Cavanaugh Macdonald
CONSULTING, LLC

The experience and dedication you deserve

CONNECTICUT STATE EMPLOYEES RETIREMENT SYSTEM

REPORT OF THE ACTUARY ON THE VALUATION PREPARED AS OF JUNE 30, 2019

www.CavMacConsulting.com

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

December 19, 2019

State of Connecticut
State Employees Retirement Commission
55 Elm Street
Hartford, CT 06106

Members of the Commission:

Connecticut General Statutes Section 5-155a governs the operation of the Connecticut State Employees Retirement System (SERS). The actuary makes periodic valuations of the contingent assets and liabilities of the Retirement System at the direction of the Commission. We are pleased to submit the report giving the results of the actuarial valuation of the Retirement System prepared as of June 30, 2019.

The purpose of the report is to provide a summary of the funded status of SERS as of June 30, 2019 and to recommend an actuarially determined contribution rate for the fiscal year ending June 20, 2021. The report indicates that an annual actuarially determined employer contribution of approximately $1.807 billion (at the rate of 49.01% of compensation) for the fiscal year ending June 30, 2021 is sufficient to support the benefits of the System.

In preparing the valuation, the actuary relied on data provided by the Comptroller's Office. While not verifying data at the source, the actuary performed tests for consistency and reasonableness.

The System is funded on an actuarial reserve basis. The actuarial assumptions recommended by the actuary and adopted by the Commission are reasonably related to the experience under the System and to reasonable expectations of anticipated experience under the System. The funding objective of the System is that contribution amounts will be sufficient to fully fund the liabilities of System over a reasonable funding period. The funding method determines the unfunded actuarial accrued liability (UAAL) as the excess of actuarial accrued liability over the actuarial value of assets. The UAAL is allocated as follows:

Portion of UAAL	Year Established	Remaining Amortization Period
Statutory Base*	1984	27 years
Transitional Base	2016	27 years
2018 Base	2018	24 years
2019 Base	2019	25 years

*Legislation enacted changed the amortization period for the Statutory Base to the same as the Transitional Base effective 7/1/2018.

3550 Busbee Pkwy, Suite 250, Kennesaw, GA 30144
Phone (678) 388-1700 • Fax (678) 388-1730
www.CavMacConsulting.com
Offices in Kennesaw, GA • Bellevue, NE

This is to certify that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonably based on the actual experience of the System.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal actuarial valuation, an analysis of the range of results is not presented herein.

The actuarial computations presented in this report are for purposes of determining the recommended funding amounts for the System. Use of these computations for purposes other than meeting these requirements may not be appropriate.

The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Sincerely yours,

John J. Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

Edward J. Koebel, FCA, MAAA, EA
Chief Executive Officer

Table of Contents

Section I – Summary of Principal Results

1. For convenience of reference, the principal results of the current and preceding valuations are summarized below:

Valuation Date	June 30, 2019	June 30, 2018
Number of active members	49,429	49,153
Annual compensation	$ 3,686,365,412	$ 3,428,068,476
Retired members and beneficiaries:		
Number	51,745	50,441
Annual allowances	$ 2,051,605,315	$ 1,931,097,538
Deferred Vested Members:		
Number	2,185	1,281
Annual allowances	$ 25,522,915	$ 18,032,761
Assets:		
Market Value	$ 13,275,692,603	$ 12,452,787,902
Actuarial Value	$ 13,795,389,341	$ 12,990,400,124
Unfunded actuarial accrued liability	$ 22,292,548,726	$ 21,223,762,645
Funded Ratio based on Actuarial Assets	38.2%	38.0%
Funded Ratio based on Market Assets	36.8%	36.4%
For Fiscal Year Ending	**June 30, 2021**	**June 30, 2020**
Actuarially Determined Employer Contribution (ADEC):		
Normal	$ 210,242,048	$ 235,397,264
Accrued liability	1,596,465,638	1,380,904,981
Total	$ 1,806,707,686	$ 1,616,302,245
Actuarially Determined Employer Contribution Rate (ADEC):		
Normal	5.70%	6.87%
Accrued liability	43.31%	40.28%
Total	49.01%	47.15%

2. The results of the valuation are given in Schedule A.
3. Comments on the valuation results are given in Section IV, comments on the experience and actuarial gains and losses during the valuation year are given in Section VII and the rates of contribution payable by employers are given in Section V.
4. Schedule B of this report presents the development of the actuarial value of assets.
5. Schedule D details the actuarial assumptions and methods employed. There were no changes to the actuarial assumptions or methods since the last valuation.
6. Schedule F gives a summary of the benefit and contribution provisions of the plan. There were no changes to the plan provisions since the last valuation.
7. The Governmental Accounting Standards Board issued Statement No. 67 (GASB 67) in June 2012 and is effective for plan years beginning after June 15, 2013. GASB 67 replaced GASB 25 for plans and a separate GASB 67 report will be prepared for the Commission. We have provided some supplemental disclosure information and tables in Section VI.
8. As shown in the Summary of Principal Results, the funded ratio of 38.2% is the ratio of the actuarial value of assets to the accrued liability. The funded ratio is an indication of progress in funding the promised benefits using a long-term, stable funding approach. Since the ratio is less than 100%, there is a need for contributions in addition to the plan's normal cost. The funded ratio based on the market value of assets is also provided for informational purposes.
9. The table on the following page provides a history of some pertinent figures.

Comparative Schedule

	Active Members				Retired Lives				Valuation Results ($ thousands)		
Valuation Date June 30	Number	Payroll ($ thousands)	Average Salary	% increase from previous valuation	Number	Active/ Retired Ratio	Annual Benefits ($ thousands)	Benefits as % of Payroll	Accrued Liability	Valuation Assets	UAAL
2011	47,778	$3,210,666	$67,200	2.1%	44,051	1.08	$1,391,091	43.3%	$21,216,725	$10,122,765	$11,003,960
2012	47,868	3,354,682	70,082	4.3	43,887	1.09	1,424,477	42.5	23,018,752	9,744,986	13,273,766
2014	49,976	3,487,577	69,785	(0.4)	45,803	1.09	1,576,606	45.2	25,505,610	10,584,795	14,920,815
2016	50,019	3,720,751	74,387	6.6	48,191	1.04	1,745,785	46.9	32,310,335	11,922,966	20,387,369
2018	49,153	3,428,068	69,743	(6.2)	50,441	0.97	1,931,098	56.3	34,214,163	12,990,400	21,223,763
2019	49,429	3,686,365	74,579	6.9	51,745	0.96	2,051,605	55.7	36,087,938	13,795,389	22,292,549

Section II – Membership

Data regarding the membership of the System for use as a basis for the valuation were furnished by the Comptroller's office. The following tables summarize the membership of the Retirement System as of June 30, 2019 upon which the valuation was based. Detailed tabulations of the data are given in Schedule G.

Active Members

			Group Averages		
Group	**Number**	**Payroll**	**Salary**	**Age***	**Service***
Tier I – Hazardous	3	$ 385,532	$ 128,511	55.0	8.3
Tier I – Plan B	505	52,361,156	103,685	62.8	36.7
Tier I – Plan C	29	2,817,176	97,144	61.2	32.0
Tier II – Hazardous	543	57,435,884	105,775	53.1	24.6
Tier II – Hybrid Plan	468	58,899,159	125,853	59.9	26.0
Tier II – Others	8,932	828,446,219	92,750	56.5	26.8
Tier IIA – Hazardous	4,204	370,399,270	88,106	46.3	15.1
Tier IIA – Hybrid Plan	992	100,106,573	100,914	53.7	15.2
Tier IIA – Others	16,045	1,262,715,117	78,698	50.1	14.9
Tier III – Hazardous	1,999	138,405,678	69,237	37.2	5.8
Tier III – Hybrid Plan	710	49,088,579	69,139	43.0	5.4
Tier III – Others	8,627	520,834,846	60,373	41.8	5.5
Tier IV – Hazardous	837	35,732,468	42,691	32.8	1.0
Tier IV – Hybrid Plan	741	25,048,183	33,803	41.8	0.6
Tier IV – Others	4,794	183,689,572	38,317	36.5	0.9
Total	49,429	$3,686,365,412	$ 74,579	47.5	13.6

*Years

Of the 49,429 active members, 32,463 are vested and 16,966 are non-vested.

Retired Lives

Type of Benefit Payment	No.	Annual Benefits	Group Averages Benefit	Age*
Retired – Pre 1980	601	$ 12,165,446	$ 20,242	91.1
Retired – 1980 - 1997	9,983	362,777,161	36,339	82.8
Retired – 1997 - 2011	25,087	1,058,660,561	42,200	70.5
Retired – 2011+	16,074	618,002,147	38,447	62.7
Total	51,745	$ 2,051,605,315	$ 39,648	70.7

*Years

Valuation also includes 2,185 deferred vested members with estimated annual benefits of $25,522,915.

Section III – Assets

1. As of June 30, 2019, the total market value of assets amounted to $13,275,692,603 as reported by the Comptroller's Office. The estimated investment return for the plan year since the last valuation was 5.67%. Schedule C shows receipts and disbursements of the System for the year preceding the valuation date and a reconciliation of the fund balances at market value.

2. The actuarial value of assets used for the current valuation using the new asset method was $13,795,389,341. The estimated investment return for the plan year on an actuarial value of assets basis was 5.90%, which can be compared to the investment return assumed over the period of 6.90%. Schedule B shows the development of the actuarial value of assets as of June 30, 2019.

3. Schedule C shows receipts and disbursements of the System for the year preceding the valuation date and a reconciliation of the fund balances at market value.

Section IV – Comments on Valuation

1. Schedule A of this report outlines the results of the valuation of the Retirement System as of June 30, 2019. The valuation was prepared in accordance with the actuarial assumptions and methods set forth in Schedule D and the actuarial cost method which is described in Schedule E.

2. The valuation shows that the System has a total actuarial accrued liability of $36,087,938,067, of which $26,401,340,717 is for the benefits payable on account of present retired members, beneficiaries of deceased members, and inactive members entitled to deferred vested benefits, and $9,686,597,350 is for the benefits expected to be payable on account of present active members, based on service to the valuation date. Against these liabilities, the System has total present assets for valuation purposes of $13,795,389,341 as of June 30, 2019. When this amount is deducted from the actuarial accrued liability of $36,087,938,067, there remains $22,292,548,726 as the unfunded actuarial accrued liability (UAAL).

3. The employer's contributions to the System consist of normal cost contributions and accrued liability contributions. The normal cost represents the ultimate cost of the benefits and the accrued liability contribution is an addition (reduction in case of a surplus) due to the amortization of the unfunded accrued liability. The valuation indicates that annual employer normal cost contributions at the rate of 5.70% of active members' compensation are required to provide the currently accruing benefits of the System.

4. The following table provides the components of the total UAAL and the derivation of the amortization amounts required in accordance with the Memorandum of Understanding (MOU) between the State and SEBAC effective December 8, 2016.

Total UAAL Amortization Schedule
($ thousands)

	Initial UAAL	Remaining UAAL	Remaining Amortization Period (years)	Amortization Payment
Statutory Base (1984 UAAL)	$ 4,138,969	$ 3,979,345	27	$ 284,089
2016 Base	16,248,400	16,728,512	27	1,194,262
2018 Base	570,349	570,441	24	43,062
2019 Base	1,014,250	1,014,251	25	75,053
Total UAAL		$22,292,549		$ 1,596,466
Annual Valuation Payroll				$ 3,686,365
UAAL Amortization Rate				43.31%

5. We have determined that a contribution of 43.31% of payroll is required to amortize the unfunded actuarial accrued liability of $22,292,548,726 over the scheduled amortization periods in accordance with the MOU.

6. Schedule J of this report shows the amortization schedule for the total UAAL.

Section V – Contributions Payable By Employer

The following table shows the amount and rate of contribution payable by the employer as determined from the present valuation for the 2020/2021 fiscal year.

Contribution for	Contribution Amount	Contribution Rate
A. Normal Cost:		
Service retirement benefits	$ 343,155,335	9.31%
Disability benefits	18,310,291	0.50%
Survivor benefits	2,117,727	0.05%
Total Normal Cost	$ 363,583,353	9.86%
B. Less Member Contributions	(153,341,305)	(4.16)%
C. Employer Normal Cost	$ 210,242,048	5.70%
D. Unfunded Actuarial Accrued Liabilities (26.8 year level percent of payroll amortization)	$1,596,465,638	43.31%
E. Total (C. + D.)	$1,806,707,686	49.01%

Section V – Contributions Payable By Employer

The following table shows a breakdown by group of the normal cost amount and rate payable by the employer as determined from the present valuation for the 2020/2021 fiscal year.

Group	Employer Normal Cost	Employer Normal Cost Rate
Tier I – Hazardous	$ 36,476	9.46%
Tier I – Plan B	3,512,489	6.71
Tier I – Plan C	124,834	4.43
Tier II – Hazardous	9,552,579	16.63
Tier II – Hybrid Plan	2,869,864	4.87
Tier II – Others	46,384,648	5.60
Tier IIA – Hazardous	50,378,022	13.60
Tier IIA – Hybrid Plan	4,853,945	4.85
Tier IIA – Others	55,244,346	4.38
Tier III – Hazardous	12,693,353	9.17
Tier III – Hybrid Plan	1,361,954	2.77
Tier III – Others	16,898,676	3.24
Tier IV – Hazardous	2,140,605	5.99
Tier IV – Hybrid Plan	481,337	1.92
Tier IV – Others	3,708,920	2.02
Total	$ 210,242,048	5.70%

Section V – Contributions Payable By Employer

The official contribution requirement for the fiscal year ending June 30, 2022 will be determined in the June 30, 2020 valuation. However, we have estimated the contribution requirement for the fiscal year ending June 30, 2022 using standard roll forward techniques from this valuation. These results assume the market value of assets will earn 6.90% and the active member population will remain static.

Projected Contributions Required for Fiscal Year Ending June 30, 2022	Roll Forward of June 30, 2019 Valuation	
	As % of Pay	$
Employer Normal Cost	5.70%	$ 217,589,000
Unfunded Actuarial Accrued Liabilities	45.89%	1,750,730,000
Total	51.59%	$ 1,968,319,000

Section VI – Accounting Information

1. The information required under Governmental Accounting Standards Board (GASB) will be issued in separate reports. The following is a distribution of the number of employees by type of membership:

NUMBER OF ACTIVE AND RETIRED MEMBERS
AS OF JUNE 30, 2019

GROUP	NUMBER
Retirees and beneficiaries currently receiving benefits	51,745
Terminated employees entitled to benefits but not yet receiving benefits	2,185
Active plan members	49,429
Total	103,359

2. Another such item is the schedule of funding progress as shown below.

SCHEDULE OF FUNDING PROGRESS
(Dollar amounts in thousands)

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) EAN (b)	Unfunded AAL (UAAL) (b – a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b – a) / c)
6/30/2011	$10,122,765	$21,126,725	$11,003,960	47.9%	$3,210,666	342.7%
6/30/2012	9,744,986	23,018,752	13,273,766	42.3	3,354,682	395.7
6/30/2014	10,584,795	25,505,610	14,920,815	41.5	3,487,577	427.8
6/30/2016#	11,922,966	32,310,335	20,387,369	36.9	3,720,751	547.9
6/30/2018	12,990,400	34,214,163	21,223,763	38.0	3,428,068	619.1
6/30/2019	13,795,389	36,087,938	22,292,549	38.2	3,686,365	604.7

Reflects change in discount rate.

Section VI – Accounting Information

3. The following shows the schedule of employer contributions (all dollar amounts are in thousands).

Fiscal Year Ending June 30	Valuation Date Ending June 30	Actuarially Determined Contribution	Actual Contribution	Percentage Contributed
2014	2012	$ 1,268,935	$ 1,268,890	100.0%
2015	2012	1,379,189	1,371,651	99.5%
2016	2014	1,514,467	1,501,805	99.2%
2017	2014	1,569,142	1,542,298	98.3%
2018	2016	1,443,110	1,444,053	100.1%
2019	2016	1,574,537	1,578,323	100.2%
2020	2018	1,616,302	N/A	N/A
2021	2019	1,806,708	N/A	N/A

4. The information presented in the required supplementary schedules was determined as part of the actuarial valuation at June 30, 2019. Additional information as of the latest actuarial valuation follows.

Valuation date	6/30/2019
Actuarial cost method	Entry Age Normal
Amortization method	Level percent of payroll, closed phasing in to Level dollar
Weighted amortization period	26.8 years
Asset valuation method	Smoothed market with 20% recognition of investment gains and losses
Actuarial assumptions:	
Investment rate of return*	6.90%
Projected salary increases*	3.50% - 19.50%
Cost-of-living adjustments	2.25% - 3.25%
Social Security Wage Base	3.50%
*Includes wage inflation at	3.50%

Section VII – Experience

Actual experience will never (except by coincidence) coincide exactly with assumed experience. It is assumed that gains and losses will be in balance over a period of years, but sizable year to year fluctuations are common. Detail on the derivation of the experience gain/(loss) for the period ended June 30, 2019 is shown below. Schedule H provides detailed gain/(loss) by source.

		$ Millions
(1)	UAAL* as of June 30, 2018	$ 21,223.8
(2)	Total Normal cost for 2019 fiscal year	366.6
(3)	Actual Employer and Employee contributions	2,067.4
(4)	Interest accrual: [[(5) + (6)] x .069] - [(7) x .0339]	1,419.5
(5)	Expected UAAL as of June 30, 2019: (1) + (2) - (3) + (4)	$ 20,942.5
(6)	Assumption/Method Changes	0.0
(7)	Expected UAAL as of June 30, 2019: (5) + (6)	$ 20,942.5
(8)	Actual UAAL as of June 30, 2019	$ 22,292.5
(9)	Gain/(loss): (7) – (8) (See Schedule H)	$ (1,350.0)
(10)	Gain/(loss) as percent of actuarial accrued liabilities at June 30, 2017 ($34,214.2)	(3.9)%

*Unfunded actuarial accrued liability.

Valuation Date June 30	Actuarial Gain/(Loss) as a % of Beginning Accrued Liabilities
2016	(4.0)%
2018	(1.5)%
2019	(3.9)%

Section VIII – Risk Assessment

Overview

Actuarial Standards of Practice (ASOP) No. 51, issued by the Actuarial Standards Board, provides guidance on assessing and disclosing risks related to pension plan funding. This guidance is binding on all credentialed actuaries practicing in the United States. This standard was issued as final in September 2017 with application to measurement dates on or after November 1, 2018.

The term "risk" frequently has a negative connotation, but from an actuarial perspective, it may be thought of as simply the fact that what actually happens in the real world will not always match what was expected, based on actuarial assumptions. Of course, when actual experience is better than expected, the favorable risk is easily absorbed. The risk of unfavorable experience will likely be unpleasant, and so there is an understandable focus on aspects of risk that are negative.

Risk usually can be reduced or eliminated at some cost. Consumers, for example, buy auto and home insurance to reduce the risk of accidents or catastrophes. Another way to express this concept, however, is that there is generally some reward for assuming risk. Thus, retirement plans invest not just in US Treasury bonds which have almost no risk, but also in equities which are considerably riskier – because they have an expected reward of a higher return that justifies the risk.

Under ASOP 51, the actuary is called on to identify the significant risks to the pension plan and provide information to help those sponsoring and administering the plan understand the implications of these risks. In this section, we identify some of the key risks for the System and provide information to help interested parties better understand these risks.

Section VIII – Risk Assessment

Investment Risk

The investment return on assets is the most obvious risk – and usually the largest risk – to funding a pension plan. To illustrate the magnitude of this risk, please review the following chart showing the Asset Volatility Ratio (AVR), defined as the market value of assets divided by covered payroll.

($ in thousands)

Valuation Date June 30	Market Value of Assets	Covered Payroll	Asset Volatility Ratio
2016	$10,636,703	$3,720,751	2.86
2018	12,527,542	3,428,068	3.65
2019	13,275,693	3,686,365	3.60

The asset volatility ratio is especially useful to compare across plans or through time. It is also frequently useful to consider how the AVR translates into changes in the Required Contribution Rate (actuarially determined employer contribution rate). For example, the following table demonstrates that with an AVR of 3.00, if the market value return is 10% below assumed, or -3.10% for the System, there will be an increase in the Required Contribution Rate of 0.49% payroll in the first year. Without asset smoothing or without returns above the expected return in the next four years, the impact on the Required Contribution Rate would be 2.47%. A higher AVR would produce more volatility in the Required Contribution Rate.

AVR	Unsmoothed Amortization	Smoothed Amortization
2.00	1.64%	0.33%
3.00	2.47%	0.49%
4.00	3.29%	0.66%

Section VIII – Risk Assessment

Sensitivity Measures

Valuations are generally performed with a single set of assumptions that reflects the best estimate of future conditions, in the opinion of the actuary and typically the governing board. Note that under actuarial standards of practice, the set of economic assumptions used for funding must be consistent. To enhance the understanding of the importance of an assumption, a sensitivity test can be performed where the valuation results are recalculated using a different assumption or set of assumptions.

The following tables contains the key measures for the System using the valuation assumption for investment return of 6.90%, along with the results if the assumption were 5.90% or 7.90%. In this analysis, only the investment return assumption is changed. Consequently, there may be inconsistencies between the investment return and other economic assumptions such as inflation or payroll increases. In addition, simply because the valuation results under alternative assumptions are shown here, it should not be implied that CMC believes that either assumption (5.90% or 7.90%) would comply with actuarial standards of practice.

($ in thousands)

As of June 30, 2019	-1% Discount Rate (5.90%)	Current Discount Rate (6.90%)	+1 Discount Rate (7.90%)
Accrued Liability	$40,519,584	$36,087,938	$32,391,234
Unfunded Liability	$26,724,195	$22,292,549	$18,595,845
Funded Ratio (AVA)	34.1%	38.2%	42.6%
ADEC Amount	$2,051,972	$1,806,708	$1,592,075

Section VIII – Risk Assessment

Mortality Risk

The mortality assumption is a significant assumption for valuation results, second only to the investment assumption in most situations. The System's mortality assumption utilizes a mortality table (with separate rates for males and females, as well as different rates by status) and a projection scale for how the mortality table is expected to improve through time.

The future, however, is not known, and actual mortality improvements may occur at a faster rate than expected, or at a slower rate than expected (or even decline). Although changes in mortality will affect the benefits paid, this assumption is carefully studied during the regular experience studies that the System conducts so that incremental changes can be made to smoothly reflect unfolding experience.

Contribution Risk

The System is primarily funded by member and employer contributions to the trust fund, together with the earnings on those accumulated contributions. Each year in the valuation, the Required Contribution Rate is determined, based on the System's funding policy. This rate is the sum of the rates for the normal cost for the plan, the amortization of the UAAL, and the administrative expenses. Since the System is obligated to make 100% of the Required Contribution Rate by statute, there is no contribution risk.

Schedule A – Results of Valuation

	JUNE 30, 2019	JUNE 30, 2018
1. ACTUARIAL ACCRUED LIABILITY		
Present value of prospective benefits payable in respect of:		
(a) Present active members		
- Tier I – Hazardous Duty	$ 739,598	$ 1,161,565
- Tier I – Plan B	389,401,127	501,016,501
- Tier I – Plan C	18,649,389	20,777,259
- Tier II – Hazardous Duty	450,708,829	729,334,664
- Tier II – Hybrid Plan	238,604,724	0
- Tier II – All Others	3,432,412,353	3,197,760,190
- Tier IIA – Hazardous Duty	1,774,951,908	2,148,016,558
- Tier IIA – Hybrid Plan	216,685,795	0
- Tier IIA – All Others	2,601,189,029	2,013,222,993
- Tier III – Hazardous Duty	163,422,455	154,905,964
- Tier III – Hybrid Plan	29,580,211	372,890,944
- Tier III – All Others	339,899,784	255,485,264
- Tier IV – Hazardous Duty	6,691,233	845,028
- Tier IV – Hybrid Plan	1,853,689	1,251,340
- Tier IV – All Others	21,807,226	3,649,682
- Total actives	$ 9,686,597,350	$ 9,400,317,952
(b) Present inactive members and members entitled to deferred vested benefits:	289,213,627	250,150,456
(c) Present annuitants and beneficiaries	26,112,127,090	24,563,694,361
(d) Total actuarial accrued liability [1(a) + 1(b) + 1(c)]	$ 36,087,938,067	$ 34,214,162,769
2. ACTUARIAL VALUE OF ASSETS	$ 13,795,389,341	$ 12,990,400,124
3. UNFUNDED ACTUARIAL ACCRUED LIABILITY [1(d) – 2]	$ 22,292,548,726	$ 21,223,762,645

Schedule B – Development of Actuarial Value of Assets

	June 30, 2019
(1) Actuarial Value Beginning of Year*	$12,990,400,124
(2) Market Value End of Year*	13,275,692,603
(3) Market Value Beginning of Year (Adjusted)	12,527,542,150
(4) Cash Flow	
(a) Contributions*	$ 2,067,422,076
(b) Disbursements	(2,033,836,994)
(c) Net: (4)(a) + (4)(b)	$ 37,289,312
(5) Investment Income	
(a) Market Total: (2) – (3) – (4)(c)	$ 710,861,141
(b) Assumed Rate	6.90%
(c) Amount for Immediate Recognition: [(1) x (5)(b)] + [(4)(c)] x (5)(b) x 0.5	897,624,090
(6) Expected Actuarial Value End of Year: (1) + (4)(c) + (5)(c)	$13,925,313,526
(7) Phased-In Recognition of Investment Income	
(a) Difference between Market & Expected Actuarial Value: (2) – (6)	(649,620,923)
(b) 20% of Difference: 0.2 x (7)(a)	(129,924,185)
(8) Preliminary Actuarial Value End of Year: (6) + (7)(b)	13,795,389,341
(9) Final Actuarial Value End of Year Using 20% Corridor: Greater of [(8) and .8 x (2)], but no more than 1.2 x (2)	$13,795,389,341
(10) Difference Between Market & Actuarial Values: (2) – (9)	$ (519,696,738)

* Before corridor constraints, if applicable.

Schedule C – Summary of Receipts and Disbursements

MARKET VALUE OF ASSETS	Year Ending June 30, 2019
Receipts for the Year	
Contributions:	
Members	$ 489,099,453
State	1,291,867,358
Federal (Net of Transfers)	286,455,265
Subtotal	$ 2,067,422,076
Investment Earnings (net of expenses)	710,861,141
Other	3,704,230
TOTAL	$ 2,781,987,447
Disbursements for the Year	
Benefit Payments	$ 2,025,081,372
Refunds to Members	6,350,314
Interest Awarded	1,711,856
Administrative Expense	693,452
Other	0
Total	$ 2,033,836,994
Excess of Receipts over Disbursements	$ 748,150,453
Reconciliation of Asset Balances	
Asset Balance as of the Beginning of Year*	$ 12,527,542,150
Excess of Receipts over Disbursements	748,150,453
Asset Balance as of the End of Year	$ 13,275,692,603
Rate of Return	5.67%

*Adjusted to reflect June 30,2018 asset balance in CAFR.

Schedule D – Outline of Actuarial Assumptions and Methods

Adopted or reaffirmed by the Commission for the June 30, 2016 and later valuations.

VALUATION INTEREST RATE: 6.90% per annum, compounded annually, net of expenses, comprised of a 2.50% price inflation assumption and a 4.40% real return assumption.

SALARY INCREASES: The assumptions for salary increases are as follows:

Years of Service	Rate*
0	9.50%
1	19.50%
2	9.50%
3	5.75%
4	5.50%
5	5.25%
6	5.00%
7	5.00%
8	5.00%
9	5.00%
10	4.50%
11	4.50%
12	4.50%
13	4.50%
14	4.50%
15+	3.50%

*includes Wage Inflation of 3.50%

COST OF LIVING ADJUSTMENTS (COLA):

Group	Rate
Pre July 1, 1980 Retirees	3.25%
July 1, 1980 – June 30, 1997 Retirees	3.00%
July 1, 1997 – October 1, 2011 Retirees	2.60%
Post October 1, 2011 Retirees	2.25%
Post July 1, 2022 Retirees	1.95%

We have also assumed a COLA moratorium for those retiring on or after July 1, 2022 for the first 30 months of retirement. We assume the first COLA received is increased by 0.15% to reflect the possible additional COLA in the event the annualized rate of increase in the CPI-W is greater than 5.5% during the first 18 months of retirement.

SOCIAL SECURITY WAGE BASE INCREASES: 3.50% per annum.

PAYROLL GROWTH ASSUMPTION: 3.50% per annum.

Schedule D – Outline of Actuarial Assumptions and Methods

SEPARATIONS BEFORE SERVICE RETIREMENT: Representative values of the assumed annual rates of separation before service retirement are as follows:

WITHDRAWAL

Annual Rates of Withdrawal								
Age	Years of Service							
	0	1	2	3	4	5	6-9	10+
Hazardous Males								
20	6.00%	3.00%	6.00%	3.00%	2.75%	2.00%	1.25%	1.25%
25	6.00	3.00	6.00	3.00	2.75	2.00	1.25	1.25
30	6.00	3.00	4.00	3.00	2.75	2.00	1.25	1.25
35	6.00	3.00	4.00	3.00	2.00	2.00	1.25	1.25
40	8.75	3.00	4.00	3.50	2.00	2.50	1.25	1.25
45	8.75	4.00	4.00	3.50	2.00	2.50	1.25	1.25
50	8.75	5.50	4.00	3.50	2.00	2.50	1.25	1.25
55+	8.75	6.00	4.00	3.50	2.00	2.50	1.25	1.25
Hazardous Females								
20	10.00%	10.00%	5.00%	2.50%	3.00%	3.50%	2.50%	1.25%
25	10.00	10.00	5.00	2.50	3.00	3.50	2.50	1.25
30	12.00	6.00	5.00	2.50	3.00	3.50	2.50	1.25
35	12.00	5.00	6.00	2.50	4.00	3.50	2.50	1.25
40	12.00	5.00	6.00	2.00	4.00	3.50	2.50	1.25
45	12.00	5.00	5.00	2.00	4.00	3.50	2.50	1.25
50	12.00	8.00	5.00	2.00	4.00	3.50	2.50	1.25
55+	12.00	8.00	5.00	2.00	4.00	3.50	2.50	1.25
Nonhazardous Males								
20	45.0%	40.0%	40.0%	20.0%	20.0%	10.0%	6.0%	5.0%
25	30.0	28.0	19.0	10.0	7.0	10.0	6.0	5.0
30	22.0	20.0	14.0	9.0	6.0	7.0	4.5	5.0
35	20.0	15.0	14.0	8.0	6.0	4.0	4.0	3.0
40	20.0	15.0	10.0	8.0	6.0	4.0	4.0	2.5
45	22.0	12.0	10.0	8.0	6.0	4.0	4.0	2.0
50	22.0	12.0	10.0	8.0	5.0	4.0	4.0	2.0
55+	25.0	19.0	10.0	8.0	4.0	4.0	3.5	2.0
Nonhazardous Females								
20	45.0%	45.0%	45.0%	20.0%	8.0%	10.0%	6.0%	4.0%
25	25.0	23.0	15.0	12.0	8.0	10.0	6.0	4.0
30	20.0	19.0	12.0	9.0	7.0	6.0	5.0	4.0
35	18.0	13.0	11.0	8.0	6.0	5.0	4.0	3.0
40	18.0	13.0	10.0	8.0	5.5	4.0	3.5	2.5
45	18.0	13.0	10.0	6.0	5.5	4.0	3.0	2.5
50	18.0	13.0	10.0	6.0	5.5	4.0	3.0	2.0
55+	18.0	13.0	10.0	6.0	5.5	4.0	3.0	2.0

DISABILITY

Annual Rates of Disability		
Age	Hazardous	Non-Hazardous
30	0.05%	0.04%
35	0.12	0.05
40	0.18	0.10
45	0.35	0.12
50	0.40	0.20
55	0.50	0.40
60	0.65	0.50
65	0.80	0.60
70	1.35	0.60

RETIREMENT: The assumed annual rates of retirement are shown below.

Annual Rates of Retirement			
Hazardous			
Age	Tier I, II & IIA		Tier III & IV
	First Year Eligible	All Years After	
40	50%	50%	20%
41	30	40	20
42	30	35	20
43	30	30	20
44	30	25	20
45	40	25	20
46	40	25	20
47	40	25	20
48	40	15	20
49	40	15	20
50	40	20	20
51	40	20	20
52	40	20	20
53	40	25	20
54	40	25	20
55	40	25	20
56	40	25	20
57	40	15	20
58	40	25	20
59	40	20	20
60-64	50	30	20
65-69	50	50	20
70-79	100	30	20
80	100	100	100

Annual Rates of Retirement									
Nonhazardous									
Age	Tier I			Tier II & IIA			Tier III & IV		
	Early	First Year	Other Years	Early	First Year	Other Years	Early	First Year	Other Years
55	6.0%	28.0%		4.5%					
56	6.0	10.0	15.0%	4.0					
57	6.0	10.0	12.5	4.0					
58	6.0	10.0	10.0	4.0			5.0%		
59	6.0	10.0	10.0	4.0			7.0		
60		12.5	12.5	4.0	13.5%		9.0		
61		15.0	12.5	4.0	15.0	13.0%	10.0		
62		10.0	20.0		15.0	24.0	12.0		
63		35.0	15.0		15.0	15.0	12.0	32.0%	
64		45.0	10.0		15.0	15.0	12.0	30.0	30.0%
65		65.0	15.0		25.0	15.0		28.0	25.0
66		65.0	20.0		25.0	21.0		25.0	35.0
67		65.0	22.0		25.0	24.0		25.0	35.0
68		65.0	15.0		25.0	18.0		25.0	35.0
69		65.0	15.0		25.0	18.0		25.0	30.0
70		100.0	15.0		50.0	20.0		50.0	30.0
71		100.0	15.0		50.0	24.0		50.0	30.0
72		100.0	15.0		50.0	22.0		50.0	30.0
73		100.0	15.0		50.0	22.0		50.0	30.0
74		100.0	15.0		50.0	22.0		50.0	30.0
75		100.0	15.0		100.0	22.0		100.0	30.0
76		100.0	15.0		100.0	25.0		100.0	30.0
77		100.0	15.0		100.0	22.0		100.0	30.0
78		100.0	15.0		100.0	25.0		100.0	30.0
79		100.0	15.0		100.0	22.0		100.0	30.0
80		100.0	100.0		100.0	100.0		100.0	100.0

We have assumed that the assumed rate of retirement will increase by 20% of the current assumed rates in the year before July 1, 2022 to reflect the potential behavior of future eligible members to avoid the July 1, 2022 COLA change and moratorium.

Schedule D – Outline of Actuarial Assumptions and Methods

DEATHS AFTER RETIREMENT: The RP-2014 White Collar Mortality Table projected to 2020 by Scale BB at 100% for males and 95% for females is used for the period after retirement and for dependent beneficiaries. Representative values of the assumed annual rates of mortality are as follows:

Age	Males	Females	Age	Males	Females
40	0.043%	0.031%	65	0.705%	0.579%
45	0.067	0.052	70	1.133	0.933
50	0.272	0.194	75	1.943	1.553
55	0.384	0.250	80	3.407	2.688
60	0.501	0.348	85	6.247	4.826

In our opinion, the projection of the mortality rates with Scale BB provide a sufficient margin in the assumed rates of mortality to allow for additional improvement in mortality experience.

The RP-2014 Disabled Retiree Mortality Table at 65% for males and 85% for females is used for the period after disability.

ASSET METHOD: Actuarial Value, as developed in Schedule B. The actuarial value of assets recognizes 20% of any difference between actual and expected investment income (gain/loss) in the valuation year and 20% of any previous years' unrecognized investment gains/losses. In addition, the actuarial value of assets cannot be less than 80% or more than 120% of the market value of assets.

VALUATION METHOD: Entry Age Normal cost method. See Schedule E for a brief description of this method.

IMPACT OF LONGLEY DECISION: Benefits for members retiring from service on or after the *Longley* decision date are assumed to increase by 0.084% as a result of the revised treatment of longevity pay. Retroactive application of *Longley* has been reflected in this valuation to the extent impacted retiree benefits have been recalculated.

SPOUSES: For members who have elected spouse coverage, husbands are assumed to be three years older than their wives.

PERCENT MARRIED: 80% of active members are assumed to be married with an average of two children who are on average age 12.

OTHER ASSUMPTIONS:

- 20% of Pre-Retirement deaths are assumed to be service related,
- 50% of Tier I Hazardous Employees are assumed to be State Police,
- To take into account State Police Supplemental Benefits and the offset of Workers Compensation, Social Security, and Non-Rehabilitation Earnings, the following minimum and maximum benefits as a percent of salary are assumed for disability benefits:

	Minimum	Maximum
Tier I State Police	60%	80%
All Other Members	40%	60%

Schedule E – Actuarial Cost Method

The valuation is prepared on projected benefit basis, under which the present value of each member's expected benefits at retirement or death is determined, based on age, service and sex and using the interest rate assumed to be earned in the future (6.90% per annum). The calculations take into account the probability of a member's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service, disability or survivor's benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active members is added to the present value of the expected future payments to retired members, beneficiaries and members entitled to deferred vested benefits to obtain the present value of all expected benefits payable from the System on account of the present group of members and beneficiaries.

The employer contributions required to support the benefits of SERS are determined following a level funding approach, and consist of a normal cost contribution and an unfunded actuarial accrued liability contribution. The normal contribution is determined using the "entry age normal" method. Under this method, a calculation is made for pension benefits to determine the uniform and constant percentage rate of employer contribution which, if applied to the compensation of the average new member during the entire period of his anticipated covered service, would be required in addition to the contributions of the member to meet the cost of all benefits payable on his behalf.

The unfunded actuarial accrued liability is determined by subtracting the actuarial value of assets from the actuarial accrued liability. The UAAL is amortized according to the MOU between the State and SEBAC which established separate UAAL bases. Each base is rolled forward to the beginning of the fiscal year for which the amortization payment is applicable. The amortization amounts are adjusted with interest to the middle of the applicable fiscal year. The employer required contribution amount is the sum of the normal cost contribution and the UAAL amortization payment.

Schedule F – Summary of Main System Provisions

AS INTERPRETED FOR VALUATION PURPOSES

The Connecticut State Employees Retirement System (CT SERS) is a defined benefit pension plan established by the Connecticut General Assembly for the purpose of providing retirement allowances and other benefits for State employees in Connecticut, and their survivors and other beneficiaries.

Eligibility Requirements

Tier I	All State Employees, Elected Officials and their Appointees hired prior to July 1, 1984. Those employees hired between July 1, 1982 and January 1, 1984 could elect to move to Tier II.
Tier II	All State Employees, Elected Officials and their Appointees hired on or after July 1, 1984.
Tier IIA	All State Employees, Elected Officials and their Appointees hired on or after July 1, 1997.
Tier III	All State Employees, Elected Officials and their Appointees hired on or after July 1, 2011.
Tier IV	All State Employees, Elected Officials and their Appointees hired on or after July 1, 2017.

Final Average Earnings (FAE)

Tier I, II, and IIA	Average Salary of the three highest paid years of service. Effective January 1, 1986, no one year's earnings can be greater than 130% of the average of the two preceding years in calculating the Final Average Earnings.
Tier III and IV	Average Salary of the five highest paid years of service. No one year's earnings can be greater than 130% of the average of the two preceding years in calculating the Final Average Earnings.

Normal Retirement Benefit

Eligibility

Tier I Hazardous – 20 years of credited service.

Tier I Plans B and C – Earliest of age 55 with 25 years of service, age 60 with 10 years of service, or age 70 with 5 years of service.

Tier II Hazardous – 20 years of credited service.

Tier II and IIA – For those who will be eligible for retirement on or before July 1, 2022, the earliest of age 62 with 10 years of vesting service (effective July 1, 1992), age 60 with 25 years of vesting service, age 70 with 5 years of vesting service, or age 62 with 5 years of actual state service for terminations on or after July 1, 1997.

For those who will not be eligible for retirement on or before July 1, 2022, the earliest of age 65 with 10 years of vesting service, age 63 with 25 years of vesting service, age 70 with 5 years of vesting service.

Tier III Hazardous – Earlier of Age 50 and 20 years of benefit service or 25 years of benefit service.

Tier III and IV – Age 63 and 25 years of benefit service or Age 65 and 10 years of benefit service.

Tier IV Hazardous – 25 years of benefit service.

Benefit

Tier I Hazardous – 50% of FAE plus 2% for each year of service in excess of 20.

Tier I Plan B – 2% of FAE times years of service up to age 65. Thereafter, 1% of FAE up to $4,800, plus 2% of FAE in excess of $4,800 times years of service. At age 70, greater of 1.25% of FAE up to $4,800 plus 2.5% of FAE in excess of $4,800 times years of service (maximum 20 years) or 1.0% of FAE up to $4,800 plus 2% of FAE in excess of $4,800 times year of service. Minimum benefit with 25 years is $833.34 per month.

Tier I Plan C – 2% of FAE times years of service. At age 70, greater of 2.5% of FAE times years of service (maximum 20 years) or 2.0% of FAE times years of service. Minimum benefit with 25 years is $833.34 per month.

Tier II,IIA, III and IV Hazardous – 2.5% of FAE times years of service up to 20 years plus 2.0% of FAE times years of service in excess of 20 years, if any. Minimum benefit with 25 years is $360 per month.

Tier II, IIA and III All Others – 1.40% of FAE plus 0.433% of FAE in excess of year's breakpoint*, times years of service from October 1, 1982 up to 35 years plus 1.625% of FAE times years of service in excess of 35 years, if any. Minimum benefit with 25 years if $360 per month.

* $10,700 increased by 6% each year after 1982, rounded to nearest $100 but not greater than Social Security Covered Compensation.

	Tier IV All Others – 1.30% of FAE times years of service. Minimum benefit with 25 years if $360 per month.

Early Retirement Benefit

Eligibility	*Hazardous* – None. *Tier I* – Age 55 with 10 years of service. *Tier II and IIA* – Age 55 with 10 years of service. *Tier III and IV* – Age 58 with 10 years of service.
Benefit	*Tier I* – Benefit is Normal Retirement Benefit reduced for retirement prior to age 60 with less than 25 years of service. *Tier II, IIA, III and IV* – Benefit is Normal Retirement Benefit reduced 0.25% (effective July 1, 1991) for each month prior to age 60 if at least 25 years of service or age 62 if at least 10 but less than 25 years of service. For those who retire on or after October 2, 2011 but prior to meeting the age and service requirements for a normal retirement, will be subject to a benefit reduced by 0.50% for each month prior to Normal Retirement.

Disability Retirement Benefit

Tier I	For non-service disabilities occurring prior to age 60 with at least 5 years of service, benefit is 3% of FAE times years of service; maximum benefit is 1.667% of FAE times year of service projected to age 65. For service disabilities occurring prior to age 60, benefit is 1.667% of Salary times years of service projected to age 65 (maximum 30 years). Exception: State Police benefit is equal to the normal retirement benefit if more than 20 years of service. State Police also receives an additional benefit of $360 per month plus $300 to spouse plus $300 to a surviving dependent child.
Tier II, IIA, III and IV	Prior to age 65 for service related disability or at any age with at least 10 years of service, benefit is 1.333% of FAE plus 0.50% of FAE in excess of the year's breakpoint, times service projected to age 65 (maximum 30 years).

Schedule F – Summary of Main System Provisions

Deferred Vested Retirement Benefit

Eligibility	_Tier I_ - 10 years of service. _Tier II and IIA_ – Effective July 1, 1997, 5 years of actual state service, 10 years of vesting service, or age 70 with 5 years of service. _Tier III and IV_ – 10 years of benefit service.
Benefit	_Tier I_ – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 55. _Tier II and IIA_ – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 55. _Tier III and IV_ – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 58.

Pre-Retirement Spouse's Benefit

Tier I	State Police – Survivor benefits to spouse of $670 per month plus $300 to a surviving dependent child. If eligible for early or normal retirement, 50% of the average of the Life Benefit and the 50% Joint & Survivor Benefit the member would have received. If not eligible for retirement but with 25 years of service, the same benefit calculated as though age 55 using service and earnings at death. If not eligible for retirement, return of contributions (5% interest).
Tier II, IIA, III and IV	If eligible for early or normal retirement, 50% of the 50% Joint & Survivor Benefit the member would have received. If not eligible for retirement but with 25 years of service, the same benefit calculated as though age 55 using service and earnings at death. If not eligible for retirement, return of contributions (5% interest).
Tiers I, II, IIA, III and IV	If death is due to employment and there are dependent children under age 18, spouse will be paid $100,000 in 10 annual installments while living and not remarried. In addition, $50 per month will be paid to each child while under age 18. If death is due to employment and there are no dependent children under age 18, spouse will be paid $50,000 in not less than 10 annual installments.

Schedule F – Summary of Main System Provisions

Payment Options

50% or 100% Joint and Survivor (Normal Form if married).
Straight life annuity (Normal Form if not married).
10 or 20 year certain and life annuity.

Cost of Living Adjustments (COLA)

Annual adjustments each July 1 of up to 5% for retirements prior to July 1, 1980; 3% for retirements after July 1, 1980. For members (and beneficiaries) not covered by Social Security and age 62 and over, the maximum increase is 6%.

For employees retiring after June 30, 1999, the annual adjustment will be 60% of the increase in CPI up to 6% and 75% of the increase in the CPI over 6%. This adjustment will be no less than 2.5% and no greater than 6%.

Employees retiring between July 1, 1997 and June 30, 1999 made an irrevocable choice between the above formula and a fixed 3% annual adjustment.

An employee from Tier IIA must have at least 10 years of actual state service or directly make the transition into retirement in order to be eligible for annual adjustments.

For employees retiring on or after October 2, 2011, the minimum COLA shall be 2.0% and the maximum COLA shall be 7.5%.

For employees retiring on or after July 1, 2022, the annual rate of increase will be the CPI-W from 0.00% to 2.00%, plus 60% of the annual rate of increase in CPI-W from 3.33% to 6.00%, plus 75% of the annual rate of increase in CPI-W above 6.00%, with a cap on the COLA rate of 7.50%. In addition, a COLA moratorium for those retiring on or after July 1, 2022 will be on the first 30 months of retirement. If rate of increase in CPI-W exceeds an annualized rate of 5.5% during the initial 18 month period of receiving retirement benefits, the COLA provided beginning with the 31st monthly benefit includes an additional adjustment based on the annual COLA rate as determined above using the annualized rate over the 18 month period. The COLA rate applied would but reduced by 2.5% and then multiplied by 1.5 to reflect the 18 month period.

Schedule F – Summary of Main System Provisions

Member Contributions*

Tier I – Hazardous	6% of earnings up to Social Security Taxable Wage Base plus 7% of earnings above that level.
Tier I – Plan B	4% of earnings up to Social Security Taxable Wage Base plus 7% of earnings above that level.
Tier I – Plan C	7% of earnings.
Tier II – Hazardous	6% of earnings.
Tier II – All Others	2% of earnings.
Tier IIA & III – Hazardous	7% of earnings.
Tier IIA & III – All Others	4% of earnings.
Tier IV – Hazardous	8% of earnings.
Tier IV – All Others	5% of earnings.

* In years where asset losses require further increases in contributions, Tier IV employees' contributions may increase by half the necessary increase in rates (up to 2.0%). Finally, all Tier IV employees must contribute 1% to the Defined Contributions (DC) portion of the Hybrid Plan and may elect additional contribution of up to 3% of salary to the DC portion.

Hybrid Defined Benefit/Defined Contribution Plan for Employees of Higher Learning

Individuals hired on or after July 1, 2011 otherwise eligible for the Alternate Retirement Plan ("ARP") shall be eligible to be members of the new Hybrid Plan in addition to their existing choices. Individuals who are currently members of the ARP shall be eligible to join the Hybrid Plan on a one time option at the full actuarial cost. The Hybrid Plan shall have defined benefits identical to Tier II/IIA and Tier III for individuals hired on or after July 1, 2011, but shall require employee contributions 3% higher than the contribution required from the Applicable Tier II/IIA/III Plan. An employee shall have the option, upon leaving state service, of accepting the defined benefit amount, or electing to receive a return of his/her contributions to the Hybrid Plan, plus a 5% employer match, plus 4% interest ("cash out option"). In the event the employee elects the cash out option, he/she shall permanently waive any entitlement they may have to health insurance as a retired state employee unless they convert the cash out option to a periodic payment as would be required under the current ARP Plan.

Schedule G – Tables of Membership Data

STATUS RECONCILIATION OF ACTIVE MEMBERS

	Total
As of June 30, 2018	49,153
Retirements	(1,710)
Disability	(127)
Terminated	(2,937)
Deaths	(90)
Rehires	626
New Participants	6,672
Refunds	(2,158)
As of June 30, 2019	49,429

STATUS RECONCILIATION OF RETIRED MEMBERS

	Retirees	Disability	Survivor	Total
As of June 30, 2018	41,275	4,199	4,967	50,441
Retirements	180	(78)		102
Disability	(1)	1		0
Survivors	(459)	(48)	507	0
Deaths with no Survivors	(1,358)	(127)	(277)	(1,762)
Rehires	(7)			(7)
Refunds			(1)	(1)
Certain Period Ended	(1)		(24)	(25)
Data Corrections	1,010	158	(33)	1,135
From Active	1,710	127	25	1,862
As of June 30, 2019	42,349	4,232	5,164	51,745

Schedule G – Tables of Membership Data

TIER I – HAZARDOUS DUTY

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34									0
35 to 39									0
40 to 44									0
45 to 49			1					1	125,500
50 to 54									0
55 to 59		1						1	177,039
60 to 64		1						1	82,993
65 to 69									0
70 & Up									0
Total		2	1					3	$ 385,532

Average Age: 55.0
Average Service: 8.3

Average Salary: $128,511

TIER I – PLAN B

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34									0
35 to 39									0
40 to 44					1			1	99,976
45 to 49					1			1	99,442
50 to 54			1	2		1	8	12	1,048,828
55 to 59	1	3	3	2	5	10	108	132	12,082,345
60 to 64		3	3	7	7	6	173	199	19,187,867
65 to 69		1			2	5	93	101	12,149,029
70 & Up			3	2	1		53	59	7,693,669
Total	1	7	10	13	17	22	435	505	$ 52,361,156

Average Age: 62.8
Average Service: 36.7

Average Salary: $103,685

TIER I – PLAN C

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

	Years of Service							Total	
Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34									0
35 to 39									0
40 to 44									0
45 to 49					1			1	102,220
50 to 54			1	1			2	4	269,150
55 to 59		1					5	6	556,608
60 to 64			1	1	3		5	10	975,911
65 to 69				1			4	5	614,247
70 & Up							3	3	299,040
Total		1	2	3	4		19	29	$ 2,817,176

Average Age: 61.2
Average Service: 32.0

Average Salary: $97,144

TIER II – HAZARDOUS DUTY

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34		1						1	84,356
35 to 39		1	1					2	154,579
40 to 44				6	9			15	1,649,961
45 to 49		1	3	15	92	25	1	137	14,943,332
50 to 54	2	1	6	13	57	86	24	189	20,777,388
55 to 59		1	1	12	34	51	33	132	13,607,481
60 to 64	1		1	5	14	18	14	53	4,939,502
65 to 69					2	5		7	646,254
70 & Up					3	4		7	633,031
Total	3	5	12	51	211	189	72	543	$ 57,435,884

Average Age: 53.1
Average Service: 24.6

Average Salary: $105,775

TIER II – HYBRID PLAN

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

	Years of Service							Total	
Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34									0
35 to 39									0
40 to 44					1			1	92,675
45 to 49			2	2	13	4		21	2,094,308
50 to 54			8	4	24	18	9	63	6,613,232
55 to 59	2	1	3	9	51	51	31	148	17,873,008
60 to 64	1	3	5	8	29	45	33	124	16,574,163
65 to 69	1		5	4	18	23	34	85	11,593,095
70 & Up			1		2	6	17	26	4,058,678
Total	4	4	24	27	138	147	124	468	$ 58,899,159

Average Age: 59.9
Average Service: 26.0

Average Salary: $125,853

Schedule G – Tables of Membership Data

TIER II – ALL OTHERS

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

	Years of Service							Total	
Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29									0
30 to 34			1	1				2	69,502
35 to 39	5	4	10	8				27	1,747,353
40 to 44	4	5	5	28	34	4		80	6,010,948
45 to 49	11	15	24	78	409	237	20	794	72,506,895
50 to 54	23	25	47	144	585	897	758	2,479	227,133,969
55 to 59	17	33	61	160	486	776	1,581	3,114	295,851,374
60 to 64	14	30	35	103	306	415	757	1,660	155,134,496
65 to 69	13	16	17	52	114	140	211	563	51,983,551
70 & Up	7	7	20	25	42	50	62	213	18,008,131
Total	94	135	220	599	1,976	2,519	3,389	8,932	$ 828,446,219

Average Age: 56.5
Average Service: 26.8

Average Salary: $92,750

TIER IIA – HAZARDOUS DUTY

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29		1	1					2	101,436
30 to 34	1	87	100	6				194	15,728,168
35 to 39	7	139	516	89				751	60,612,417
40 to 44	1	70	436	445	55	1		1,008	91,387,488
45 to 49		57	316	400	140	4	1	918	84,897,465
50 to 54	1	36	188	308	74	2		609	54,844,525
55 to 59		23	143	168	50	1	1	386	33,813,340
60 to 64	1	9	76	109	29	1	1	226	19,640,053
65 to 69		1	18	56	6			81	6,932,164
70 & Up		2	2	22	3			29	2,442,214
Total	11	425	1,796	1,603	357	9	3	4,204	$ 370,399,270

Average Age: 46.3
Average Service: 15.1

Average Salary: $88,106

Schedule G – Tables of Membership Data

TIER IIA – HYBRID PLAN

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

	Years of Service							Total	
Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29		2						2	68,268
30 to 34	1	3	2					6	359,541
35 to 39	3	6	19	7	1			36	2,692,041
40 to 44	3	13	49	29	7			101	8,893,957
45 to 49	3	23	77	55	15			173	17,609,850
50 to 54	8	15	54	88	31	1		197	21,067,632
55 to 59	5	18	54	93	46	3		219	22,202,428
60 to 64	4	7	49	76	28	1		165	16,987,738
65 to 69	3	9	19	32	15	1		79	8,703,225
70 & Up		2	6	6				14	1,521,893
Total	30	98	329	386	143	6		992	$ 100,106,573

Average Age: 53.7
Average Service: 15.2

Average Salary: $100,914

Schedule G – Tables of Membership Data

TIER IIA – ALL OTHERS

The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25									$ 0
25 to 29	4	20	11					35	1,436,981
30 to 34	20	210	287	17				534	35,817,477
35 to 39	21	326	1,062	342	7			1,758	130,142,259
40 to 44	29	279	1,202	880	231	3		2,624	208,294,226
45 to 49	17	242	1,118	950	541	14		2,882	237,305,598
50 to 54	19	272	1,046	859	477	34	43	2,750	223,742,166
55 to 59	22	239	1,003	819	419	43	131	2,676	212,464,531
60 to 64	18	206	698	541	260	21	5	1,749	139,901,861
65 to 69	14	82	301	215	97	5	1	715	54,180,692
70 & Up	18	44	123	96	34	2	5	322	19,429,326
Total	182	1,920	6,851	4,719	2,066	122	185	16,045	$ 1,262,715,117

Average Age: 50.1
Average Service: 14.9

Average Salary: $78,698

Schedule G – Tables of Membership Data

TIER III – HAZARDOUS DUTY

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25	3							3	$ 199,604
25 to 29	173	99	5					277	18,310,830
30 to 34	215	415	43	5				678	46,486,337
35 to 39	112	305	15	17				449	31,553,267
40 to 44	65	160	6	3				234	16,464,130
45 to 49	58	84	4	2				148	10,694,078
50 to 54	46	65	3		1	2		117	8,047,745
55 to 59	15	42	2	2	1		1	63	4,564,514
60 to 64	7	13	2					22	1,576,383
65 to 69	4	3						7	430,023
70 & Up		1						1	78,767
Total	698	1,187	80	29	2	2	1	1,999	$ 138,405,678

Average Age: 37.2
Average Service: 5.8

Average Salary: $69,237

Schedule G – Tables of Membership Data

TIER III – HYBRID PLAN

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25	4							4	$ 114,173
25 to 29	40	21	1					62	3,104,806
30 to 34	54	43	12	1				110	6,441,423
35 to 39	65	66	4	2				137	9,344,012
40 to 44	49	49	7					105	7,791,579
45 to 49	53	39	4					96	7,146,377
50 to 54	24	42	2					68	5,593,046
55 to 59	32	29	2	1			1	65	4,725,335
60 to 64	15	22						37	2,902,515
65 to 69	9	13						22	1,756,735
70 & Up	1	2					1	4	168,578
Total	346	326	32	4			2	710	$ 49,088,579

Average Age: 43.0
Average Service: 5.4

Average Salary: $69,139

TIER III – ALL OTHERS

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25	318	22						340	$ 3,884,541
25 to 29	528	314	18					860	46,098,606
30 to 34	688	727	211	11	1			1,638	98,943,210
35 to 39	622	617	85	95	1			1,420	91,732,493
40 to 44	471	501	43	32				1,047	70,945,023
45 to 49	432	467	28	14	3			944	61,265,120
50 to 54	426	436	25	16	2			905	58,535,155
55 to 59	323	388	18	16		1		746	47,253,249
60 to 64	178	247	10	5	3	1		444	26,706,254
65 to 69	80	95	4	5				184	10,880,161
70 & Up	45	46	6	2				99	4,591,034
Total	4,111	3,860	448	196	10	2		8,627	$ 520,834,846

Average Age: 41.8
Average Service: 5.5

Average Salary: $60,373

Schedule G – Tables of Membership Data

TIER IV – HAZARDOUS DUTY

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service 0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	Total No.	Total Payroll
Under 25	84							84	$ 2,534,931
25 to 29	265	7	1					273	11,005,292
30 to 34	204	3						207	9,523,113
35 to 39	132							132	5,708,804
40 to 44	57							57	2,775,703
45 to 49	37							37	1,625,387
50 to 54	24							24	1,302,276
55 to 59	18							18	759,734
60 to 64	4		1					5	497,228
65 to 69									0
70 & Up									0
Total	825	10	2					837	$ 35,732,468

Average Age: 32.8
Average Service: 1.0

Average Salary: $42,691

Schedule G – Tables of Membership Data

TIER IV – HYBRID PLAN

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

Age	Years of Service							Total	
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25	29							29	$ 704,475
25 to 29	103	2						105	3,149,267
30 to 34	124	1	2					127	4,420,377
35 to 39	108		1	1				110	4,593,143
40 to 44	88							88	3,100,876
45 to 49	75							75	2,697,994
50 to 54	61							61	2,274,602
55 to 59	57							57	2,225,213
60 to 64	47	1						48	1,237,401
65 to 69	30							30	413,096
70 & Up	11							11	231,739
Total	733	4	3	1				741	$ 25,048,183

Average Age: 41.8
Average Service: 0.6

Average Salary: $33,803

Schedule G – Tables of Membership Data

TIER IV – ALL OTHERS

The Number and Average Annual Compensation of Active Employees
By Age and Service as of June 30, 2019

	Years of Service							Total	
Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 30	30 & Up	No.	Payroll
Under 25	753	7						760	$ 14,020,905
25 to 29	924	25						949	35,417,061
30 to 34	789	13	20	2				824	34,701,969
35 to 39	579	1	10	3				593	25,820,356
40 to 44	433	4	2					439	19,897,553
45 to 49	363	1	5	1				370	16,835,525
50 to 54	348	1	6	2		1		358	17,220,374
55 to 59	259	2			1		2	264	11,832,721
60 to 64	133			1			1	135	5,786,823
65 to 69	66	1	1					68	1,433,858
70 & Up	33	1						34	722,427
Total	4,680	56	44	9	1	1	3	4,794	$ 183,689,572

Average Age: 36.5
Average Service: 0.9

Average Salary: $38,317

Schedule G – Tables of Membership Data

NUMBER OF RETIRED MEMBERS AND THEIR BENEFITS BY AGE

Age	Number	Total Annual Benefits	Average Annual Benefits
Under 50	964	$ 47,890,731	$ 49,679
50 – 54	1,896	99,624,888	52,545
55 – 59	3,636	162,237,514	44,620
60 – 64	7,032	299,876,119	42,644
65 – 69	9,354	391,499,232	41,854
70 – 74	9,073	370,403,271	40,825
75 – 79	6,219	248,520,584	39,962
80 – 84	4,006	155,455,182	38,806
85 – 89	2,552	91,645,587	35,911
90 – 94	1,378	43,660,573	31,684
95 & Over	471	12,285,732	26,084
Total	46,581	$ 1,923,099,413	$ 41,285

NUMBER OF BENEFICIARIES AND THEIR BENEFITS BY AGE

Age	Number	Total Annual Benefits	Average Annual Benefits
Under 50	252	$ 5,691,408	$ 22,585
50 – 54	111	2,933,589	26,429
55 – 59	201	5,530,004	27,512
60 – 64	352	9,050,481	25,712
65 – 69	499	14,364,564	28,787
70 – 74	678	18,218,753	26,871
75 – 79	829	20,802,617	25,094
80 – 84	796	18,983,887	23,849
85 – 89	739	17,230,949	23,317
90 – 94	490	10,823,954	22,090
95 & Over	217	4,875,696	22,469
Total	5,164	$ 128,505,902	$ 24,885

Schedule G – Tables of Membership Data

**NUMBER OF DEFERRED VESTED MEMBERS
AND THEIR BENEFITS BY AGE**

Age	Number	Total Annual Benefits	Average Annual Benefits
Under 50	1,050	$ 10,935,492	$ 10,415
50 – 54	431	7,348,988	17,051
55 – 59	320	4,906,359	15,332
60 – 64	186	1,643,801	8,838
65 – 69	111	512,797	4,620
70 – 74	52	112,666	2,167
75 – 79	24	43,211	1,800
80 – 84	6	11,616	1,936
85 – 89	5	7,985	1,597
90 – 94	0	0	0
95 & Over	0	0	0
Total	2,185	$ 25,522,915	$ 11,681

Schedule H – Analysis of Financial Experience

Gains & Losses in Accrued Liabilities Resulting from Difference Between Assumed Experience & Actual Experience ($ Millions)

Type of Activity	$ Gain (or Loss) For One-Year Period Ending 6/30/2019	$ Gain (or Loss) For Two-Year Period Ending 6/30/2018
Age & Service Retirements. If members retire at older ages, there is a gain. If younger ages, a loss.	$ (311.4)	$ 91.6
Disability Retirements. If disability claims are less than assumed, there is a gain. If more claims, a loss.	(90.7)	(36.8)
Death-in Service Benefits. If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	(31.0)	(15.0)
Withdrawal From Employment. If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.	(100.5)	63.5
Pay Increases. If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	(520.7)	(36.5)
New Members. Additional unfunded accrued liability will produce a loss.	(142.7)	(165.1)
Investment Income. If there is a greater investment income than assumed, there is a gain. If less income, a loss.	(129.9)	(3.9)
Death After Retirement. If retirants live longer than assumed, there is a loss. If not as long, a gain.	81.3	(102.8)
Other. Miscellaneous gains and losses resulting from changes in valuation software, data adjustments, timing of financial transactions, etc.	(104.4)	(279.8)
Gain (or Loss) During Year From Financial Experience	$ (1,350.0)	$ (484.8)
Non-Recurring Items. Adjustments for plan amendments, assumption changes, or method changes.	0.0	(121.3)
Composite Gain (or Loss) During Year	$ (1,350.0)	$ (606.1)

Schedule I – Actuarial Surplus Test

Section 5-162(h) of the General Statutes of Connecticut provides that the Retirement Commission may grant additional Cost-of-Living Adjustments (COLAs) for retired members if an actuarial surplus exists. An actuarial surplus is deemed to exist if three criteria are met.

I. ***Investment Income:*** The actual rate of return for the Fiscal Year ending on the valuation date must exceed the actuarial interest rate assumption.

Market Value of Assets on June 30, 2018: (A)	$12,452,787,902
Market Value of Assets on June 30, 2019: (B)	$13,275,692,603
Investment Income for FY 2018-2019: (I)	$710,861,141
Actual Rate of Return for FY 2018-2019: 2I / (A + B – I)	5.67%
Actuarial Interest Rate Assumption:	6.90%

Actual return of 5.67% is less than the assumed 6.90%, so the first criterion is <u>not</u> met.

II. ***Assets vs. Liabilities:*** Market value of assets must exceed 50% of specified liabilities.

Market Value of Assets on June 30, 2019:	$13,275,692,603
Specified Liabilities on June 30, 2019:	
Liability for Retired Members	$26,112,127,090
Liability for Terminated Vested Members	$289,213,627
Liability for Member Contributions with Interest	$1,359,784,149
Total	$27,761,124,866
50% of Specified Liabilities	$13,880,562,433

Market Value does not exceed 50% of specified liabilities so the second criterion is <u>not</u> met.

III. ***Unfunded Liability***: Actual unfunded liability must be less than the projected unfunded liability five years from the determination date.

Actual Unfunded Liability on June 30, 2019:	$22,292,548,726
Projected Unfunded Liability on June 30, 2024 (see next page):	$7,433,609,000

Actual Unfunded Liability is not less than Projected Unfunded Liability so the third criterion is <u>not</u> met and therefore, no actuarial surplus exists.

Schedule I – Actuarial Surplus Test

ACTUARIAL SURPLUS TEST
PROJECTION OF UNFUNDED LIABILITY

Section 5-162-h(b)(2) of the General Statutes of Connecticut specifies the means of calculating the Projected Unfunded Liability used in the third criterion of the Actuarial Surplus Test. The projection reflects the actual unfunded liability as of December 31, 1983 adjusted for changes in actuarial assumptions and cost methods through the determination date. No provision is made in the Statute for reflecting the impact of plan changes. The projection below reflects the following changes: data correction (June 30, 1987); change in actuarial assumptions (June 30, 1987); change in actuarial cost method (June 30, 1988); change in actuarial assumptions - interest rate only (June 30, 1989); change in actuarial cost method – amortization period only (June 30, 1992); change in actuarial assumptions (June 30, 1993); change in actuarial cost method – level percent amortization (June 30, 1997); change in actuarial methods and assumptions (June 30, 2000); change in actuarial assumptions (June 30, 2004); change in actuarial assumptions (June 30, 2008); change in actuarial assumptions (June 30, 2012) change in actuarial assumptions (June 30, 2016).

Year	($000) June 30 Unfunded Liability	Year	($000) June 30 Unfunded Liability	Year	($000) June 30 Unfunded Liability
1987	$2,524,556	2002	$2,360,589	2017	$9,951,987
1988	1,954,257	2003	2,429,273	2018	9,659,917
1989	1,432,333	2004	2,502,591	2019	9,424,079
1990	1,939,758	2005	2,569,504	2020	9,140,386
1991	1,930,524	2006	2,634,814	2021	8,804,428
1992	1,920,505	2007	2,698,021	2022	8,411,458
1993	1,794,192	2008	2,823,251	2023	7,956,355
1994	1,787,586	2009	2,861,884	2024	7,433,609
1995	1,780,419	2010	2,895,933	2025	6,837,282
1996	1,772,643	2011	2,924,709	2026	6,160,985
1997	1,764,205	2012	4,160,465	2027	5,397,841
1998	1,835,087	2013	4,172,971	2028	4,540,451
1999	1,907,249	2014	4,174,465	2029	3,580,857
2000	2,222,296	2015	4,163,616	2030	2,510,500
2001	2,291,494	2016	10,057,733	2031	1,320,178
				2032	0

Schedule J – Projections of Unfunded Accrued Liability

Valuation Year	Unfunded Accrued Liability ($ in thousands)	Amortization Payment ($ in thousands)
2019	$ 22,292,549	$ 1,596,466
2020	22,211,918	1,739,660
2021	21,992,703	1,875,720
2022	21,634,480	1,875,720
2023	21,251,539	1,875,720
2024	20,842,176	1,875,720
2025	20,404,566	1,875,720
2026	19,936,761	1,875,720
2027	19,436,677	1,875,720
2028	18,902,088	1,875,720
2029	18,330,613	1,875,720
2030	17,719,705	1,875,720
2031	17,066,645	1,875,720
2032	16,368,523	1,875,720
2033	15,622,231	1,875,720
2034	14,824,445	1,875,720
2035	13,971,612	1,875,720
2036	13,059,934	1,875,720
2037	12,085,349	1,875,720
2038	11,043,518	1,875,720
2039	9,929,801	1,875,720
2040	8,739,237	1,875,720
2041	7,466,525	1,875,720
2042	6,105,995	1,875,720
2043	4,651,589	1,825,672
2044	3,146,876	1,738,099
2045	1,625,911	1,738,099
2046	0	