



**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, 2018**





# Cavanaugh Macdonald

CONSULTING, LLC

*The experience and dedication you deserve*

November 12, 2018

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, 2018.

The purpose of the report is to provide a summary of the funded status of SERS as of June 30, 2018 and to recommend an actuarially determined contribution rate for the fiscal year ending June 20, 2020. The report indicates that an annual actuarially determined employer contribution at the rate of 51.73% of compensation, or approximately \$1.773 billion, for the fiscal year ending June 30, 2020 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	13 years
Transitional Base	2016	28 years
2018 Base	2018	25 years



Members of the Commission  
November 12, 2018  
Page 2

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,

A handwritten signature in blue ink that reads 'John J. Garrett'.

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

A handwritten signature in blue ink that reads 'Edward J. Koebel'.

Edward J. Koebel, FCA, MAAA, EA  
Principal and Consulting Actuary



## Table of Contents

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<u>Section</u>	<u>Item</u>	<u>Page No.</u>
I	Summary of Principal Results	1
II	Membership	4
III	Assets	6
IV	Comments on Valuation	6
V	Contributions Payable by Employers	9
VI	Accounting Information	10
VII	Experience	14
 <u>Schedule</u>		
A	Results of Valuation	15
B	Development of Actuarial Value of Assets	16
C	Summary of Receipts and Disbursements	17
D	Outline of Actuarial Assumptions and Methods	18
E	Actuarial Cost Method	23
F	Summary of Main Plan Provisions as Interpreted for Valuation Purposes	24
G	Tables of Membership Data	30
H	Analysis of Financial Experience	46
I	Actuarial Surplus Test	47
J	Projection of Unfunded Accrued Liability	49





## 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, 2018	June 30, 2016
Number of active members	49,153	50,019
Annual compensation	\$ 3,428,068,476	\$ 3,720,751,429
Retired members and beneficiaries:		
Number	50,441	48,191
Annual allowances	\$ 1,931,097,538	\$ 1,745,785,103
Deferred Vested Members:		
Number	1,281	1,412
Annual allowances	\$ 18,032,761	\$ 20,316,080
Assets:		
Market Value	\$ 12,452,787,902	\$ 10,636,702,645
Actuarial Value	\$ 12,991,227,724	\$ 11,922,965,860
Unfunded actuarial accrued liability	\$ 21,222,935,045	\$ 20,387,369,150
Funded Ratio based on Actuarial Assets	38.0%	36.9%
Funded Ratio based on Market Assets	36.4%	32.9%
<b>For Fiscal Year Ending</b>	<b>June 30, 2020</b>	
Actuarially Determined Employer Contribution (ADEC)*:		
Normal	\$ 235,397,264	
Accrued liability	<u>1,537,970,588</u>	
Total	\$ 1,773,367,852	
Actuarially Determined Employer Contribution Rate (ADEC):		
Normal	6.87%	
Accrued liability	<u>44.86%</u>	
Total	51.73%	

\* The ADEC for the fiscal years ending June 30, 2018 and June 30, 2019 were \$1,443,110,000 and \$1,574,537,000, respectively.





## Section I – Summary of Principal Results

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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. Since the last valuation, the asset method has been changed to the same method as the Connecticut Municipal Employees Retirement System (MERS) using a smoothed market value with 20% recognition of investment gains and losses.
6. Schedule F gives a summary of the benefit and contribution provisions of the plan. Since the last valuation, based on the SEBAC 2017 Agreement, employee contributions were increased by 1.5% of salary effective July 1, 2017 for all non-Tier 4 members.
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 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.





## Section I – Summary of Principal Results

### Comparative Schedule\*

Valuation Date June 30	Active Members				Retired Lives				Valuation Results (\$ thousands)		
	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
2010	50,064	\$3,295,666	\$65,829	0.1	41,782	1.20	\$1,264,025	38.4%	\$21,054,197	\$9,349,605	\$11,704,592
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	12,991,228	21,222,935





## 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, 2018 upon which the valuation was based. Detailed tabulations of the data are given in Schedule G.

### Active Members

Group	Number	Payroll	Group Averages		
			Salary	Age*	Service*
Tier I – Hazardous	4	\$374,201	\$93,550	58.8	16.8
Tier I – Plan B	691	69,611,801	100,741	61.5	35.3
Tier I – Plan C	36	3,450,844	95,857	61.3	31.3
Tier II – Hazardous	962	97,238,211	101,079	52.5	23.9
Tier II – Others	9,190	819,641,701	89,188	56.0	26.3
Tier IIA – Hazardous	5,903	487,982,182	82,667	45.6	14.5
Tier IIA – Others	15,049	1,069,320,807	71,056	50.1	13.9
Tier III – Hazardous	2,628	161,026,213	61,273	36.4	4.9
Tier III – Hybrid Plan	1,943	168,484,407	86,714	51.0	14.2
Tier III – Others	10,444	491,078,424	47,020	40.3	4.4
Tier IV – Hazardous	279	7,821,192	28,033	31.8	0.8
Tier IV – Hybrid Plan	298	9,464,465	31,760	42.6	1.0
Tier IV – Others	1,726	42,574,028	24,666	35.2	1.1
<b>Total</b>	<b>49,153</b>	<b>\$3,428,068,476</b>	<b>\$69,743</b>	<b>47.4</b>	<b>13.7</b>

\*Years

Of the 49,153 active members, 33,462 are vested and 15,691 are non-vested.







## Section II – Membership

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### Retired Lives

Type of Benefit Payment	No.	Annual Benefits	Group Averages	
			Benefit	Age*
Retired – Pre 1980	760	\$14,771,142	\$19,436	91.2
Retired – 1980 - 1997	11,072	383,914,774	34,674	82.5
Retired – 1997 - 2011	25,579	1,044,811,814	40,846	69.6
Retired – 2011+	13,030	487,599,808	37,421	62.4
<b>Total</b>	<b>50,441</b>	<b>\$1,931,097,538</b>	<b>\$38,284</b>	<b>70.9</b>

\*Years

This valuation also includes 1,281 deferred vested members with estimated annual benefits of \$18,032,761.





## Section III – Assets

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1. As of June 30, 2018, the total market value of assets amounted to \$12,452,787,902 as reported by the Comptroller's Office. This amount includes \$11,401,980 of receivables as of the valuation date. The estimated investment return for the two plan years since the last valuation were 13.82% and 7.12%, respectively. Schedule C shows receipts and disbursements of the System for the two years 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 \$12,991,227,724. The estimated investment return for the two plan years on an actuarial value of assets basis was 6.94% and 6.61%, respectively, which can be compared to the investment return assumed over the two-year period of 6.90%. Schedule B shows the development of the actuarial value of assets as of June 30, 2018.
  
3. Schedule C shows receipts and disbursements of the System for the two years preceding the valuation date and a reconciliation of the fund balances at market value.





## Section IV – Comments on Valuation

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1. Schedule A of this report outlines the results of the valuation of the Retirement System as of June 30, 2018. 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 \$34,214,162,769, of which \$24,813,844,817 is for the benefits payable on account of present retired members, beneficiaries of deceased members, and inactive members entitled to deferred vested benefits, and \$9,400,317,952 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 \$12,991,227,724 as of June 30, 2018. When this amount is deducted from the actuarial accrued liability of \$34,214,162,769, there remains \$21,222,935,045 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 6.87% of active members' compensation are required to provide the currently accruing benefits of the System.





## Section IV – Comments on Valuation

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)

	<b>Initial UAAL</b>	<b>Remaining UAAL</b>	<b>Remaining Amortization Period (years)</b>	<b>Amortization Payment</b>
Statutory Base (1984 UAAL)	\$ 4,138,969	\$ 3,968,724	13	\$ 414,929
2016 Base	16,248,400	16,683,862	28	1,083,777
2018 Base	570,349	<u>570,349</u>	25	<u>39,265</u>
Total UAAL		\$21,222,935		\$ 1,537,971
Annual Valuation Payroll				\$ 3,428,068
UAAL Amortization Rate				44.86%

5. We have determined that a contribution of 44.86% of payroll is required to amortize the unfunded actuarial accrued liability of \$21,222,935,045 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 2019/2020 fiscal year.

Contribution for	Contribution Amount	Contribution Rate
A. Normal Cost:		
Service retirement benefits	\$346,694,342	10.11%
Disability benefits	18,108,928	0.53%
Survivor benefits	<u>1,839,219</u>	<u>0.06%</u>
Total Normal Cost	\$366,642,489	10.70%
B. Less Member Contributions	(131,245,225)	(3.83)%
C. Employer Normal Cost	\$235,397,264	6.87%
D. Unfunded Actuarial Accrued Liabilities (22.8 year level percent of payroll amortization)	\$1,537,970,588	44.86%
E. Total (C. + D.)	\$1,773,367,852	51.73%





## 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 2019/2020 fiscal year.

Group	Normal Cost	Normal Rate
Tier I – Hazardous	\$ 56,361	15.06%
Tier I – Plan B	5,860,453	8.42
Tier I – Plan C	82,367	2.39
Tier II – Hazardous	17,500,773	18.0
Tier II – Others	48,831,667	5.96
Tier IIA – Hazardous	69,123,154	14.17
Tier IIA – Others	51,201,949	4.79
Tier III – Hazardous	15,293,284	9.50
Tier III – Hybrid Plan	7,407,595	4.40
Tier III – Others	18,633,926	3.79
Tier IV – Hazardous	533,717	6.82
Tier IV – Hybrid Plan	198,843	2.10
Tier IV – Others	673,175	1.58
Total	\$ 235,397,264	6.87%





## Section V – Contributions Payable By Employer

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The official contribution requirement for the fiscal year ending June 30, 2021 will be determined in the June 30, 2019 valuation. However, we have estimated the contribution requirement for the fiscal year ending June 30, 2021 using standard roll forward techniques from this valuation. These results assume the market value of assets will earn 6.90%, payroll will increase as set forth in the SEBAC 2017 Agreement, and the active member population will remain static.

Projected Contributions Required for Fiscal Year Ending June 30, 2021	Roll Forward of June 30, 2018 Valuation	
	As % of Pay	\$
Employer Normal Cost	6.37%	\$ 218,207,000
Unfunded Actuarial Accrued Liabilities	48.96%	1,678,500,000
Total	55.33%	\$1,896,707,000





## 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, 2018

GROUP	NUMBER
Retirees and beneficiaries currently receiving benefits	50,441
Terminated employees entitled to benefits but not yet receiving benefits	1,281
Active plan members	<u>49,153</u>
Total	100,875

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) - PUC (b)	Unfunded AAL (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b - a) / c)
6/30/2010	\$9,349,605	\$21,054,197	\$11,704,592	44.4%	\$3,295,666	355.2%
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	12,991,228	34,214,163	21,222,935	38.0	3,428,068	619.1

# 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	Annual Required 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	N/A	N/A
2020	2018	1,773,368	N/A	N/A

4. The information presented in the required supplementary schedules was determined as part of the actuarial valuation at June 30, 2018. Additional information as of the latest actuarial valuation follows.

Valuation date	6/30/2018
Actuarial cost method	Entry Age Normal
Amortization method	Level percent of payroll, closed phasing in to Level dollar
Remaining amortization period	22.8 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 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 two year period ended June 30, 2018 is shown below. Schedule H provides detailed gain/(loss) by source.

	<u>\$ Millions</u>
(1) UAAL* as of June 30, 2016	\$ 20,387.4
(2) Total Normal cost from 2016 valuation	404.7
(3) Actual Employer and Employee contributions	1,689.8
(4) Interest accrual: $[(1) + (2)] \times .069 - [(3) \times .0339]$	<u>1,377.3</u>
(5) Expected UAAL as of June 30, 2017: (1) + (2) – (3) + (4)	\$ 20,479.6
(6) Total Normal cost for 2017 fiscal year	401.6
(7) Actual Employer and Employee contributions	1,649.4
(8) Interest accrual: $[(5) + (6)] \times .069 - [(7) \times .0339]$	<u>1,384.8</u>
(9) Expected UAAL as of June 30, 2018: (5) + (6) - (7) + (8)	\$ 20,616.6
(10) Assumption/Method Changes	<u>121.3</u>
(11) Expected UAAL as of June 30, 2018: (9) + (10)	\$ 20,737.9
(12) Actual UAAL as of June 30, 2018	\$ 21,222.9
(13) Gain/(loss): (11) – (12) (See Schedule H)	\$ (485.0)
(14) Gain/(loss) as percent of actuarial accrued liabilities at June 30, 2016 (\$32,310.3)	(1.5)%

\*Unfunded actuarial accrued liability.

Valuation Date June 30	Actuarial Gain/(Loss) as a % of Beginning Accrued Liabilities
2014	(5.8)%
2016	(4.0)%
2018	(1.5)%





## Schedule A – Results of Valuation

	JUNE 30, 2018	JUNE 30, 2016
<b>1. ACTUARIAL ACCRUED LIABILITY</b>		
Present value of prospective benefits payable in respect of:		
(a) Present active members		
- Tier I – Hazardous Duty	\$ 1,161,565	\$ 34,072,996
- Tier I – Plan B	501,016,501	1,014,122,784
- Tier I – Plan C	20,777,259	27,450,256
- Tier II – Hazardous Duty	729,334,664	1,090,001,648
- Tier II – All Others	3,197,760,190	3,393,530,559
- Tier IIA – Hazardous Duty	2,148,016,558	1,681,131,552
- Tier IIA – All Others	2,013,222,993	1,605,639,996
- Tier III – Hazardous Duty	154,905,964	65,732,535
- Tier III – Hybrid Plan	372,890,944	358,214,031
- Tier III – All Others	255,485,264	108,837,251
- Tier IV – Hazardous Duty	845,028	0
- Tier IV – Hybrid Plan	1,251,340	0
- Tier IV – All Others	<u>3,649,682</u>	<u>0</u>
- Total actives	\$ 9,400,317,952	\$ 9,378,733,608
(b) Present inactive members and members entitled to deferred vested benefits:	250,150,456	266,708,800
(c) Present annuitants and beneficiaries	<u>24,563,694,361</u>	<u>22,664,892,602</u>
(d) Total actuarial accrued liability [1(a) + 1(b) + 1(c)]	\$ 34,214,162,769	\$ 32,310,335,010
<b>2. ACTUARIAL VALUE OF ASSETS</b>	<u>\$ 12,991,227,724</u>	<u>\$ 11,922,965,860</u>
<b>3. UNFUNDED ACTUARIAL ACCRUED LIABILITY</b> [1(d) – 2]	\$ 21,222,935,045	\$ 20,387,369,150





## Schedule B – Development of Actuarial Value of Assets

	June 30, 2018
(1) Actuarial Value Beginning of Year*	\$12,593,751,330
(2) Market Value End of Year**	12,452,787,902
(3) Market Value Beginning of Year	11,929,236,420
(4) Cash Flow	
(a) Contributions**	\$ 1,649,398,223
(b) Disbursements	<u>(1,963,643,892)</u>
(c) Net: (4)(a) + (4)(b)	\$ (314,245,669)
(5) Investment Income	
(a) Market Total: (2) – (3) – (4)(c)	\$ 837,797,151
(b) Assumed Rate	6.90%
(c) Amount for Immediate Recognition: [(1) x (5)(b)] + [(4)(c) less Receivable**] x (5)(b) x 0.5	857,733,998
(6) Expected Actuarial Value End of Year: (1) + (4)(c) less Receivable** + (5)(c)	\$13,125,837,679
(7) Phased-In Recognition of Investment Income	
(a) Difference between Market & Expected Actuarial Value: (2) – (6)	(673,049,777)
(b) 20% of Difference: 0.2 x (7)(a)	(134,609,955)
(8) Preliminary Actuarial Value End of Year: (6) + (7)(b)	12,991,227,724
(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)	\$12,991,227,724
(10) Difference Between Market & Actuarial Values: (2) – (9)	\$ (538,439,822)

\* Before corridor constraints, if applicable.

\*\* Includes receivables of \$11,401,980 at 6/30/2018.





## Schedule C – Summary of Receipts and Disbursements

(Market Value)

	YEAR ENDING		
	June 30, 2018	June 30, 2017	June 30, 2016
<u>Receipts for the Year</u>			
Contributions:			
Members	\$ 193,942,825	\$ 132,557,554	\$ 135,028,539
State	1,167,731,091	1,253,898,621	1,218,966,824
Federal (Net of Transfers)	<u>276,322,327</u>	<u>288,399,266</u>	<u>282,838,166</u>
Subtotal	\$ 1,637,996,243	\$ 1,674,855,441	\$ 1,636,833,529
Amount Receivable	11,401,980	14,976,110	15,989,968
Investment Earnings (net of expenses)	<u>837,797,151</u>	<u>1,458,389,131</u>	<u>(17,334,272)</u>
TOTAL	\$ 2,487,195,374	\$ 3,148,220,682	\$ 1,635,489,225
<u>Disbursements for the Year</u>			
Benefit Payments	\$ 1,952,445,438	\$ 1,845,261,975	\$ 1,729,181,426
Refunds to Members	<u>7,659,204</u>	<u>5,551,507</u>	<u>4,036,909</u>
TOTAL	\$ 1,963,643,892	\$ 1,855,686,907	\$ 1,736,278,654
<u>Excess of Receipts over Disbursements</u>	\$ 523,551,482	\$ 1,292,533,775	\$ (100,789,429)
<u>Reconciliation of Asset Balances</u>			
Asset Balance as of the Beginning of Year	\$ 11,929,236,420	\$ 10,636,702,645	\$ 10,737,492,074
Excess of Receipts over Disbursements	<u>523,551,482</u>	<u>1,292,533,775</u>	<u>(100,789,429)</u>
Asset Balance as of the End of Year	\$ 12,452,787,902	\$ 11,929,236,420	\$ 10,636,702,645
Rate of Return	7.12%	13.82%	(0.16)%





## 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:** From the Framework Document between the State and SEBAC, we have assumed the rate of wage inflation is 0.00% for fiscal years ending June 30, 2017, 2018 and 2019 for each active member. In addition, we have reduced the rate of increase by one half due to promotion and merit over this same three-year period. Once this three-year period is complete, 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+
<b>Hazardous Males</b>								
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
<b>Hazardous Females</b>								
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
<b>Nonhazardous Males</b>								
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
<b>Nonhazardous Females</b>								
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





## Schedule D – Outline of Actuarial Assumptions and Methods

### 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







## Schedule D – Outline of Actuarial Assumptions and Methods

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:

	<u>Minimum</u>	<u>Maximum</u>
Tier I State Police	60%	80%
All Other Members	40%	60%





## Schedule E – Actuarial Cost Method

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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	<u>Tier I Hazardous</u> – 20 years of credited service.  <u>Tier I Plans B and C</u> – Earliest of age 55 with 25 years of service, age 60 with 10 years of service, or age 70 with 5 years of service.  <u>Tier II Hazardous</u> – 20 years of credited service.
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## Schedule F – Summary of Main System Provisions

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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 is \$360 per month.

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





## Schedule F – Summary of Main System Provisions

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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	<p><u>Tier I</u> - 10 years of service.</p> <p><u>Tier II and IIA</u> – Effective July 1, 1997, 5 years of actual state service, 10 years of vesting service, or age 70 with 5 years of service.</p> <p><u>Tier III and IV</u> – 10 years of benefit service.</p>
Benefit	<p><u>Tier I</u> – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 55.</p> <p><u>Tier II and IIA</u> – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 55.</p> <p><u>Tier III and IV</u> – Benefit is payable at Normal Retirement Age or an Early Retirement Benefit is payable at age 58.</p>

### Pre-Retirement Spouse's Benefit

Tier I	<p>State Police – Survivor benefits to spouse of \$670 per month plus \$300 to a surviving dependent child.</p> <p>If eligible for early or normal retirement, 50% of the average of the Life Benefit and the 50% Joint &amp; Survivor Benefit the member would have received.</p> <p>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.</p> <p>If not eligible for retirement, return of contributions (5% interest).</p>
Tier II, IIA, III and IV	<p>If eligible for early or normal retirement, 50% of the 50% Joint &amp; Survivor Benefit the member would have received.</p> <p>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.</p> <p>If not eligible for retirement, return of contributions (5% interest).</p>
Tiers I, II, IIA, III and IV	<p>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.</p> <p>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.</p>





## Schedule F – Summary of Main System Provisions

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### 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

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### Member Contributions\*

Tier I – Hazardous	4% of earnings up to Social Security Taxable Wage Base plus 5% of earnings above that level.
Tier I – Plan B	2% of earnings up to Social Security Taxable Wage Base plus 5% of earnings above that level.
Tier I – Plan C	5% of earnings.
Tier II – Hazardous	4% of earnings.
Tier II – All Others	None.
Tier IIA & III – Hazardous	5% of earnings.
Tier IIA & III – All Others	2% of earnings.
Tier IV – Hazardous	8% of earnings.
Tier IV – All Others	5% of earnings.

\* Increased for anyone electing to maintain retirement eligibility. In addition, there will be an increase to all non-Tier IV members contribution rates by 1.5% of earnings effective July 1, 2017 and an additional 0.5% of earnings effective July 1, 2019. 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, 2016	50,019
Retirements	(3,193)
Disability	(211)
Terminated	(3,017)
Deaths	(114)
Rehires	733
New Participants	5,643
Refunds	(707)
As of June 30, 2018	49,153

### STATUS RECONCILIATION OF RETIRED MEMBERS

	Retirees	Disability	Survivor	Total
As of June 30, 2016	39,187	4,232	4,772	48,191
Retirements	245	(121)		124
Disability	(2)	2		0
Survivors	(408)	(52)	460	0
Deaths with no Survivors	(46)	(1)	(44)	(91)
Rehires			(1)	(1)
Refunds				0
Certain Period Ended			(24)	(24)
Data Corrections	(894)	(72)	(237)	(1,203)
From Active	3,193	211	41	3,445
As of June 30, 2018	41,275	4,199	4,967	50,441





## 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, 2018

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									0
50 to 54									0
55 to 59	1	1		1				3	329,157
60 to 64							1	1	45,044
65 to 69									0
70 & Up									0
<b>Total</b>	<b>1</b>	<b>1</b>		<b>1</b>			<b>1</b>	<b>4</b>	<b>\$ 374,201</b>

Average Age: 58.8

Average Service: 16.8

Average Salary: \$93,550





## Schedule G – Tables of Membership Data

### TIER I – PLAN B

#### The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2018

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	93,263
45 to 49									0
50 to 54			3	3	3	2	47	58	5,015,806
55 to 59	2	4	4	7	7	9	192	225	20,043,850
60 to 64	1	2	5	7	10	7	203	235	23,468,091
65 to 69	6	1			4	2	100	113	13,418,490
70 & Up			3	2			54	59	7,572,301
<b>Total</b>	<b>9</b>	<b>7</b>	<b>15</b>	<b>20</b>	<b>24</b>	<b>20</b>	<b>596</b>	<b>691</b>	<b>\$ 69,611,801</b>

Average Age: 61.5

Average Service: 35.3

Average Salary: \$100,741





## Schedule G – Tables of Membership Data

### TIER I – PLAN C

#### The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2018

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		1						1	83,421
40 to 44					1			1	124,963
45 to 49			1					1	28,632
50 to 54							6	6	555,069
55 to 59				1	2		4	7	720,088
60 to 64			1		1		6	8	695,607
65 to 69		1		1			4	6	572,917
70 & Up	1				1		4	6	670,147
<b>Total</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>5</b>		<b>24</b>	<b>36</b>	<b>\$ 3,450,844</b>

Average Age: 61.3

Average Service: 31.3

Average Salary: \$95,857





## Schedule G – Tables of Membership Data

### TIER II – HAZARDOUS DUTY

#### The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2018

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	50,693
30 to 34			1					1	47,614
35 to 39			1	3				4	305,507
40 to 44			1	10	22	1		34	3,141,841
45 to 49		1	10	34	181	46	1	273	27,485,736
50 to 54	2	5	13	21	142	117	35	335	34,626,528
55 to 59		3	7	12	70	56	48	196	19,684,614
60 to 64			5	14	28	22	16	85	8,304,085
65 to 69			1	2	9	5	4	21	2,174,835
70 & Up				1	5	6		12	1,416,758
<b>Total</b>	<b>2</b>	<b>10</b>	<b>39</b>	<b>97</b>	<b>457</b>	<b>253</b>	<b>104</b>	<b>962</b>	<b>\$ 97,238,211</b>

Average Age: 52.5

Average Service: 23.9

Average Salary: \$101,079





## 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, 2018

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					2	37,065
35 to 39	6	3	4	8	1			22	1,203,915
40 to 44	2	2	8	25	56			93	6,845,129
45 to 49	17	15	37	85	595	261	40	1,050	89,704,123
50 to 54	27	29	56	139	664	944	830	2,689	239,708,914
55 to 59	40	25	89	132	568	844	1,362	3,060	278,378,254
60 to 64	22	21	41	92	341	420	592	1,529	140,256,621
65 to 69	22	15	32	37	137	150	159	552	49,158,836
70 & Up	8	7	14	17	44	48	55	193	14,348,844
<b>Total</b>	<b>145</b>	<b>117</b>	<b>282</b>	<b>535</b>	<b>2,406</b>	<b>2,667</b>	<b>3,038</b>	<b>9,190</b>	<b>\$ 819,641,701</b>

Average Age: 56.0

Average Service: 26.3

Average Salary: \$89,188





## Schedule G – Tables of Membership Data

### TIER IIA – HAZARDOUS DUTY

#### The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2018

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		5	3					8	489,371
30 to 34		221	218	8				447	31,919,223
35 to 39	6	243	689	147	2			1,087	81,589,663
40 to 44	6	153	571	588	70	3		1,391	117,385,803
45 to 49	2	111	430	559	138	8	1	1,249	109,524,817
50 to 54	1	62	278	341	87	8	1	778	65,849,796
55 to 59	2	50	173	231	40	10	1	507	43,857,968
60 to 64	2	19	118	120	24	5	3	291	24,658,566
65 to 69		5	28	62	12			107	9,682,959
70 & Up		2	5	26	5			38	3,024,016
<b>Total</b>	<b>19</b>	<b>871</b>	<b>2,513</b>	<b>2,082</b>	<b>378</b>	<b>34</b>	<b>6</b>	<b>5,903</b>	<b>\$ 487,982,182</b>

Average Age: 45.6

Average Service: 14.5

Average Salary: \$82,667







## 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, 2018

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		5						5	\$ 34,423
25 to 29	5	37	13					55	2,216,314
30 to 34	26	302	371	17				716	43,910,284
35 to 39	37	414	988	230	11			1,680	111,565,569
40 to 44	45	345	1,084	724	112			2,310	167,021,107
45 to 49	32	326	1,080	859	223	6		2,526	188,405,846
50 to 54	41	354	1,023	780	225	42	76	2,541	188,520,234
55 to 59	32	309	1,006	768	214	38	81	2,448	180,774,781
60 to 64	32	241	741	525	125	15	5	1,684	120,383,921
65 to 69	18	123	338	188	55	3	5	730	49,238,778
70 & Up	30	76	143	85	13	1	6	354	17,249,550
Total	298	2,532	6,787	4,176	978	105	173	15,049	\$ 1,069,320,807

Average Age: 50.1

Average Service: 13.9

Average Salary: \$71,056





## 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, 2018

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	6	1						7	\$ 287,484
25 to 29	427	110	9					546	30,481,530
30 to 34	492	269	67	3	1			832	50,777,436
35 to 39	324	164	26	12				526	32,881,448
40 to 44	163	77	8					248	15,890,838
45 to 49	140	54	11	1		1		207	13,134,227
50 to 54	91	47	5	2				145	9,048,948
55 to 59	50	26	1	2				79	5,720,359
60 to 64	22	5			1			28	1,821,568
65 to 69	6	4						10	982,375
70 & Up									0
Total	1,721	757	127	20	2	1		2,628	\$ 161,026,213

Average Age: 36.4

Average Service: 4.9

Average Salary: \$61,273





## 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, 2018

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	6	3						9	\$ 126,111
25 to 29	46	26						72	3,139,606
30 to 34	62	35	18					115	6,183,147
35 to 39	92	50	27	6				175	10,022,757
40 to 44	61	33	45	20	7			166	11,447,375
45 to 49	48	47	60	61	20	3	1	240	19,830,976
50 to 54	50	31	58	85	41	14	8	287	26,898,955
55 to 59	44	33	53	100	78	42	29	379	35,886,934
60 to 64	19	23	52	87	45	54	26	306	31,811,763
65 to 69	9	8	21	42	25	26	29	160	18,711,888
70 & Up	2	3	3	4	4	5	13	34	4,424,895
Total	439	292	337	405	220	144	106	1,943	\$ 168,484,407

Average Age: 51.0

Average Service: 14.2

Average Salary: \$86,714





## Schedule G – Tables of Membership Data

### TIER III – ALL OTHERS

#### The Number and Average Annual Compensation of Active Employees By Age and Service as of June 30, 2018

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	728	67						795	\$ 7,492,218
25 to 29	1,114	360	27					1,501	55,685,452
30 to 34	1,132	489	194	14				1,829	90,248,913
35 to 39	945	431	82	53				1,511	82,193,822
40 to 44	725	300	46	16				1,087	61,020,972
45 to 49	718	325	36	14	2			1,095	59,484,579
50 to 54	633	290	21	15	3	2		964	53,736,566
55 to 59	562	214	22	14	2	1	1	816	42,030,071
60 to 64	300	181	12	5	2		2	502	25,199,788
65 to 69	134	69	10	4				217	10,172,866
70 & Up	78	42	4	1	1		1	127	3,813,177
<b>Total</b>	<b>7,069</b>	<b>2,768</b>	<b>454</b>	<b>136</b>	<b>10</b>	<b>3</b>	<b>4</b>	<b>10,444</b>	<b>\$ 491,078,424</b>

Average Age: 40.3

Average Service: 4.4

Average Salary: \$47,020





## 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, 2018

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	28							28	\$ 586,657
25 to 29	105	6	2					113	3,081,976
30 to 34	61	2		1				64	1,747,772
35 to 39	36							36	1,008,874
40 to 44	17							17	550,474
45 to 49	12							12	534,168
50 to 54	5							5	210,691
55 to 59	1							1	19,339
60 to 64	2		1					3	81,241
65 to 69									0
70 & Up									0
Total	267	8	3	1				279	\$ 7,821,192

Average Age: 31.8

Average Service: 0.8

Average Salary: \$28,033





## 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, 2018

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	10							10	\$ 306,238
25 to 29	41							41	955,594
30 to 34	54							54	1,738,916
35 to 39	39							39	1,429,166
40 to 44	32							32	1,200,101
45 to 49	32							32	1,267,658
50 to 54	22							22	735,326
55 to 59	27							27	1,046,905
60 to 64	20							20	481,565
65 to 69	16							16	225,801
70 & Up	5							5	77,195
Total	298							298	\$ 9,464,465

Average Age: 42.6

Average Service: 1.0

Average Salary: \$31,760





## 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, 2018

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	335	2						337	\$ 4,546,067
25 to 29	335	33						368	9,524,102
30 to 34	265	4	21	1				291	7,708,926
35 to 39	197	1	7	3				208	6,249,236
40 to 44	131		3					134	4,022,748
45 to 49	119	1	2					122	3,478,081
50 to 54	99	4	5		2		1	111	3,311,738
55 to 59	72	1	1				1 1	76	2,214,395
60 to 64	35		1				1	37	816,561
65 to 69	23	2	1					26	395,984
70 & Up	15	1						16	306,190
<b>Total</b>	<b>1,626</b>	<b>49</b>	<b>41</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1,726</b>	<b>\$ 42,574,028</b>

Average Age: 35.2

Average Service: 1.1

Average Salary: \$24,666





## 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	936	\$ 44,213,116	\$ 47,236
50 – 54	1,809	91,235,334	50,434
55 – 59	3,507	151,083,959	43,081
60 – 64	6,855	291,591,790	42,537
65 – 69	9,077	371,738,246	40,954
70 – 74	8,528	335,904,899	39,388
75 – 79	6,051	229,805,853	37,978
80 – 84	4,005	149,273,148	37,272
85 – 89	2,670	91,586,416	34,302
90 – 94	1,499	44,152,577	29,455
95 & Over	537	13,292,731	24,754
Total	45,474	\$ 1,813,878,069	\$ 39,888

### NUMBER OF BENEFICIARIES AND THEIR BENEFITS BY AGE

Age	Number	Total Annual Benefits	Average Annual Benefits
Under 50	253	\$ 5,349,848	\$ 21,146
50 – 54	113	2,876,542	25,456
55 – 59	205	5,037,157	24,571
60 – 64	326	8,536,416	26,185
65 – 69	473	13,420,218	28,373
70 – 74	635	16,097,508	25,350
75 – 79	751	17,889,657	23,821
80 – 84	768	17,152,687	22,334
85 – 89	727	15,804,812	21,740
90 – 94	491	10,618,853	21,627
95 & Over	225	4,435,771	19,715
Total	4,967	\$ 117,219,469	\$ 23,600







## 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	419	\$ 4,919,194	\$ 11,740
50 – 54	456	7,402,296	16,233
55 – 59	259	3,948,379	15,245
60 – 64	112	1,401,387	12,512
65 – 69	26	278,397	10,708
70 – 74	8	71,300	8,913
75 – 79	1	11,808	11,808
80 – 84	0	0	0
85 – 89	0	0	0
90 – 94	0	0	0
95 & Over	0	0	0
Total	1,281	\$ 18,032,761	\$ 14,077





## 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 Two Year Period Ending 6/30/2018
<b>Age &amp; Service Retirements.</b> If members retire at older ages, there is a gain. If younger ages, a loss.	\$ 91.6
<b>Disability Retirements.</b> If disability claims are less than assumed, there is a gain. If more claims, a loss.	(36.8)
<b>Death-in Service Benefits.</b> If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	(15.0)
<b>Withdrawal From Employment.</b> If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.	63.5
<b>Pay Increases.</b> If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	(36.5)
<b>New Members.</b> Additional unfunded accrued liability will produce a loss.	(165.1)
<b>Investment Income.</b> If there is a greater investment income than assumed, there is a gain. If less income, a loss.	(4.1)
<b>Death After Retirement.</b> If retirants live longer than assumed, there is a loss. If not as long, a gain.	(102.8)
<b>Other.</b> Miscellaneous gains and losses resulting from changes in valuation software, data adjustments, timing of financial transactions, etc.	<u>(279.8)</u>
<b>Gain (or Loss) During Year From Financial Experience</b>	<u>\$ (485.0)</u>
<b>Non-Recurring Items.</b> Adjustments for plan amendments, assumption changes, or method changes.	<u>(121.3)</u>
<b>Composite Gain (or Loss) During Year</b>	<u>\$ (606.3)</u>





## 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, 2017: (A)	\$11,929,236,420
Market Value of Assets on June 30, 2018: (B)	\$12,452,787,902
Investment Income for FY 2017-2018: (I)	\$837,797,151
Actual Rate of Return for FY 2017-2018: $2I / (A + B - I)$	7.12%
Actuarial Interest Rate Assumption:	6.90%

Actual return of 7.12% is more than the assumed 6.90%, so the first criterion is met.

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

Market Value of Assets on June 30, 2018:	\$12,452,787,902
Specified Liabilities on June 30, 2018:	
Liability for Retired Members	\$24,563,694,361
Liability for Terminated Vested Members	\$250,150,456
Liability for Member Contributions with Interest	\$1,127,909,201
Total	\$25,941,754,018
50% of Specified Liabilities	\$12,970,877,009

Market Value does not exceed 50% of specified liabilities so the second criterion is not 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, 2018:	\$21,222,935,045
Projected Unfunded Liability on June 30, 2023 (see next page):	\$7,956,355,000

Actual Unfunded Liability is not less than Projected Unfunded Liability so the third criterion is not 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)
2018	\$ 21,222,935	\$ 1,537,971
2019	21,117,050	1,678,500
2020	20,872,127	1,813,021
2021	20,486,592	1,938,467
2022	19,961,700	1,938,467
2023	19,400,590	1,938,467
2024	18,800,764	1,938,467
2025	18,159,550	1,938,467
2026	17,474,092	1,938,467
2027	16,741,337	1,938,467
2028	15,958,022	1,938,467
2029	15,120,659	1,938,467
2030	14,225,517	1,938,467
2031	13,268,611	1,454,071
2032	12,730,075	1,454,071
2033	12,154,379	1,454,071
2034	11,538,960	1,454,071
2035	10,881,077	1,454,071
2036	10,177,801	1,454,071
2037	9,425,998	1,454,071
2038	8,622,321	1,454,071
2039	7,763,191	1,454,071
2040	6,844,780	1,454,071
2041	5,862,999	1,454,071
2042	4,813,475	1,454,071
2043	3,691,534	1,404,096
2044	2,542,154	1,404,096
2045	1,313,467	1,404,096
2046	0	