and Funding Progress

The Governmental Accounting Standards Board (GASB) Statement No. 67, Financial Reporting for Pension Plans (Issued 6/2012), has replaced the requirements under GASB Statement No. 25, Financial Reporting for Defined Benefit Pension Plans and Note Disclosures for Defined Contribution Plans (Issued 11/1994), effective for financial statements for fiscal years beginning after June 15, 2013. GASB Statement No. 68, Accounting and Financial Reporting for Pensions (Issued 6/2012), has replaced GASB Statement No. 27, Accounting for Pensions by State and Local Governmental Employers (Issued 11/1994), effective for fiscal years beginning after June 15, 2014.

Plan reporting information for GASB Statement No. 67 can be found in the FPPA Comprehensive Annual Financial Report at FPPAco.org. Employer reporting information for GASB Statement No. 68 is provided in a separate report to the employer.

Although it will no longer be required for financial reporting purposes, we have continued to include Table 12 (Schedule of Funding Progress) which shows a historical summary of the funded ratios and other information for FPPA. While not required, it shows insight into funding trends over time. Similarly, the graph below shows the trend of assets and liabilities over the last decade.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AAL	$848	$963	$1,050	$1,271	$1,405	$1,534	$1,653	$1,847	$2,022	$2,269
AVA	$856	$964	$1,080	$1,226	$1,375	$1,547	$1,715	$1,891	$2,050	$2,353

The AAL referenced above is the actuarial accrued liability and the AVA is the actuarial value of assets.

Significant Factors Affecting Trends in Actuarial Information

Investment returns during 2017, created actuarial investment gains for the Plan. Outstanding deferred investment gains will put upward pressure on the funded ratio in future valuations if not offset by future losses. In 2014, the members elected to increase the member contribution rate to the Plan beginning in 2015. Member contribution rates will increase 0.5 percent annually through 2022 to a total of 12 percent of base salary. With the additional future contributions, it is expected that the funded status of the plan will gradually improve over time.

Risk Metrics

The Statewide Defined Benefit Plan is a defined benefit plan for Colorado Fire and Police employees hired on or after April 8, 1978. In comparison to its public sector peers, the Statewide Defined Benefit could be considered a "young" plan as the Plan's liabilities are still largely attributable to active members and are comparably small in relation to the active member payroll. Historically, in addition to new hires and wage inflation, the Statewide Defined Benefit payroll has grown through additional affiliations into the Plan (reentry groups). This potential pool of reentry members is diminishing, and it is unlikely that this will continue at the historical rate.

Over time, as with all defined benefit plans, the Statewide Defined Benefit Plan active member population will stabilize and the retiree population will continue to grow, thus becoming more leveraged in relation to the active payroll. The funded status and contribution requirements will become more volatile as a result and the Board will have to give added consideration to the impact from possible adverse experience.

Valuation Year	AVA as % of Covered Payroll	AAL as % of Covered Payroll	ADC as % of Covered Payroll	Increase in ADC if Assets Decrease 10%	Funded Ratio	Change in Funded Ratio if Assets Decrease 10%
2007	295%	241%	8.29%	1.61%	122.5%	-12.3%
2008	304%	254%	9.98%	1.63%	119.4%	-11.9%
2009	253%	251%	12.51%	1.36%	101.0%	-10.1%
2010	265%	265%	12.66%	1.53%	100.0%	-10.0%
2011	306%	297%	12.28%	1.60%	102.9%	-10.3%
2012	318%	330%	14.60%	1.68%	96.4%	-9.6%
2013	338%	346%	14.38%	1.80%	97.9%	-9.8%
2014	363%	359%	13.82%	1.99%	100.9%	-10.1%
2015	389%	375%	13.59%	2.10%	103.8%	-10.4%
2016	399%	390%	14.74%	2.17%	102.4%	-10.2%
2017	399%	393%	14.98%	2.15%	101.4%	-10.1%
2018	407%	393%	14.40%	2.25%	103.7%	-10.4%

Data shown is for years in which GRS was the retained actuary.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in Appendix A of this report. This report includes risk metrics as shown above but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the plan's financial condition.

Market Value Results

Investment gains and losses are smoothed over five years, and currently, the smoothed or actuarial value of assets is 97.5% of the market value. If the Funded Ratio and Actuarially Determined Contribution had been measured using the Market Value of Assets, they would be 106.3% and 13.83% of payroll, respectively.

SECTION III

TABLES

Table 1 - Development of Contribution Rate

		January 1, 2018	January 1, 2017
1.	Covered payroll for upcoming year	$ 595,033,678	$ 536,429,567
2.	Present value of future pay	$ 5,967,875,397	$ 5,285,615,841
3.	Total normal cost rate	14.65%	14.63%
4.	Actuarial accrued liability for active members		
	a. Present value of future benefits for active members	$ 2,238,857,602	$ 1,986,185,036
	b. Less: present value of future normal costs	(867,920,413)	(767,762,587)
	c. Actuarial accrued liability (a - b)	$ 1,370,937,189	$ 1,218,422,449
5.	Total actuarial accrued liability for:		
	a. Retirees and beneficiaries	$ 690,104,592	$ 619,451,369
	b. Inactive members (terminated vested and nonvested)	88,613,582	72,477,381
	c. Active members (Item 4c)	1,370,937,189	1,218,422,449
	d. Stabilization reserve account	119,755,322	111,175,684
	e. Total	$ 2,269,410,684	$ 2,021,526,883
6.	Actuarial value of assets	$ 2,353,241,861	$ 2,050,113,711
7.	Unfunded actuarial accrued liability (UAAL)/(surplus) (Item 5e - Item 6)	$ (83,831,177)	$ (28,586,828)
8.	Contribution requirement		
	a. UAAL amortization payment as % of pay	(0.80%)	(0.30%)
	b. Normal cost	14.65%	14.63%
	c. Administrative expense	0.55%	0.65%
	d. Contribution requirement (a + b + c)	14.40%	14.98%

Table 2 - Actuarial Present Value of Future Benefits

			January 1, 2018	January 1, 2017
1.	Active members			
	a.	Retirement benefits	$ 2,139,031,377	$ 1,900,023,576
	b.	Deferred termination benefits	62,938,439	58,604,891
	c.	Refunds	31,793,466	22,969,359
	d.	Death benefits	5,094,320	4,587,210
	e.	Total	$ 2,238,857,602	$ 1,986,185,036
2.	Members in pay status			
	a.	Service retirements	$ 675,886,868	$ 606,860,077
	b.	Beneficiaries	14,217,724	12,591,292
	c.	Total	$ 690,104,592	$ 619,451,369
4.	Inactive members			
	a.	Vested terminations	$ 53,222,514	$ 45,959,686
	b.	Nonvested terminations	35,391,068	26,517,695
	c.	Total	$ 88,613,582	$ 72,477,381
5.	Stabilization Reserve Account		$ 119,755,322	$ 111,175,684
6.	Total actuarial present value of future benefits		$ 3,137,331,097	$ 2,789,289,470

Table 3 - Analysis of Normal Cost by Component

		January 1, 2018	January 1, 2017
1.	Retirement benefits	12.77%	12.77%
2.	Deferred termination benefits	0.66%	0.66%
3.	Refunds	1.19%	1.17%
4.	Death benefits	0.03%	0.03%
5.	Total normal cost	14.65%	14.63%

Table 4a - Actuarial Gain/(Loss) on UAAL

		January 1, 2018	January 1, 2017
1.	Unfunded actuarial accrued liability (UAAL) as of January 1 of prior year	$ (28,586,828)	$ (43,642,069)
2.	Total normal cost for year (Normal Cost % x actual payroll paid during year)	85,877,243	79,166,021
3.	Non service purchase contributions during year ending December 31	(96,975,710)	(86,947,337)
4.	Interest on UAAL for one year	(2,144,012)	(3,273,155)
5.	Interest on Item 2 and Item 3 for one-half year	(408,669)	(286,524)
6.	Expected UAAL as of January 1 (1 + 2 + 3 + 4 + 5)	$ (42,237,976)	$ (54,983,065)
7.	Actual UAAL at end of year	$ (83,831,177)	$ (28,586,828)
8.	Actuarial gain/(loss) for the period (6 - 7)	$ 41,593,200	$ (26,396,236)
	SOURCE OF GAINS/(LOSSES)		
9.	Asset gain/(loss) (See Table 10)	$ 15,008,646	$ (18,797,618)
10.	SRA liability gain/(loss) for the period (unsmoothed)	$ (9,179,176)	$ (543,881)
11.	Salary liability gain/(loss) for the period	$ 10,773,453	$ (12,010,000)
12.	Benefit Adjustment Granted as of October 1 (0.25% in 2017, 0.56% in 2016)	$ (1,548,628)	$ (3,080,926)
13.	Net liability gain/(loss) for the period (8 - 9 - 10 - 11 - 12)	$ 26,538,905	$ 8,036,189

Table 4b - Analysis of Change in Calculated Contribution Rate

		January 1, 2018	January 1, 2017
A.	Results Assuming No Future Benefit Adjustments		
1.	Recommended contribution rate as of last valuation	14.98%	14.74%
2.	Change in contribution rate during year		
a.	Change in normal cost	(0.08%)	0.04%
b.	Change in assumptions	0.00%	0.00%
c.	Change in benefit provisions	0.00%	0.00%
d.	Impact of contributing less/(more) than calculated rate	(0.14%)	(0.12%)
e.	Recognition of asset losses/(gains)	(0.16%)	0.21%
f.	Effect of payroll growth	0.04%	0.02%
g.	Benefit adjustment granted October 1, (year preceding valuation)	0.02%	0.03%
h.	Resetting Funding Period to 30 Years	0.01%	0.01%
i.	Actuarial (gain)/loss from other liability sources	(0.27%)	0.05%
j.	Total change	(0.58%)	0.24%
3.	Recommended contribution rate as of this valuation	14.40%	14.98%

Table 5 - Summary of Historical Valuation Results

As of the Valuation Date January 1,

	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
1. Number of Members										
a. Active	7,602	6,900	6,602	6,245	6,110	5,807	5,717	5,314	5,331	5,197
b. Retired/DROP/Beneficiaries	1,435	1,301	1,175	1,049	908	755	641	513	424	353
c. Inactive members	1,066	939	846	725	637	573	501	499	507	530
d. Total	10,103	9,140	8,623	8,019	7,655	7,135	6,859	6,326	6,262	6,080
2. Covered payroll (prior year)	$ 577,624	$ 513,837	$ 473,360	$ 441,314	$ 426,690	$ 406,259	$ 384,804	$ 353,485	$ 348,254	$ 322,971
3. Average Compensation	$ 76.0	$ 74.5	$ 71.7	$ 70.7	$ 69.8	$ 70.0	$ 67.3	$ 66.5	$ 65.3	$ 62.1
4. Covered payroll for upcoming year	$ 595,034	$ 536,430	$ 496,733	$ 465,325	$ 449,010	$ 440,873	$ 411,051	$ 378,877	$ 374,678	$ 348,486
5. Actuarial Value of Assets	$ 2,353,242	$ 2,050,114	$ 1,890,604	$ 1,714,971	$ 1,546,834	$ 1,374,577	$ 1,225,538	$ 1,080,284	$ 963,501	$ 856,090
6. Market Value of Assets	$ 2,413,276	$ 1,985,393	$ 1,848,725	$ 1,765,759	$ 1,623,050	$ 1,365,232	$ 1,168,400	$ 1,079,348	$ 914,227	$ 713,408
7. Present Value of Benefits										
a. Retired/Beneficiaries	$ 690,105	$ 619,451	$ 550,165	$ 469,967	$ 401,555	$ 318,254	$ 261,825	$ 184,827	$ 145,688	$ 114,919
b. Terminations	88,614	72,477	58,821	51,525	42,303	37,451	34,400	25,972	19,702	20,084
c. Actives	2,238,858	1,986,185	1,832,618	1,680,050	1,613,689	1,541,950	1,448,314	1,203,990	1,164,736	1,065,738
d. Reserve Account	119,755	111,176	111,750	117,009	106,084	102,709	97,802	104,988	103,516	91,297
Total	$ 3,137,331	$ 2,789,289	$ 2,553,355	$ 2,318,551	$ 2,163,630	$ 2,000,365	$ 1,842,341	$ 1,519,776	$ 1,433,642	$ 1,292,039
8. Total Recommended Contribution										
a. Amount	$ 85,686	$ 80,348	$ 73,222	$ 63,243	$ 62,031	$ 63,382	$ 60,003	$ 46,515	$ 47,426	$ 43,590
b. Percent of Pay	14.40%	14.98%	14.74%	13.59%	13.82%	14.38%	14.60%	12.28%	12.66%	12.51%
c. SRA Allocation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

$ amounts in '000s

Table 6 - Allocation of Plan Assets at Fair Value

	Actual Allocation at January 1, 2018	Target Allocation
1. Global Equity	38.3%	37.0%
2. Equity Long/Short	8.9%	9.0%
3. Absolute Return	9.4%	9.0%
4. Illiquid Alternatives	22.3%	24.0%
5. Managed Futures	4.0%	4.0%
6. Fixed Income	15.3%	15.0%
7. Cash	1.8%	2.0%
	100.0%	100.0%

Asset Allocation as of January 1, 2018

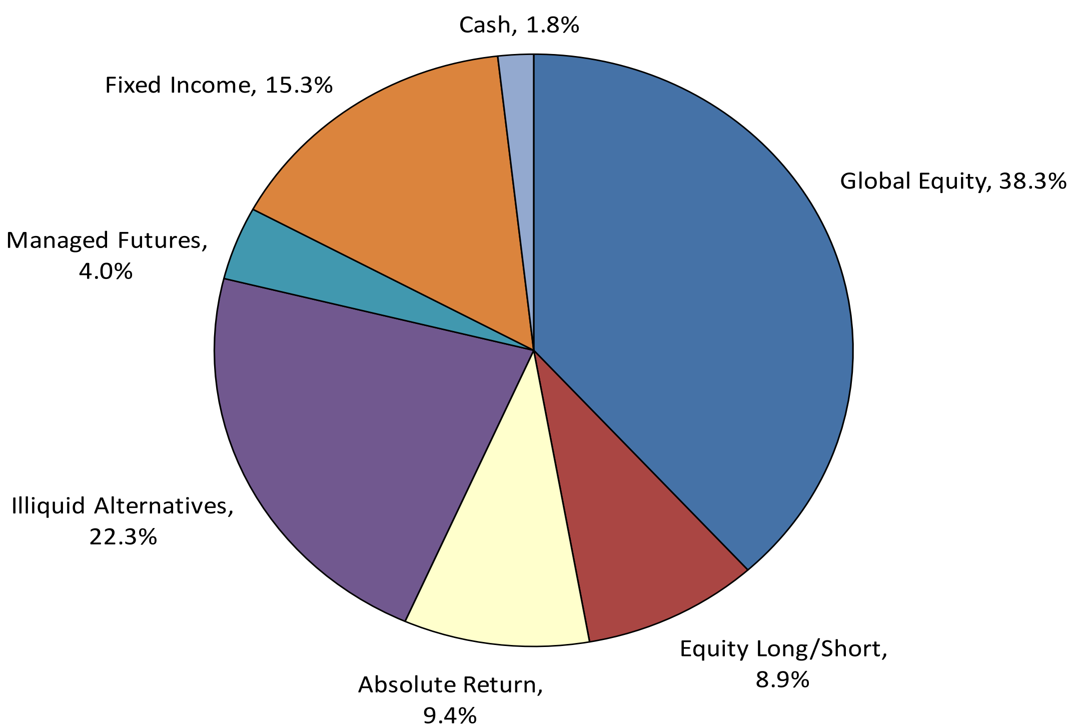


Table 7 - Reconciliation of Plan Net Assets

		Year Ending	
		December 31, 2017	December 31, 2016
1.	Market value of assets at beginning of year	$ 1,985,393,043	$ 1,848,724,853
2.	Revenue for the year		
a.	Contributions and Affiliations		
i.	Member contributions	$ 156,430,319	$ 59,427,866
ii.	Employer contributions	44,362,720	40,930,412
iii.	SWDD roll to normal contributions	0	20,412
b.	Net investment income		
i.	Interest	$ 5,847,816	$ 5,234,069
ii.	Dividends	15,570,298	14,709,348
iii.	Net change in accrued income	1,269,817	(99,863)
iv.	Unrealized gain/(loss)	180,364,593	47,414,242
v.	Realized gain/(loss)	97,727,198	42,659,040
vi.	Defined contribution earnings (net)	(11,650)	(11,906)
vii.	Investment expense	(20,764,556)	(16,414,665)
viii.	Other income	18,375,334	7,985,677
c.	Total revenue	$ 499,171,888	$ 201,854,632
3.	Expenditures for the year		
a.	Refunds	$ (2,187,599)	$ (1,813,179)
b.	Benefit payments	(65,965,013)	(59,989,380)
c.	Administrative expense	(3,135,872)	(3,383,884)
d.	Total expenditures	$ (71,288,484)	$ (65,186,443)
4.	Increase in net assets (Item 2c + Item 3d)	$ 427,883,404	$ 136,668,189
5.	Market value of assets at end of year (Item 1 + Item 4)	$ 2,413,276,447	$ 1,985,393,043

Table 8 - Development of Actuarial Value of Assets

1.	Actuarial value of assets at beginning of year		$ 2,050,113,711
2.	Net new investments		
	a.	Contributions and Affiliations	$ 200,793,039
	b.	Benefits paid	(65,965,013)
	c.	Refunds	(2,187,599)
	d.	Administrative expenses	(3,135,872)
	e.	Subtotal	$ 129,504,555
3.	Assumed investment return rate for fiscal year		7.5%
4.	Assumed investment return for fiscal year		$ 158,614,949
5.	Expected Actuarial Value at end of year		$ 2,338,233,215
6.	Market value of assets at end of year		$ 2,413,276,447
7.	Excess return (6-5)		$ 75,043,232

8. Development of amounts to be recognized as of December 31, 2017:

Fiscal Year End	Remaining Deferrals of Excess/(Shortfall) of Investment Income	Offsetting of Gains/(Losses)	Net Deferrals Remaining	Years Remaining	Recognized for this valuation	Remaining after this valuation
	(1)	(2)	(3) = (1) + (2)	(4)	(5) = (3) / (4)	(6) = (3) - (5)
2013	$ 0	$ 0	$ 0	1	$ 0	$ 0
2014	0	0	0	2	0	0
2015	(31,409,411)	31,409,411	0	3	0	0
2016	(33,311,258)	33,311,258	0	4	0	0
2017	139,763,901	(64,720,669)	75,043,232	5	15,008,646	60,034,586
Total	$ 75,043,232	$ 0	$ 75,043,232		$ 15,008,646	$ 60,034,586

9.	Actuarial value of assets as of December 31, 2017 (Item 6 - Item 8)	$ 2,353,241,861
10.	Ratio of actuarial value to market value	97.5%

Amounts in column (1) for fiscal years ending 2013 through 2016 are from the prior valuation. The column (1) amount for fiscal year 2017 is developed using item 7 less the total of column (1) for fiscal years ending 2013 through 2016. To the extent possible, the 2017 excess or shortfall is used to reduce prior bases. In this case, both the 2015 and 2016 base were offset by the gains in 2017. The fiscal year 2013 and 2014 bases are $0 because they were previously offset.

Table 9 - Investment Yields

Item	Market Value	Actuarial Value
1. Assets as of January 1, 2017 (A)	$ 1,985,393,043	$ 2,050,113,711
2. Contributions during FY17	200,793,039	200,793,039
3. Benefit payments made during FY17	(65,965,013)	(65,965,013)
4. Refunds of contributions during FY17	(2,187,599)	(2,187,599)
5. Administrative expenses during FY17	(3,135,872)	(3,135,872)
6. Investment return during FY17	298,378,849	173,623,595
7. Assets as of January 1, 2018 (B): (1 + 2 + 3 + 4 + 5 + 6)	$ 2,413,276,447	$ 2,353,241,861
8. Approximate rate of return on average invested assets		
a. Net investment income (I)	$ 298,378,849	$ 173,623,595
b. Estimated return based on (2I / (A + B - I))	14.55%	8.21%

Table 10 - Gain/(Loss) on Actuarial Value of Assets

Item	Valuation as of January 1, 2018	Valuation as of January 1, 2017
1. Actuarial assets, prior valuation	$ 2,050,113,711	$ 1,890,604,068
2. Total contributions since prior valuation	$ 200,793,039	$ 100,378,690
3. Benefits, refunds, and administrative expense since prior valuation	$ (71,288,484)	$ (65,186,443)
4. Assumed net investment income at actuarial rate%*		
a. Beginning assets	$ 153,758,528	$ 141,795,305
b. Contributions	7,529,739	3,764,201
c. Benefits, refunds paid, and administrative expense	(2,673,318)	(2,444,492)
e. Total	$ 158,614,949	$ 143,115,014
5. Expected actuarial assets (1 + 2 + 3 + 4)	$ 2,338,233,215	$ 2,068,911,329
6. Actual actuarial assets, this valuation	$ 2,353,241,861	$ 2,050,113,711
7. Asset gain/(loss) (6 - 5)	$ 15,008,646	$ (18,797,618)
	Gain	Loss

**7.5% as of January 1, 2012*

Table 11 - History of Investment Return Rates

For Fiscal Year Ending	Market Value	Actuarial Value
December 31, 2008	(29.67%)	(13.67%)
December 31, 2009	19.93%	6.12%
December 31, 2010	13.54%	7.95%
December 31, 2011	0.48%	5.49%
December 31, 2012	11.59%	7.25%
December 31, 2013	15.08%	8.86%
December 31, 2014	6.63%	8.58%
December 31, 2015	1.54%	6.90%
December 31, 2016	5.44%	6.51%
December 31, 2017	14.55%	8.21%
Average Returns:		
Last 5 Years	8.52%	7.81%
Last 10 Years	4.92%	5.01%

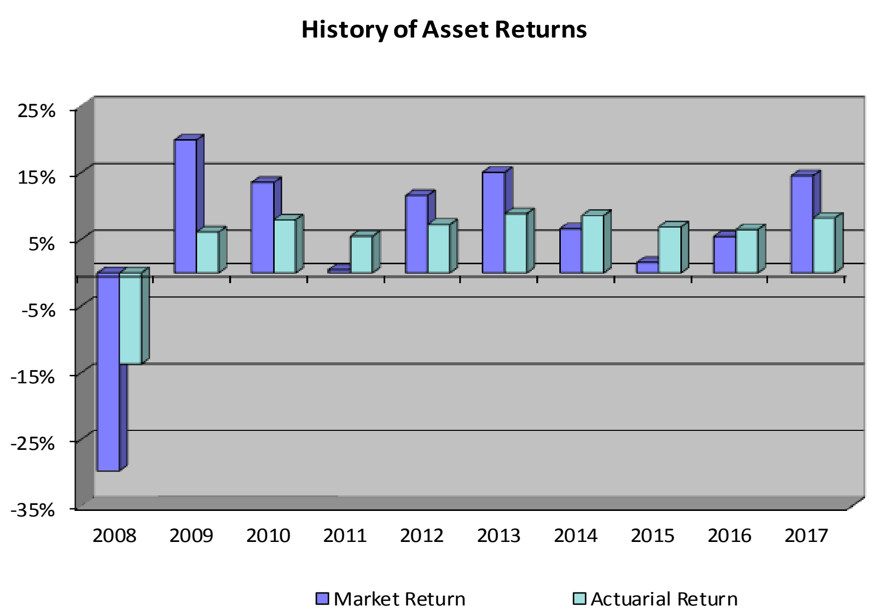


Table 12 - Schedule of Funding Progress

Date	Actuarial Value of Assets (AVA)	Actuarial Accrued Liability (AAL)	Unfunded Actuarial Accrued Liability (UAAL) (3) - (2)	Funded Ratio (2)/(3)	Annual Payroll	UAAL as % of Payroll (4)/(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
January 1, 2003	$ 424,088,589	$ 371,056,405	$ (53,032,184)	114.3%	$ 172,625,858	(30.7%)
January 1, 2004	473,006,658	426,673,675	(46,332,983)	110.9%	189,359,234	(24.5%)
January 1, 2005	557,949,693	495,915,617	(62,034,076)	112.5%	217,752,582	(28.5%)
January 1, 2006	681,193,087	569,819,934	(111,373,153)	119.5%	246,693,626	(45.1%)
January 1, 2007	801,426,848	654,097,657	(147,329,192)	122.5%	271,906,902	(54.2%)
January 1, 2008	950,114,346	795,499,983	(154,614,363)	119.4%	312,857,166	(49.4%)
January 1, 2009	856,090,014	847,821,122	(8,268,892)	101.0%	337,918,774	(2.4%)
January 1, 2010	963,500,681	963,300,852	(199,829)	100.0%	363,265,902	(0.1%)
January 1, 2011	1,080,284,447	1,049,622,033	(30,662,414)	102.9%	353,484,986	(8.7%)
January 1, 2012	1,225,537,747	1,271,490,169	45,952,422	96.4%	384,803,645	11.9%
January 1, 2013	1,374,576,631	1,404,607,765	30,031,134	97.9%	406,258,662	7.4%
January 1, 2014	1,546,834,469	1,533,631,141	(13,203,328)	100.9%	426,690,241	(3.1%)
January 1, 2015	1,714,971,185	1,652,901,084	(62,070,101)	103.8%	441,313,862	(14.1%)
January 1, 2016	1,890,604,068	1,846,961,999	(43,642,069)	102.4%	473,359,565	(9.2%)
January 1, 2017	2,050,113,711	2,021,526,883	(28,586,828)	101.4%	513,837,288	(5.6%)
January 1, 2018	2,353,241,861	2,269,410,684	(83,831,177)	103.7%	577,624,013	(14.5%)

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. With regard to any funded status measurements presented in this report:

(1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.
(2) The measurement alone is inappropriate for assessing the need for or the amount of future employer contributions.
(3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

Table 13 - Solvency Test

Valuation Date	Aggregated Accrued Liabilities for: Active Members Contributions	Retirees Beneficiaries and Vested Terminations	Members (Employer Financed Portion)	Actuarial Value of Assets	Portion of Accrued Liabilities Covered by Reported Assets: (5)/(2)	[(5)-(2)]/(3)	[(5)-(2)-(3)]/(4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
January 1, 2002	$ 85,368	$ 15,946	$ 236,078	$ 428,389	100.0%	100.0%	100.0%
January 1, 2003	95,830	19,925	255,301	424,089	100.0%	100.0%	100.0%
January 1, 2004	106,332	28,578	291,764	473,007	100.0%	100.0%	100.0%
January 1, 2005	130,910	40,029	324,977	557,950	100.0%	100.0%	100.0%
January 1, 2006	161,665	57,780	350,375	681,193	100.0%	100.0%	100.0%
January 1, 2007	177,180	82,227	394,691	801,427	100.0%	100.0%	100.0%
January 1, 2008	211,285	110,301	473,914	950,114	100.0%	100.0%	100.0%
January 1, 2009	232,742	135,004	480,075	856,090	100.0%	100.0%	100.0%
January 1, 2010	259,369	165,390	538,542	963,501	100.0%	100.0%	100.0%
January 1, 2011	276,908	210,799	561,915	1,080,284	100.0%	100.0%	100.0%
January 1, 2012	331,763	296,225	643,502	1,225,538	100.0%	100.0%	92.9%
January 1, 2013	353,206	355,705	695,697	1,374,577	100.0%	100.0%	95.7%
January 1, 2014	369,248	443,857	720,526	1,546,834	100.0%	100.0%	100.0%
January 1, 2015	384,837	521,492	746,572	1,714,971	100.0%	100.0%	100.0%
January 1, 2016	422,699	608,987	815,276	1,890,604	100.0%	100.0%	100.0%
January 1, 2017	441,466	691,929	888,132	2,050,114	100.0%	100.0%	100.0%
January 1, 2018	559,153	778,718	931,540	2,353,242	100.0%	100.0%	100.0%

$ amounts in '000s

Table 14 - Cash Flow Analysis

Year Ending December 31,	Contributions for the Year	Expenditures During the Year: Benefit Payments	Refund of Contributions	Identified Receipts	Expenses	Total	External Cash Flow for the Year	Market Value of Assets	External Cash Flow as Percent of Market Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2003	$ 29,729	$ (1,304)	$ (1,862)	$ (117)	$ (1,896)	$ (5,180)	$ 24,548	$ 483,967	5.1%
2004	42,708	(2,005)	(1,694)	(83)	(2,113)	(5,895)	36,813	583,615	6.3%
2005	56,453	(3,129)	(2,889)	0	(4,152)	(10,171)	46,282	692,649	6.7%
2006	44,137	(5,114)	(4,061)	0	(5,089)	(14,264)	29,873	831,477	3.6%
2007	72,338	(7,261)	(4,698)	(51)	(6,428)	(18,438)	53,900	967,883	5.6%
2008	52,585	(10,525)	(3,621)	0	(7,118)	(21,265)	31,321	713,408	4.4%
2009	68,550	(13,272)	(1,927)	(1)	(7,119)	(22,318)	46,232	914,227	5.1%
2010	64,648	(24,277)	(1,751)	0	(7,399)	(33,428)	31,221	1,079,348	2.9%
2011	113,795	(28,285)	(1,882)	0	(8,745)	(38,912)	74,883	1,168,400	6.4%
2012	91,636	(31,959)	(1,616)	0	(11,596)	(45,171)	46,465	1,365,232	3.4%
2013	93,538	(42,443)	(2,796)	0	(14,401)	(59,639)	33,899	1,623,050	2.1%
2014	83,472	(47,701)	(1,849)	0	(15,647)	(65,196)	18,276	1,765,759	1.0%
2015	110,242	(53,076)	(1,763)	0	(1,854)	(56,694)	53,548	1,848,725	2.9%
2016	100,379	(59,989)	(1,813)	0	(3,384)	(65,186)	35,192	1,985,393	1.8%
2017	200,793	(65,965)	(2,188)	0	(3,136)	(71,288)	129,505	2,413,276	5.4%
2018*	107,106	(67,337)	(5,033)	0	(3,246)	(75,616)	31,490	2,626,943	1.2%
2019*	113,934	(78,817)	(5,209)	0	(3,359)	(87,385)	26,549	2,851,509	0.9%
2020*	121,109	(87,833)	(5,391)	0	(3,477)	(96,701)	24,408	3,090,695	0.8%

* Results for 2018, 2019, & 2020 are based on expected contributions, expected benefit payments, and assumed investment return of 7.5%.
Expected contributions are based on combined employee and employer rate of 18.0%/18.5%/19.0% and 3.5% annual payroll growth, for 2018/2019/2020, respectively.
Expected benefit payments are based on current plan benefits and expected retirements, terminations, and mortality.
Assets are assumed to increase at the annual return of 7.5% with all cash flow occurring in the middle of the year.

$ amounts in '000s

Table 15 - Membership Data

	January 1, 2018	January 1, 2017	January 1, 2016
1. Active members			
a. Number	7,602	6,900	6,602
b. Total payroll	$ 577,624,013	$ 513,837,288	$ 473,359,565
c. Average annual salary	$ 75,983	$ 74,469	$ 71,699
d. Average age	40.5	40.7	40.7
e. Average service	10.3	10.5	10.5
2. Inactive members			
a. Vested	235	223	211
b. NonVested *	831	716	635
3. Service retirees			
a. Number	1,373	1,247	1,131
b. Total annual benefits	$ 59,950,357	$ 53,675,830	$ 47,349,686
c. Average annual benefit	$ 43,664	$ 43,044	$ 41,865
d. Average age	63.1	62.6	62.1
4. Beneficiaries and spouses			
a. Number	62	54	44
b. Total annual benefits	$ 1,281,737	$ 1,132,582	$ 984,591
c. Average annual benefit	$ 20,673	$ 20,974	$ 22,377
d. Average age	58.4	57.0	57.6

* Includes members who have terminated and could elect a deferred benefit, but have not yet been processed

Table 16 - Historical Summary of Active Member Data

Valuation Date	Active Count	Average Age	Average Service	Covered Payroll	Average Annual Salary	Percent Change in Average Salary
2002	3,179	38.0	8.8	$ 151,369,850	$ 47,616	5.04%
2003	3,340	38.4	9.1	166,734,883	49,921	4.84%
2004	3,459	38.9	9.4	182,825,786	52,855	5.88%
2005	3,907	39.0	9.1	209,765,329	53,690	1.58%
2006	4,302	39.1	9.1	239,642,543	55,705	3.75%
2007	4,512	39.3	9.2	264,560,282	58,635	5.26%
2008	4,988	39.3	9.2	298,313,990	59,806	2.00%
2009	5,197	39.6	9.5	322,971,268	62,146	3.91%
2010	5,331	40.1	9.9	348,253,545	65,326	5.12%
2011	5,314	40.7	10.5	353,484,986	66,520	1.83%
2012	5,717	40.8	10.5	384,803,645	67,309	1.19%
2013	5,807	41.0	10.8	406,258,662	69,960	3.94%
2014	6,110	40.7	10.6	426,690,241	69,835	-0.18%
2015	6,245	40.8	10.7	441,313,862	70,667	1.19%
2016	6,602	40.7	10.5	473,359,565	71,699	1.46%
2017	6,900	40.7	10.5	513,837,288	74,469	3.86%
2018	7,602	40.5	10.3	577,624,013	75,983	2.03%

Table 17 - Distribution of Active Members by Age and by Years of Service
As of December 31, 2017

	Years of Credited Service												
	Less than 1	1-2	2-3	3-4	4-5	5-9	10-14	15-19	20-24	25-29	30-34	35 & Over	Total
Attained Age	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.	Count & Avg. Comp.
Under 25	110	60	27	4									201
	$46,917	$51,609	$52,666	$55,891									$49,269
25-29	284	191	141	121	74	69							880
	$49,995	$53,947	$57,713	$62,353	$69,365	$71,960							$57,140
30-34	214	180	157	137	150	326	124	2					1,290
	$50,967	$55,789	$58,494	$64,993	$70,598	$72,743	$81,827	$96,988					$64,869
35-39	95	71	87	76	94	335	450	83	2				1,293
	$51,752	$56,911	$61,820	$65,802	$72,637	$74,566	$83,026	$89,902	$98,568				$74,373
40-44	48	45	49	43	42	187	366	351	52	2			1,185
	$61,406	$54,203	$62,878	$66,223	$73,077	$73,934	$83,641	$90,218	$97,569	$111,589			$80,832
45-49	20	26	39	28	14	151	296	407	280	42			1,303
	$58,387	$54,396	$65,585	$63,750	$76,813	$73,182	$83,695	$89,804	$95,745	$102,081			$85,549
50-54	18	15	17	17	11	62	145	199	196	175	27	1	883
	$57,360	$71,808	$64,249	$65,234	$70,178	$79,034	$82,535	$89,670	$95,341	$101,711	$106,630	$105,705	$89,769
55-59	5	10	8	9	7	23	40	71	86	86	47	7	399
	$41,828	$51,088	$85,342	$67,281	$78,390	$70,133	$84,628	$88,224	$94,743	$100,858	$107,646	$107,904	$91,367
60-64	3	6	9	2	4	14	24	25	17	19	7	7	137
	$43,761	$67,197	$87,404	$78,886	$60,539	$78,566	$82,761	$88,503	$89,483	$98,670	$102,482	$114,912	$87,135
65 & Over	2	1	1	3	2		7	6	4	1	1	3	31
	$69,705	$56,030	$34,070	$76,775	$86,326		$75,606	$105,329	$87,695	$89,849	$117,005	$108,610	$86,360
Total	799	605	535	440	398	1,167	1,452	1,144	637	325	82	18	7,602
	$51,077	$55,180	$60,478	$64,565	$71,434	$73,820	$83,170	$89,882	$95,426	$101,379	$106,984	$110,625	$75,983

Average:	Age:	40.5	Number of participants:	Males:	6,892
	Service:	10.3		Females:	710

Table 18 - Schedule of Retirants & Annuitants Added to & Removed from Rolls*

	Added to Rolls**		Removed from Rolls		Rolls-End of Year			
Year Ended	Number	Annual Benefits	Number	Annual Benefits	Number	Annual Benefits	% Increase in Annual Benefits	Average Annual Benefits
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
December 31, 1996	8	$ 54,955	1	$ 568	19	$ 137,627	53.59%	$ 7,244
December 31, 1997	2	22,218	1	568	20	156,512	13.72%	7,826
December 31, 1998	5	61,039	0	0	25	253,185	61.77%	10,127
December 31, 1999	4	56,252	1	6,592	28	311,906	23.19%	11,140
December 31, 2000	5	50,774	1	15,482	32	353,534	13.35%	11,048
December 31, 2001	16	374,072	1	3,697	47	735,257	107.97%	15,644
December 31, 2002	14	301,795	0	0	61	1,054,842	43.47%	17,292
December 31, 2003	24	606,147	2	21,898	83	1,648,771	56.31%	19,865
December 31, 2004	27	825,955	0	0	110	2,506,161	52.00%	22,783
December 31, 2005	51	1,458,446	2	22,713	159	3,941,893	57.29%	24,792
December 31, 2006	69	2,284,964	2	97,352	226	6,129,506	55.50%	27,122
December 31, 2007	66	2,201,387	1	29,009	291	8,301,884	35.44%	28,529
December 31, 2008	65	2,375,478	3	75,874	353	10,601,488	27.70%	30,033
December 31, 2009	75	2,981,664	4	43,765	424	13,539,387	27.71%	31,933
December 31, 2010	94	3,862,662	5	131,169	513	17,270,880	27.56%	33,666
December 31, 2011	130	5,949,060	2	68,483	641	23,151,457	34.05%	36,118
December 31, 2012	115	5,199,290	1	43,620	755	28,307,127	22.27%	37,493
December 31, 2013	155	7,528,613	2	81,763	908	35,753,977	26.31%	39,377
December 31, 2014	146	6,358,310	5	121,694	1,049	41,990,593	17.44%	40,029
December 31, 2015	131	6,463,995	5	120,311	1,175	48,334,277	15.11%	41,136
December 31, 2016	131	6,612,256	5	138,121	1,301	54,808,412	13.39%	42,128
December 31, 2017	140	6,701,667	6	277,985	1,435	61,232,094	11.72%	42,670

**Includes beneficiaries of deceased members with a deferred benefit.*
***Includes benefit adjustments*

Table 19 - Summary of Members and Adjusted Payroll by Employer

City Code	City Name	Police No.	Police Earnings	Fire No.	Fire Earnings	Total No.	Total Earnings
550	ADAMS COUNTY	0	$ 0	86	$ 7,143,922	86	$ 7,143,922
4	ALMA	1	51,958	0	0	1	51,958
5	ANTONITO	1	31,200	0	0	1	31,200
501	ARVADA FPD	0	0	156	13,464,478	156	13,464,478
711	ASPEN FPD	0	0	2	256,882	2	256,882
9	AULT	5	244,379	0	0	5	244,379
712	AULT FPD	0	0	3	151,500	3	151,500
10	AURORA	0	0	306	22,884,645	306	22,884,645
12	BASALT	10	743,927	0	0	10	743,927
719	BASALT & RURAL FPD	0	0	8	593,215	8	593,215
13	BAYFIELD	7	359,946	0	0	7	359,946
718	BENNETT FPD #7	0	0	17	791,817	17	791,817
503	BERTHOUD FPD	0	0	26	1,679,829	26	1,679,829
538	BEULAH FIRE PROTECTION & AMBULANCE	0	0	1	56,784	1	56,784
580	BLACK FOREST RESCUE	0	0	12	693,324	12	693,324
723	BLACK HAWK	0	0	18	1,473,273	18	1,473,273
18	BLANCA	1	37,964	0	0	1	37,964
726	BOULDER MOUNTAIN AUTH	0	0	4	215,893	4	215,893
730	BOULDER RURAL FPD	0	0	16	1,228,136	16	1,228,136
7700	BRIGGSDALE FPD	0	0	1	50,500	1	50,500
326	BRIGHTON	63	4,710,691	0	0	63	4,710,691
26	BRIGHTON (GREATER) FPD	0	0	69	5,019,819	69	5,019,819
504	BROADMOOR FPD	0	0	4	300,858	4	300,858
28	BRUSH	9	453,131	0	0	9	453,131
29	BUENA VISTA	7	332,259	2	91,970	9	424,229
735	BYERS FPD #9	0	0	1	40,000	1	40,000
33	CANON CITY	32	1,562,626	0	0	32	1,562,626
740	CARBONDALE AND RURAL FPD	0	0	20	1,304,384	20	1,304,384
35	CASTLE ROCK	0	0	79	6,771,353	79	6,771,353
37	CENTER	7	278,233	0	0	7	278,233

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City		Police		Fire		Total	
Code	City Name	No.	Earnings	No.	Earnings	No.	Earnings
749	CHAFFEE COUNTY FPD	0	$ 0	5	$ 247,371	5	$ 247,371
754	CIMARRON HILLS FPD	0	0	13	789,907	13	789,907
7125	CLEAR CREEK AUTHORITY	0	0	3	151,154	3	151,154
509	CLIFTON FPD	0	0	16	979,084	16	979,084
757	COAL CREEK CANYON FPD	0	0	1	67,244	1	67,244
531	COLORADO RIVER FRA	0	0	51	3,278,946	51	3,278,946
45	COLORADO SPRINGS	352	23,780,681	283	21,642,673	635	45,423,354
46	COLUMBINE VALLEY	6	357,354	0	0	6	357,354
765	CORTEZ FPD	0	0	14	557,288	14	557,288
772	CRESTED BUTTE FPD	0	0	12	653,617	12	653,617
774	CRIPPLE CREEK	0	0	13	732,328	13	732,328
57	DACONO	9	550,715	0	0	9	550,715
58	DEBEQUE	4	229,819	0	0	4	229,819
779	DEBEQUE FPD	0	0	7	449,810	7	449,810
62	DENVER	1,411	123,715,088	897	79,824,770	2,308	203,539,859
63	DILLON	7	479,622	0	0	7	479,622
64	DINOSAUR	1	42,000	0	0	1	42,000
566	DONALD WESCOTT FPD	0	0	16	1,060,925	16	1,060,925
567	DURANGO & RESCUE AUTH	0	0	60	4,137,253	60	4,137,253
507	EAST GRAND FPD #4	0	0	6	349,785	6	349,785
795	EATON FPD	0	0	14	680,114	14	680,114
73	EDGEWATER	16	1,020,018	0	0	16	1,020,018
74	ELIZABETH	6	342,401	0	0	6	342,401
7102	ELK CREEK FPD	0	0	13	748,232	13	748,232
75	EMPIRE	1	52,000	0	0	1	52,000
76	ENGLEWOOD	60	4,826,271	0	0	60	4,826,271
77	ERIE	29	2,149,788	0	0	29	2,149,788
523	ESTES VALLEY FPD	0	0	2	170,000	2	170,000
79	EVANS	6	573,503	0	0	6	573,503
579	EVANS FPD	0	0	18	1,039,443	18	1,039,443
7109	EVERGREEN FPD	0	0	1	95,695	1	95,695
510	FAIRMOUNT FPD	0	0	23	1,489,851	23	1,489,851

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City Code	City Name	Police No.	Police Earnings	Fire No.	Fire Earnings	Total No.	Total Earnings
80	FAIRPLAY MARSHALLS	1	$ 50,491	0	$ 0	1	$ 50,491
7112	FALCON FPD	0	0	21	1,173,284	21	1,173,284
81	FEDERAL HEIGHTS	21	1,359,656	16	963,985	37	2,323,641
82	FIRESTONE	23	1,686,215	0	0	23	1,686,215
85	FLORENCE	13	576,621	0	0	13	576,621
7222	FOOTHILLS & RESCUE	0	0	2	101,385	2	101,385
7122	FORT LEWIS-MESA FPD	0	0	2	119,587	2	119,587
7123	FORT LUPTON FPD	0	0	25	1,376,287	25	1,376,287
89	FOUNTAIN	0	0	25	1,545,883	25	1,545,883
90	FOWLER	2	73,600	0	0	2	73,600
511	FRANKTOWN FPD	0	0	20	1,179,781	20	1,179,781
92	FREDERICK	18	1,182,215	0	0	18	1,182,215
592	FREDERICK FIRESTONE FPD	0	0	45	2,852,026	45	2,852,026
93	FRISCO	12	751,287	0	0	12	751,287
7131	FRONT RANGE FIRE RESCUE FPD	0	0	28	1,818,497	28	1,818,497
95	GARDEN CITY	4	215,500	0	0	4	215,500
7135	GATEWAY-UNAWEEP FPD	0	0	1	65,000	1	65,000
7136	GENESEE FPD	0	0	2	159,744	2	159,744
97	GEORGETOWN	3	190,276	0	0	3	190,276
7147	GRAND FPD #1	0	0	3	185,319	3	185,319
7149	GRAND LAKE FPD	0	0	8	393,876	8	393,876
7150	GRAND VALLEY FPD	0	0	14	1,221,675	14	1,221,675
7153	GREATER EAGLE FPD	0	0	14	771,466	14	771,466
107	GREELEY	0	0	97	7,611,276	97	7,611,276
7156	GYPSUM FPD	0	0	6	388,096	6	388,096
7158	HARTSEL FPD	0	0	2	105,504	2	105,504
115	HAXTUN	3	131,022	0	0	3	131,022
119	HOLYOKE	4	178,774	0	0	4	178,774
7176	HUDSON FPD	0	0	20	1,044,245	20	1,044,245
124	HUGO	2	74,970	0	0	2	74,970
125	IDAHO SPRINGS	8	450,789	0	0	8	450,789
126	IGNACIO	7	447,186	0	0	7	447,186

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City		Police		Fire		Total	
Code	City Name	No.	Earnings	No.	Earnings	No.	Earnings
7185	INDIAN HILLS FPD	0	$ 0	1	$ 43,260	1	$ 43,260
7187	INTER-CANYON FPD	0	0	2	148,202	2	148,202
7191	JEFFERSON-COMO FPD	0	0	4	180,900	4	180,900
129	JOHNSTOWN	18	1,086,826	0	0	18	1,086,826
132	KERSEY	4	185,746	0	0	4	185,746
7198	KIOWA FPD	0	0	2	111,845	2	111,845
136	KREMMLING	4	263,076	0	0	4	263,076
5136	KREMMLING FPD	0	0	1	50,500	1	50,500
138	LA JARA	3	115,000	0	0	3	115,000
144	LA SALLE	7	384,261	0	0	7	384,261
7211	LA SALLE FPD	0	0	12	727,585	12	727,585
146	LA VETA	2	73,129	0	0	2	73,129
137	LAFAYETTE	36	2,738,164	23	1,644,376	59	4,382,540
7206	LAKE GEORGE FPD	0	0	1	50,500	1	50,500
263	LAKESIDE	4	220,480	0	0	4	220,480
141	LARKSPUR FPD	0	0	18	1,057,912	18	1,057,912
147	LEADVILLE	8	331,252	11	594,989	19	926,242
574	LEFTHAND FPD	0	0	3	226,480	3	226,480
149	LITTLETON	0	0	137	11,688,423	137	11,688,423
150	LOCHBUIE	9	551,573	0	0	9	551,573
214	LOG LANE VILLAGE	3	130,474	0	0	3	130,474
268	LONE TREE	50	3,957,499	0	0	50	3,957,499
578	LOS PINOS FPD	0	0	21	1,144,580	21	1,144,580
7226	LOWER VALLEY FPD	0	0	12	674,958	12	674,958
7227	LYONS FPD	0	0	1	78,208	1	78,208
155	MANASSA	1	39,000	0	0	1	39,000
157	MANITOU SPRINGS	13	737,213	6	350,467	19	1,087,680
160	MEAD	4	248,650	0	0	4	248,650
163	MILLIKEN	7	405,348	0	0	7	405,348
537	MONTROSE FPD	0	0	32	2,279,640	32	2,279,640
170	MOUNTAIN VIEW	7	366,364	0	0	7	366,364
516	MOUNTAIN VIEW FPD	0	0	86	6,991,474	86	6,991,474

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City Code	City Name	Police No.	Police Earnings	Fire No.	Fire Earnings	Total No.	Total Earnings
7246	NEDERLAND FPD	0	$ 0	4	$ 178,767	4	$ 178,767
7251	NORTH FORK FPD	0	0	1	64,748	1	64,748
532	NORTH METRO FIRE RESCUE	0	0	131	10,679,790	131	10,679,790
7253	NORTH ROUTT COUNTY	0	0	1	65,000	1	65,000
7255	NORTHEAST TELLER COUNTY FPD	0	0	14	825,040	14	825,040
7259	NORTH-WEST FPD	0	0	10	481,078	10	481,078
178	NUNN	1	45,800	0	0	1	45,800
179	OAK CREEK	2	103,979	0	0	2	103,979
7263	OAK CREEK FPD	0	0	4	203,938	4	203,938
180	OLATHE	5	220,338	0	0	5	220,338
588	PAGOSA FPD	0	0	8	369,726	8	369,726
188	PAGOSA SPRINGS	6	304,048	0	0	6	304,048
189	PALISADE	9	482,542	2	126,030	11	608,573
190	PALMER LAKE	2	117,684	3	109,131	5	226,815
192	PAONIA	2	86,824	0	0	2	86,824
106	PARACHUTE	5	278,935	0	0	5	278,935
191	PARKER	72	5,836,695	0	0	72	5,836,695
7481	PLATEAU VALLEY FPD	0	0	5	314,117	5	314,117
7285	PLATTE CANYON FPD	0	0	16	1,009,548	16	1,009,548
7287	PLATTE VALLEY FPD	0	0	21	1,305,133	21	1,305,133
196	PLATTEVILLE	9	462,319	0	0	9	462,319
513	PLATTEVILLE/GILCREST FPD	0	0	23	1,417,097	23	1,417,097
7289	PLEASANT VIEW METRO FIRE DISTRICT	0	0	7	395,031	7	395,031
199	PUEBLO	188	12,707,571	125	8,622,639	313	21,330,211
519	PUEBLO RURAL FPD	0	0	28	1,405,505	28	1,405,505
7294	PUEBLO W. METRO	0	0	19	965,736	19	965,736
7298	RATTLESNAKE FPD	0	0	3	194,686	3	194,686
521	RED WHITE & BLUE FPD	0	0	51	3,877,341	51	3,877,341
7307	RIO BLANCO FPD	0	0	1	73,866	1	73,866
752	ROCKY MOUNTAIN FPD	0	0	38	3,170,113	38	3,170,113
7314	RYE FPD	0	0	6	236,913	6	236,913
542	SABLE-ALTURA FPD	0	0	4	187,178	4	187,178

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City		Police		Fire		Total	
Code	City Name	No.	Earnings	No.	Earnings	No.	Earnings
213	SALIDA	16	$ 833,889	10	$ 664,024	26	$ 1,497,913
215	SANFORD	1	12,974	0	0	1	12,974
543	SECURITY FPD	0	0	32	1,359,211	32	1,359,211
220	SHERIDAN	29	1,989,454	0	0	29	1,989,454
222	SILT	6	287,276	0	0	6	287,276
524	SNOWMASS-WILDCAT FPD	0	0	17	1,341,332	17	1,341,332
525	SOUTH ADAMS COUNTY FPD	0	0	59	3,650,541	59	3,650,541
7339	SOUTH FORK	2	123,576	0	0	2	123,576
5339	SOUTH FORK FPD	0	0	4	178,745	4	178,745
540	SOUTH METRO FIRE RESCUE FPD	0	0	61	4,814,068	61	4,814,068
7340	SOUTHEAST WELD FPD	0	0	18	981,496	18	981,496
548	SOUTHERN PARK COUNTY FPD	0	0	1	32,000	1	32,000
229	SPRINGFIELD	4	155,272	0	0	4	155,272
231	STEAMBOAT SPRINGS	0	0	27	1,728,147	27	1,728,147
232	STERLING	21	1,033,984	22	973,589	43	2,007,573
7348	STRASBURG FPD #8	0	0	4	156,671	4	156,671
7349	STRATMOOR HILLS FPD	0	0	5	229,045	5	229,045
233	STRATTON	1	50,534	0	0	1	50,534
549	SUMMIT FIRE AND EMS AUTHORITY	0	0	55	3,574,796	55	3,574,796
545	TELLURIDE FPD	0	0	8	648,664	8	648,664
238	THORNTON	198	14,892,295	88	7,337,936	286	22,230,231
7354	TIMBERLINE FPD	0	0	3	146,091	3	146,091
2557	TRI-LAKES MONUMENT FPD	0	0	44	2,752,366	44	2,752,366
240	TRINIDAD	0	0	13	661,956	13	661,956
595	UPPER PINE RIVER FPD	0	0	27	1,374,199	27	1,374,199
7369	WELLINGTON FPD	0	0	23	1,158,267	23	1,158,267
7373	WEST DOUGLAS COUNTY FPD	0	0	1	88,885	1	88,885
534	WEST METRO FPD	0	0	236	19,281,347	236	19,281,347
7375	WEST ROUTT FPD	0	0	4	244,070	4	244,070
252	WESTMINSTER	159	12,661,243	123	9,802,193	282	22,463,436
254	WIGGINS	2	68,897	0	0	2	68,897
257	WINDSOR	30	2,000,840	0	0	30	2,000,840

Table 19 (continued) - Summary of Members and Adjusted Payroll by Employer

City Code	City Name	Police No.	Police Earnings	Fire No.	Fire Earnings	Total No.	Total Earnings
7384	WINDSOR SEVERANCE FPD	0	$ 0	35	$ 2,222,355	35	$ 2,222,355
260	WRAY	5	244,656	0	0	5	244,656
262	YUMA	7	334,717	0	0	7	334,717
	Totals	3,134	$ 241,464,578	4,468	$ 336,159,435	7,602	$ 577,624,013

SECTION IV

APPENDICES

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

I. Valuation Date

The valuation date is January 1st of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

II. Actuarial Cost Method

The actuarial valuation uses the Entry Age Normal actuarial cost method. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate, and (ii) a rate that will amortize the unfunded actuarial liability.

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future (7.50%). The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Plan on account of the present group of participants and beneficiaries.

2. The employer contributions required to support the benefits of the Plan are determined following a level funding approach, and consist of a normal cost contribution and an accrued liability contribution.

3. The normal cost contribution is determined using the Entry Age Normal method. Under this method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each participant during the entire period of his anticipated covered service (from hire), would be required in addition to the contributions of the participant to meet the cost of all benefits payable on their behalf.

4. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability and amortizing the result over 30 years from the valuation date as a level percentage of payroll. It is assumed that payments are made monthly throughout the year.

III. Actuarial Value of Assets

Effective January 1, 2013, the actuarial value of assets is equal to the market value of assets less a five-year phase in of the excess/(shortfall) between expected investment return and actual income. The actual calculation is based on the difference between actual earnings and expected earnings each year, and recognizes the cumulative excess return (or shortfall) over at a minimum rate of 20% per year. The speed of the recognition will increase if the Plan continues to be in the same net deferred position (net gain or net loss) from one year to the next. This is intended to ensure the smoothed value of assets will converge towards the market value in a reasonable amount of time. In addition, a gain or loss that is in the opposite direction of the current net position will be immediately recognized.

Expected earnings are determined using the assumed investment return rate and the beginning of year actuarial value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of administrative and investment expenses. In future years, the returns will be net of investment expenses only.

IV. Actuarial Assumptions

The current assumptions were adopted by the Board in 2015 for first use in the actuarial valuation as of January 1, 2016, following a regularly scheduled experience study. The rationale for all of the current assumptions is included in that report, dated June 1, 2015.

A. Economic Assumptions

1. Investment return: 7.50% per annum, compounded annually, composed of an assumed 2.50% inflation rate and a 5.00% real rate of return. This rate represents the assumed return, net of all investment expenses.

2. Salary increase rate: Inflation rate of 2.50%, plus productivity component of 1.50%, plus step-rate/ promotional component as shown on the following page:

Years of Service	Annual Step-rate/ Promotional Rate	Total Annual Rate of Increase Including 2.50% Inflation Component and 1.50% Productivity Component
(1)	(2)	(4)
1	10.00%	14.00%
2	8.50%	12.50%
3	8.00%	12.00%
4	7.50%	11.50%
5	2.50%	6.50%
6	1.50%	5.50%
7	1.50%	5.50%
8	1.00%	5.00%
9	0.75%	4.75%
10	0.50%	4.50%
11	0.50%	4.50%
12	0.50%	4.50%
13	0.25%	4.25%
14	0.25%	4.25%
15	0.00%	4.00%

Salary increases are assumed to occur once a year, on January 1. Therefore the pay used for the period between the valuation date and the first anniversary of the valuation date is equal to the reported pay for the prior year, annualized if necessary, and then increased by the salary increase assumption.

3. Payroll growth rate: In the amortization of the unfunded actuarial accrued liability, payroll is assumed to increase 3.50% per year. This increase rate is primarily due to the effect of inflation on salaries, with no allowance for future membership growth.

B. Demographic Assumptions

1. Healthy retirees and beneficiaries: For ages less than 55, RP-2014 Mortality Tables for Blue Collar Employees. For ages 65 and older, RP-2014 Mortality Tables for Blue Collar Healthy Annuitants. For ages 55 through 64, a blend of the previous tables. All tables are projected with Scale BB.

	Annual Rate per 1,000 Members				
Attained Age in 2018	Males	Females	Attained Age in 2018 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
50	2.16	1.22	70	18.53	13.31
55	3.65	1.95	75	29.66	21.89
60	7.13	4.53	80	48.82	36.36
65	12.02	8.31	85	81.74	61.95

The following table provides the life expectancy in years for an individual age 55 at retirement in a given year based on the assumption with full generational projection:

	Year of Retirement			
Gender	2016	2021	2026	2031
Male	30.2	30.7	31.3	31.9
Female	32.8	33.3	33.7	34.2

2. Mortality rates (active members) – RP-2014 Mortality Tables for Blue Collar Employees, projected with Scale BB, 55% multiplier for off-duty mortality. Increased by 0.00020 for on-duty related Fire and Police experience. Sample rates are shown below:

	Annual Rate per 1,000 Members				
Attained Age in 2018	Males	Females	Attained Age in 2018 (cont.)	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)
20	0.49	0.30	40	0.64	0.44
25	0.54	0.31	45	0.88	0.60
30	0.52	0.33	50	1.39	0.87
35	0.57	0.37	55	2.16	1.21

3. Disability rates: Sample rates are shown below by age and disability type.

	Annual Rate per 1,000 Members	
Age	Occupational Disability Rates	Total Disability Rates
(1)	(2)	(3)
25	0.29	0.02
30	1.35	0.17
35	1.82	0.34
40	2.67	0.52
45	3.29	0.72
50	4.89	0.94
55	6.88	1.17

Disability rates are turned off at eligibility for normal retirement.

4. Termination rates (for causes other than death, disability or retirement): Termination rates are based on service. Termination rates are not applied after a member becomes eligible for a retirement benefit. Rates at selected ages are shown:

	Annual Rate per 1,000 Members				
Service	Rates	Service (cont.)	Rates	Service (cont.)	Rates
0	98.5	8	25.5	16	9.4
1	84.6	9	21.3	17	9.1
2	72.3	10	17.9	18	8.8
3	61.4	11	15.3	19	8.5
4	51.9	12	13.3	20	8.1
5	43.6	13	11.7	21	7.5
6	36.5	14	10.7	22	6.5
7	30.5	15	9.9	23	5.2

5. Retirement rates:

Age-Based Retirement rates, for members with more than 25 years of service

Age	Annual Rate per 100 Members
55	60
56-59	50
60	100

Service-Based Retirement rates*

Service	Annual Rate per 100 Members
5-10	4
11	5
12	6
13	7
14	8
15	9
16	10
17	11
18	12
19	13
20	15
21	20
22-24	25

*Rates first applied at age 55; 100 percent retirement assumed at age 70.

C. <u>Other Assumptions</u>

1. Administrative expenses: An explicit administrative expense equal to the prior year actual expenses.

2. Covered payroll projected for the calendar year following the valuation date (used in determining the contribution rate necessary to amortize the unfunded liability) is equal to actual pay that was paid during the calendar year preceeding the valuation date for members active at any time during that period increased by the payroll growth rate assumption and adjusted for differences in active membership count.

3. Percent married: 85% of employees are assumed to be married or in a civil union.

4. Age difference: Male members are assumed to be two years older than their spouses, and female members are assumed to be two years younger than their spouses.

5. Post-retirement benefit adjustments: 0%.

6. Percent electing annuity on death (when eligible): All of the spouses of vested, married participants are assumed to elect an annuity.

7. 10% of members who become occupationally disabled after the age of 50 will transfer back to the SWDB Plan at age 55. No other assumption is made for recoveries once disabled.

8. Percent electing deferred termination benefit: Vested terminating members are assumed to elect a refund or a deferred benefit, whichever is more valuable at the time of termination.

9. No surviving spouse will remarry and there will be no children's benefit.

10. Assumed age for commencement of deferred benefits: Members electing to receive a deferred benefit are assumed to commence receipt at the first age at which unreduced benefits are available.

11. Pay increase timing: Beginning of (fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

12. Decrement timing: Decrements of all types are assumed to occur mid-year.

13. Eligibility testing: Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

14. Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

15. Incidence of Contributions: Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.

16. Benefit Service: All members are assumed to accrue 1 year of service each year. Exact fractional service is used to determine the amount of benefit payable.

17. Inactive Population: All members included in the inactive non-vested population with at least 10 years of service are valued using two times member contributions.

D. <u>Participant Data</u>

Participant data was supplied on electronic files in the form of spreadsheets. There were separate tabs for (i) active and non-vested inactive members, and (ii) members and beneficiaries receiving benefits or vested inactives.

The data for active members included birthdate, sex, service, salary and employee contribution account balance. For retired members and beneficiaries, the data included date of birth, sex, spouse's date of birth (where applicable), amount of monthly benefit, date of retirement, and a form of payment code.

Salary supplied for the current year was based on the earnings for the year preceding the valuation date adjusted for service accrued during the year. In cases where the earnings for the year two years prior to the valuation date was higher, this higher amount was used. This salary was adjusted by the salary increase rate for one year.

Assumptions were made to correct for missing, bad, or inconsistent data. These had no material impact on the results presented.

E. Allocation to SRA

The SRA contribution rate is determined annually based on the normal cost plus amortization of unfunded liability (surplus). The excess of the total contribution rate (17.00% in 2016, ratcheted up by 0.50% until reaching 20.0% in 2022) over the actuarial requirement is available as the SRA contribution rate. The Board has the authority and responsibility to choose the SRA rate. Other considerations may be evaluated such as:

1. Investment performance subsequent to the actuarial valuation
2. Potential future plan changes under consideration
3. Stability of SRA
4. Projections of future SRA contributions
5. Ability to grant future benefit adjustments to retired members

F. Changes to the assumptions:

There have been no changes to the assumptions since the prior valuation.

SUMMARY OF BENEFIT PROVISIONS

Plan Description

The Fire & Police Pension Association Defined Benefit System – Statewide Defined Benefit Plan ("Plan") is a cost-sharing multiple-employer defined benefit pension plan. The Plan covers substantially all full-time employees of participating fire or police departments in Colorado hired on or after April 8, 1978, provided that they are not already covered by a statutorily exempt plan. As of August 5, 2003, the Plan may include clerical and other personnel from fire districts whose services are auxiliary to fire protection. The Plan was established in 1980 pursuant to Colorado Revised Statutes.

Employers once had the option to elect to withdraw from the Plan, but a change in state statutes permitted no further withdrawals after January 1, 1988, unless the employer elects into and is determined to be eligible to participate in the Statewide Money Purchase Plan.

The Plan assets are included in the Fire & Police Members' Benefit Investment Fund and the Fire & Police Members' Self-Directed Investment Fund (for Deferred Retirement Option Plan "DROP" assets and Separate Retirement Account "SRA" assets from eligible retired members.)

Plan Year

A twelve-month period ending December 31.

Members Included

Members included are active employees who are full-time salaried employees of a participating municipality, fire protection district, fire authority, or county improvement district normally serving at least 1,600 hours in a calendar year and whose duties are directly involved with the provision of police or fire protection. As of August 5, 2003, the Plan may include clerical and other personnel employed by a fire protection district, fire authority, or a county improvement district.

Also included are employees of any employer that covers members under the federal Social Security Act or any county that chooses to affiliate with the Fire & Police Pension Association and includes all personnel employed by a sheriff expected to work 1,600 hours or more in a calendar year who are directly involved with the provision of law enforcement or fire protection as certified by the county.

Compensation Considered (Base Salary)
Base salary means the total base rate of pay including Member Contributions to the Statewide Defined Benefit Plan or Statewide Money Purchase Plan which are "picked up" by the employer:

1) And shall also include longevity pay, sick leave pay taken in the normal course of employment, vacation leave pay taken in the normal course of employment, shift differential, and mandatory overtime that is part of the Member's fixed, periodic compensation.

2) Accumulated vacation leave pay will also be included if a Member completes his/her service requirement for purposes of Normal retirement while exhausting accumulated vacation leave.

3) In the event an employer has established or does establish a Deferred Compensation Plan, the amount of the Member's salary that is deferred shall be included in the Member's base salary.

4) Any amounts voluntarily contributed to an Internal Revenue Code Section 125 "Cafeteria Plan" shall be included in the Member's base salary.

5) Base salary shall not include overtime pay (except as noted in the preceding sentence), step-up pay or other pay for temporarily acting in a higher rank, uniform allowances, accumulated sick leave pay, accumulated vacation leave pay (except as noted in the preceding sentence), and other forms of extra pay (including Member Contributions which are paid by the employer and not deducted from the Member's salary).

Contribution Rates
Contribution rates for this Plan are set by state statute. Employer contribution rates can only be amended by state statute. Member contribution rates can be amended by state statute or by election of the membership.

Members of this Plan and their employers contributed at the rate of 8 percent of base salary for a total contribution rate of 16 percent through 2014. In 2014, the members elected to increase the member contribution rate to the Plan beginning in 2015. Member contribution rates will increase 0.5 percent annually through 2022 to a total of 12 percent of base salary. Employer contributions will remain at 8 percent resulting in a combined contribution rate of 20 percent in 2022.

Contributions from members and employers of plans reentering the system are established by resolution and approved by the Fire & Police Pension Association's Board of Directors. The reentry group had a combined contribution rate of 20 percent of base salary through 2014. It is a local decision on who pays the additional 4 percent contribution. Per the 2014 member election, the reentry group also had their required member contribution rate increase 0.5 percent annually beginning in 2015 through 2022 for a total combined member and employer contribution rate of 24 percent.

The contribution rate for members and employers of affiliated social security employers was 4 percent of base salary for a total contribution rate of 8 percent effective January 1, 2007 through 2014. Per the 2014 member election, the affiliated social security group also had their required member contribution rate increase 0.25 percent annually beginning in 2015 through 2022 to a total of 6 percent of base salary. Employer contributions will remain at 4 percent resulting in a combined contribution rate of 10 percent in 2022.

Statewide Defined Benefit Plan - Contribution Rate Implementation Schedule

Effective Date	Member Contribution Rate	Employer Contribution Rate	Total Combined Contribution Rate
1/1/2014	8.0%	8.0%	16.0%
1/1/2015	8.5%	8.0%	16.5%
1/1/2016	9.0%	8.0%	17.0%
1/1/2017	9.5%	8.0%	17.5%
1/1/2018	10.0%	8.0%	18.0%
1/1/2019	10.5%	8.0%	18.5%
1/1/2020	11.0%	8.0%	19.0%
1/1/2021	11.5%	8.0%	19.5%
1/1/2022	12.0%	8.0%	20.0%
Beyond	12.0%	8.0%	20.0%

Note: The Statewide Defined Benefit Plan - Reentry group had a combined contribution rate of 20 percent through 2014. It is a local decision on who pays the additional 4 percent contribution. Effective 1/1/2015, the member contribution rate increased by 0.5 percent per year over 8 years for a total combined member and employer contribution rate of 24 percent.

Statewide Defined Benefit Plan - Supplemental Social Security - Contribution Rate Implementation Schedule

Effective Date	Member Contribution Rate	Employer Contribution Rate	Total Combined Contribution Rate
1/1/2014	4.00%	4.00%	8.00%
1/1/2015	4.25%	4.00%	8.25%
1/1/2016	4.50%	4.00%	8.50%
1/1/2017	4.75%	4.00%	8.75%
1/1/2018	5.00%	4.00%	9.00%
1/1/2019	5.25%	4.00%	9.25%
1/1/2020	5.50%	4.00%	9.50%
1/1/2021	5.75%	4.00%	9.75%
1/1/2022	6.00%	4.00%	10.00%
Beyond	6.00%	4.00%	10.00%

Highest Average Salaries (HAS)
HAS is the average of the member's highest three annual base salaries.

Normal Retirement Date
A member's Normal Retirement shall be the date on which the member has completed at least 25 years of credited service and has attained the age of 55.

Normal Retirement Benefit
The annual Normal Retirement Benefit shall be 2 percent of the average of the member's highest three years base salary for each year of credited service up to ten years plus 2.5 percent for each year thereafter.

The benefit for members of affiliated social security employers will be reduced by the amount of social security income the member receives annually, calculated as if the social security benefit started as of age 62 for benefits prior to 2007. Beginning January 1, 2007, members of affiliated social security employers will participate in the Fire & Police Pension Association supplemental social security program which will provide benefits equal to 1 percent of the average of the member's highest three years base salary for each year of credited service up to ten years plus 1.25 percent for each year thereafter.

Benefits are paid as a monthly life annuity. Other forms of payment are available.

Early Retirement Benefit
A member shall be eligible for an Early Retirement Benefit after completion of 30 years of service or attainment of age 50 with at least five years of credited service. The Early Retirement Benefit shall be the Normal Retirement Benefit reduced on an actuarially equivalent basis.

Benefits are paid as a monthly life annuity. Other forms of payment are available.

Terminated Vested Benefit
A member who terminates with at least five years of service is vested. A vested member who does not withdraw their contributions from the Plan is eligible for a vested benefit, payable at age 55. The annual vested benefit is equal to 2 percent of the average of the member's highest three years base salary for each year of credited service up to ten years plus 2.5 percent for each year thereafter. Both the highest average salary and service are determined at the time the member leaves active employment or enters the Deferred Retirement Option Plan (DROP). Benefits may commence at age 55.

The benefit for members of affiliated social security employers earned prior to January 1, 2007 will be reduced by the amount of social security income the member receives annually.

Benefits are paid as a monthly life annuity. Other forms of payment are available.

Deferred Retirement Benefit
Members who qualify for a Normal or Vested Retirement may defer the receipt of their defined benefit pension to as late as age 65 and receive the actuarial equivalent of the benefit.

Benefits are paid as a monthly life annuity. Other forms of payment are available.

Severance Benefit
All members leaving covered employment with less than five years of service credit are eligible. Optionally, vested members (those with five or more years of service credit) may withdraw their accumulated contributions in lieu of the future vested benefits otherwise due.

The member receives a lump-sum payment equal to the sum of their member contributions. 5 percent as interest is credited on these contributions.

Death Benefit of Active Members
Death must have occurred while an active or an inactive, non-retired member.

Upon the death of a non-vested active, unmarried member with no spouse, no dependent children, and no beneficiary, a refund of the member's contributions is paid to the member's estate. If the member was vested, single and had no dependent children and was not eligible for a Normal or Early retirement, a joint and survivor annuity may be paid to the beneficiary if greater than the refund. The benefit for members of affiliated social security employers earned prior to January 1, 2007 will be reduced by the amount of social security income the member receives annually.

Survivors (spouse or dependent children) of active members who die prior to retirement eligibility are covered by the benefits provided by the Statewide Death & Disability Plan. For purposes of the Statewide Death & Disability Plan benefits, a spouse includes a partner in a civil union.

Survivors of an active or inactive member who is eligible for a Normal or Early retirement and who dies after leaving active service but before electing a payment option or receiving the first pension payment is eligible to receive a benefit according to payment Option 1, (Joint and 100% Survivor benefits).

Forms of Payment
The Plan provides six choices for receipt of the retirement benefit.

Normal Option – The retiree receives a monthly pension benefit for their life. No monthly benefits are paid to a beneficiary following the retiree's death. However, if at the time of the member's death, they have not recouped in pension payments the amount of the member contributions (including all funds paid in to purchase service credit), the remaining funds plus 5% as interest would be paid to the member's beneficiary or estate as a lump sum.

Option 1 (Joint and 100% Survivor) - Under Option 1, an actuarially equivalent normal, deferred, early or vested retirement pension will be paid from the effective date of the retiree's retirement or later in the case of a deferred retirement. The actuarially equivalent monthly pension will continue for the life of the retiree. Upon the death of the retiree, the same monthly pension will be paid to the retiree's designated beneficiary for life.

Option 2 (Joint and 50% Survivor) - Under Option 2, an actuarially equivalent normal, deferred, early or vested retirement pension will be paid from the effective date of the retiree's retirement or later in the case of a deferred retirement. The actuarially equivalent monthly pension will continue for the life of the retiree. Upon the death of the retiree, 50 percent of the same monthly pension will be paid to the retiree's designated beneficiary for life.

Option 3 (Joint and 50% Last Survivor) - Under Option 3, an actuarially equivalent normal, deferred, early or vested retirement monthly pension will be shared by the retiree and their named beneficiary. Upon the death of either the retiree or the designated beneficiary, 50 percent of the same monthly pension will be paid to the survivor for life.

Option 4 (Joint and 100% Survivor with "Pop Up") – Under Option 4, an actuarially equivalent normal, deferred, early or vested retirement pension will be paid from the effective date of the retiree's retirement or later in the case of a deferred retirement. The actuarially equivalent monthly pension will continue for the life of the retiree. Upon the death of the retiree, the same monthly pension will be paid to the retiree's designated beneficiary for life. However, if the designated beneficiary dies before the retiree, the monthly pension benefit "pops-up" or reverts to the Normal Option effective with the first day of the month following the date of the death of the beneficiary.

Option 5 (Joint and 50% Survivor with "Pop Up") – Under Option 5, an actuarially equivalent normal, deferred, early or vested retirement pension will be paid from the effective date of the retiree's retirement or later in the case of a deferred retirement. The actuarially equivalent monthly pension will continue for the life of the retiree. Upon the death of the retiree, 50 percent of the same monthly pension benefit will be paid to the retiree's beneficiary for life. However, if the beneficiary dies before the retiree, the monthly pension benefit "pops-up" or reverts to the Normal Option effective with the first day of the month following the date of the death of the beneficiary.

Survivor benefits are paid according to the payment option elected by the member at the time of retirement or entry into DROP.

Actuarial equivalence is based on tables adopted by the Fire & Police Pension Association Board of Directors.

Benefit Adjustments for Benefits in Pay Status

Benefits to members and beneficiaries may be increased annually on October 1. The amount is based on the Fire & Police Pension Association Board of Directors discretion and can range from 0 percent to the higher of 3 percent or the Consumer Price Index. Benefit adjustment may begin once the retired member has been receiving retirement benefits for at least 12 calendar months prior to October 1.

Stabilization Reserve Account (SRA)
Annually, at the discretion of the Board of Directors, the difference between the combined member/employer contribution and the actuarially determined contribution rate may be allocated to the stabilization reserve account (SRA). Amounts set aside in the SRA are allocated to individual accounts for each member. A member may receive the amounts in this individual account only upon election of Normal, Early, Disability or Vested retirement. If the cost of the Plan exceeds the combined member/employer contribution rate, funds from the SRA may be used to make up the shortfall. If a member leaves with less than five years of service credit, the SRA account is forfeited. Likewise, if a vested member elects to take a refund of member contributions instead of a retirement, the SRA is forfeited. The SRA may be payable in the event of the active member's death if the member was vested at the time of death, or if the member's survivors receive benefits from the Statewide Death & Disability Plan, the applicable SRA offset applies.

Members of plans reentering the system have a higher contribution rate. As a result their SRA has two components: the standard SRA and the reentry SRA. The component of the member's SRA attributable to the higher contribution rate is considered the reentry SRA. The reentry SRA cannot be used to subsidize the costs of the non-reentry members. The reentry SRA could be used to correct any deficiencies in the cost of participation for the reentry members only.

A member may elect to convert the SRA or reentry SRA to a lifetime monthly benefit with survivor benefits.

Deferred Retirement Option Plan (DROP)
A member may elect to participate in the DROP after reaching eligibility for normal retirement, early retirement, or vested retirement and age 55. A member can continue to work while participating in the DROP, but must terminate employment within five years of entry into the DROP. The member's percentage of retirement benefit is determined at the time of entry into the DROP. The monthly payments that begin at entry into the DROP are accumulated in a DROP account until the member terminates service, at which time the DROP accumulated benefits can be paid as periodic installments, a lump sum, or if desired a member may elect to convert the DROP to a lifetime monthly benefit with survivor benefits. While participating in DROP, the member continues to make pension contributions, which are credited to the DROP. Effective January 1, 2003, the member shall self-direct the investments of their DROP funds.