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Virginia Retirement System

Report on the Actuarial Valuation for Hampton Roads Sanitation District (55411)

Prepared as of June 30, 2018

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February 8, 2019

To the Governing Body of: Hampton Roads Sanitation District

We are pleased to submit the results of the annual actuarial valuation for Hampton Roads Sanitation District (the "Plan"), a political subdivision participating in the Virginia Retirement System (VRS), prepared as of June 30, 2018.

The purpose of this report is to provide a summary of the funded status of the Plan as of June 30, 2018 and to recommend rates of employer contribution. The funded status of the Plan is the ratio of the assets to the actuarial accrued liability. While the market value of assets gives an indication of the funded status of a plan at a particular point in time and is used for financial reporting, it is not used directly in the calculation of the employer contribution rates. A less volatile actuarial value of assets, which smooths the effect of market fluctuations over a five year period, is applied to determine the funded status for rate setting purposes. For informational purposes, we exhibit the funded status based on this smoothed actuarial value of assets basis as well as the market value in this report. The interest rate used for determining liabilities is based on the expected return on assets. Therefore, liability amounts in this report cannot be used to assess a settlement of the obligation.

The unfunded actuarial accrued liability (UAAL) is the difference between the actuarial value of assets and the actuarial accrued liability of the Plan. The actuarial accrued liability is calculated using the entry age normal cost method. The employer contribution rate includes an amortization charge, which is a payment to the UAAL. The development of the amortization charge and other components of the employer contribution rate are discussed in more detail in Section I under Employer Contribution Rates.

The employer contribution rate based on the June 30, 2018 actuarial valuation is 5.86% of payroll. Contribution rates for VRS employers are established every two years based on the odd year valuations, so this rate is for informational purposes only. The employer contribution rate based on the June 30, 2017 actuarial valuation was 6.02%, and this rate is for fiscal years ending 2019 and 2020.

The assumptions recommended by the actuary and adopted by the Board are in the aggregate reasonably related to the experience under the Plan and to reasonable expectations of anticipated experience under the Plan.

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Our organization has only a contractual relationship with the Virginia Retirement System to provide actuarial consulting services and we do not provide other services to nor have a financial interest in the Virginia Retirement System. There are no known interests or relationships that our firm has with the Virginia Retirement System that may impair or appear to impair the objectivity of our work.

While not verifying the data at source, the actuary performed tests for consistency and reasonability.

This is to certify that the independent consulting actuary is a Member of the American Academy of Actuaries and has experience in performing valuations for public retirement systems, 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 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 annual actuarial valuation, an analysis of the range of results is not presented herein.

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

The Table of Contents, which immediately follows, outlines the material contained in the report.

Respectfully submitted,

Larry Langer, ASA, FCA, EA, MAAA
Principal and Consulting Actuary

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Consulting Actuary

Table of Contents

Section I – Summary of Principal Results

Introduction and Summary

This report contains the actuarial valuation results as of June 30, 2018 for Hampton Roads Sanitation District as determined by Cavanaugh Macdonald Consulting, the actuary for the Virginia Retirement System (VRS). Questions about this report should be directed to the VRS rather than to Cavanaugh Macdonald Consulting.

Employer Contribution Rates

The previous employer contribution rate was set by the June 30, 2017 valuation and is effective for the period July 1, 2018 through June 30, 2020, or fiscal years ending 2019 and 2020. The June 30, 2018 calculated rate shown in Table 1, Item 9f is for informational purposes. Rates for subsequent fiscal years will be determined by future actuarial valuations.

The recommended employer contribution rate consists of five pieces which are shown in Table 1, Item 9:

- **Employer Normal Cost Rate -** The ongoing annual cost of active employees accruing benefits under the plan. This rate is net of the member contribution rate. The normal cost is developed using the entry age normal cost method, which develops normal costs for active members which stay level during their career if benefit provisions are unchanged and assumptions are realized.
- **Amortization Charge -** The amortization of, or payment towards, the unfunded actuarial accrued liability (UAAL) for the year. The UAAL is the amount by which the actuarial value of assets falls short of, or exceeds, the actuarial accrued liability for this plan. Under the funding arrangement adopted by the Board, the UAAL is being amortized as individual layered bases. The legacy unfunded actuarial accrued liability, the unfunded actuarial accrued liability as of June 30, 2013, is amortized over a closed 30 year period beginning June 30, 2013. The amortization period of the legacy unfunded will decrease by one in each subsequent valuation until reaching 0 years. The actuarial gains and losses and other changes in the unfunded due to benefit and actuarial assumption and method changes for each valuation subsequent to the June 30, 2013 valuation will be amortized over a closed 20 year period.
- **Administrative Expenses -** An estimate of the administrative expenses to be paid out of the trust in the upcoming fiscal year.
- **Additional Funding Contribution -** The additional contribution rate needed to allow for the use of the 7.00% investment return as the single equivalent investment return assumption for purposes of the GASB 67/68 statements.
- **DC Contribution for Hybrid Members -** 1% mandatory employer contribution as well as an estimate of the employer match to the voluntary contributions made to the DC plan by Hybrid Plan members.

Benefit Provisions

The main benefit provisions are summarized in Section V of this report. This actuarial valuation took into account the provisions of VRS that were applicable to political subdivision employers on the valuation date of June 30, 2018. The valuation reflects any mandatory or elected enhanced hazardous duty benefits that have been adopted by June 30, 2018, even if the enhanced benefits are effective after that date.

Actuarial Assumptions and Methods

Section III and Section IV of this report outline the full set of actuarial assumptions and methods used in the current valuation. Effective with the June 30, 2017 valuation, the actuarial assumptions were revised to reflect the results of the experience study for the period 2012 – 2016. The next experience review is expected to be implemented with the June 30, 2021 annual valuation. The valuation assumes an annual cost-of-living adjustment of 2.50% for Plan 1 members and 2.25% for Plan 2 and Hybrid members. Salary increases range between 3.50% and 5.35% depending on the member's service and classification (i.e., members with general employee benefits or with enhanced hazardous duty coverage). Liabilities were determined under the Entry Age Normal actuarial cost method.

Assets

Table 1, Item 4 shows the market and actuarial values of assets for this employer. Five-year smoothed market value of assets is used for actuarial valuation purposes. The actuarial value reflects only a portion of the excess (or shortfall) between recent market value returns and the corresponding expected returns based on the 7.00% investment return assumption. The actuarial value recognizes this excess return (or shortfall) over a five-year period at the rate of 20% per year. This approach dampens year-to-year fluctuations in the contribution rates. The actuarial value of assets cannot be less than 80% or more than 120% of the market value of assets.

Member Data

This actuarial valuation is based on census data supplied by the VRS. The number of active members is shown in Table 1, Item 1a. The number of members who have worked for this employer at one time, but who are now active at another employer, is shown in Table 1, Item 1b. The liability for this employer's share of the benefits for such former employees has been reflected in the liabilities and in the contribution rates. The number of retirees shown includes those who retired from this employer, as well as those who retired from another employer with service attributed to this employer. The liabilities also take into account this employer's share of the benefits for former active members who later were employed by another VRS employer, and subsequently retired. Section VI provides a summary of the average data.

Any changes in coverage adopted but not included in the valuation data may not be reflected in the current contribution rate. Subsequent valuations may therefore result in a change to the required contribution rate, reflective of the change in coverage.

Experience

The employer experienced an actuarial gain for the year ended June 30, 2018, which means that the unfunded actuarial accrued liability was smaller than anticipated. Investment returns on an actuarial basis partially contributed to the gain.

Tables

There are five tables included in this report.

- Table 1 is a summary of the membership statistics, asset values and contribution rates for this employer.
- Table 2 presents a breakdown of normal cost by type of benefit.
- Table 3 shows the actuarial present value of future benefits, broken down by membership category and type of benefit.
- Table 4 provides the details of the development of the recommended contribution rate, including a breakdown of contribution rates for members with general employees benefit coverage and members with enhanced hazardous duty benefit coverage. The breakdown of contribution rates between general employees and enhanced hazardous duty covered employees is shown for informational purposes only.
- Table 5 shows estimated contribution rates for the next five years, which are based on the plan's future experience matching all actuarial assumptions and reflecting the impact of asset smoothing on the current difference between market and actuarial value of assets.

Summary of Results (Table 1)

For convenience of reference, a comparison of the principal results of the current and the previous valuations is summarized below. The following exhibit shows the development of the contribution rate based on the June 30, 2018 actuarial valuation. This contribution was developed using level percent of pay amortization of the unfunded liability with a closed amortization period. The June 30, 2017 valuation contribution rate shown below established the contribution rate, for funding purposes, for the fiscal years ending 2019 and 2020. Please note that the contribution rate determined in the 2018 valuation is for informational purposes only.

		June 30, 2018	June 30, 2017
1.	**Participants**		
	a. Actives	790	780
	b. Transfers Out	78	80
	c. Retirees and Beneficiaries	339	327
	d. Retirees and Beneficiaries Elsewhere	46	42
	e. LTD	0	0
	f. Inactive, Vested	97	105
	g. Inactive, Nonvested	150	138
	h. Total	1,500	1,472
2.	**Covered Payroll**	$50,495,758	$48,528,494
3.	**Expected Retirement Benefits**	$9,176,474	$8,519,580
4.	**Assets**		
	a. Market Value of Assets	$207,354,975	$196,157,300
	b. Actuarial Value of Assets	$205,670,641	$193,420,020
5.	**Actuarial Accrued Liability**	$228,368,710	$218,137,630
6.	**Funded Ratio**		
	a. Market Value of Assets	90.80%	89.92%
	b. Actuarial Value of Assets	90.06%	88.67%
7.	**Unfunded Actuarial Accrued Liability** (5 – 4b)	$22,698,069	$24,717,610
8.	**Normal Cost Rate**		
	a. Gross Normal Cost Rate	7.67%	7.72%
	b. Member Contribution Rate	4.69%	4.71%
	c. Employer Normal Cost Rate (8a – 8b)	2.98%	3.01%
9.	**Recommended Employer Contribution Rate for Fiscal Year Ending**	**Informational Purposes Only**	**2019 & 2020**
	a. Employer Normal Cost Rate	2.98%	3.01%
	b. Amortization Charge	1.91%	2.29%
	c. Administrative Expenses	0.25%	0.26%
	d. Additional Funding Contribution	0.00%	0.00%
	e. DC Contribution for Hybrid Members	0.72%	0.46%
	f. Total (9a through 9d (not less than zero) + 9e)	5.86%	6.02%
10.	**Amortization Period**	16 - 25	17 - 26

Section II – Plan Contribution Development

Normal Cost (Table 2)

The Normal Cost represents active participant benefits that are to accrue during the plan year and is a component of the contribution. The following table shows the Normal Cost as it is attributable to the plan benefits under the current plan.

		June 30, 2018	June 30, 2017
1.	**Normal Cost as Percent of Payroll**		
	a. Retirement Benefits	4.22%	4.29%
	b. Termination Benefits	2.24%	2.19%
	c. Disability Benefits	0.99%	1.00%
	d. Death Benefits	0.22%	0.24%
	e. Total	7.67%	7.72%
2.	**Covered Payroll**	$50,495,758	$48,528,494

Section II – Plan Contribution Development

Actuarial Present Value of Future Benefits (Table 3)

The actuarial present value of future benefits represents the obligations of the plan as of the valuation date for active and inactive members with respect to each member's expected benefit payable at retirement, termination from service, disability or death. The following table shows the components of the liability.

		June 30, 2018	June 30, 2017
1.	**Active Members**		
	a. Retirement Benefits	$127,695,817	$123,711,117
	b. Termination Benefits	8,142,704	7,356,744
	c. Disability Benefits	8,850,933	8,755,794
	d. Death Benefits	3,952,275	3,849,023
	e. Total	$148,641,729	$143,672,678
2.	**Retired Members**		
	a. Service Retirements	$79,562,600	$75,748,376
	b. Disability Retirements	15,452,552	14,297,302
	c. Beneficiaries	6,277,533	5,220,626
	d. Total	$101,292,685	$95,266,304
3.	**Terminated Members with Future Benefits**		
	a. Vested Terminations	$5,592,232	$5,726,519
	b. Nonvested Terminations	443,039	383,887
	c. Total	$6,035,271	$6,110,406
4.	**Total Present Value of Future Benefits**	$255,969,685	$245,049,388

Section II – Plan Contribution Development

Development of the Annual Contribution (Table 4)

The following exhibit shows the development of the June 30, 2018 contribution rate. This contribution was developed using level percent of pay amortization of the unfunded liability with a closed amortization period. The contribution rate determined in the 2017 valuation established the contribution rate for fiscal years ending 2019 and 2020. Please note that the contribution rate determined in the 2018 valuation is for informational purposes only.

		June 30, 2018	June 30, 2017
1.	**Covered Payroll**		
	a. General Employees Benefit Coverage	$50,495,758	$48,528,494
	b. Enhanced Hazardous Duty Benefit Coverage	N/A	N/A
	c. Total	$50,495,758	$48,528,494
2.	**Present Value of Future Pay**	$348,759,969	$335,944,445
3.	**Total Normal Cost**	$3,687,856	$3,574,800
4.	**Normal Cost Rate**		
	a. Total Normal Cost	7.67%	7.72%
	b. Less: Member Contribution Rate	4.69%	4.71%
	c. Employer Normal Cost Rate	2.98%	3.01%
5.	**Actuarial Accrued Liability**		
	a. Actives	$121,040,754	$116,760,920
	b. Inactives	107,327,956	101,376,710
	c. Total	$228,368,710	$218,137,630
6.	**Actuarial Value of Assets**	$205,670,641	$193,420,020
7.	**Unfunded Actuarial Accrued Liability (UAAL)** (5c – 6)	$22,698,069	$24,717,610
8.	**UAAL as a Percent of Covered Payroll**	44.95%	50.93%
9.	**UAAL Amortization Charge**	1.91%	2.29%
10.	**Administrative Expense Rate**	0.25%	0.26%
11.	**Additional Funding Contribution**	0.00%	0.00%
12.	**DC Contribution for Hybrid Members**	0.72%	0.46%
13.	**Recommended Employer Contribution Rate for Fiscal Year Ending**	**Informational Purposes Only**	**2019 & 2020**
	((4c + 9 + 10 + 11), not less than zero, + 12)	5.86%	6.02%
14.	**Breakdown of Employer Contribution Rate for Informational Purposes Only**		
	a. General Employees Benefit Coverage	5.86%	6.02%
	b. Enhanced Hazardous Duty Benefit Coverage	N/A	N/A

Development of the Annual Contribution (Table 4) – Continued

This table shows the employer normal cost before and after pension reform has been fully phased-in.

	Employer Normal Cost Rate June 30, 2018*	
	2018 Valuation	**After Full Impact of 2012 Pension Reform**
General Employees	3.70%	3.47%
Hazardous Duty	N/A	N/A
Total Blended Rate	3.70%	3.47%
Long-Term Savings		0.23%

Phase in of the impact of Hybrid plan and benefit changes for members with enhanced hazardous duty benefits, if applicable, is estimated to take over 20 years.

* Net of 5% member contribution rate for Plan 1 and Plan 2 and 4% member contribution rate under Hybrid plan. Rates include an assumed employer defined contribution rate of 2.30% for members in the Hybrid plan based on prior year experience.

5-Year Projection of Biennial Employer Contribution Rates (Table 5)

This table shows estimated contribution rates for the next five years, which are based on the Plan's future experience matching all actuarial assumptions. The rates do not include the employer contribution to the defined contribution portion of the Hybrid plan.

Fiscal Year Ending	Projected Employer Contribution Rate*
June 30, 2018	7.70%
June 30, 2019	5.56%
June 30, 2020	5.56%
June 30, 2021	5.22%
June 30, 2022	5.22%
June 30, 2023	4.89%

*Note: Contribution rates are net of employee contributions

The rate shown for the fiscal year ending 2018 is based on the June 30, 2015 actuarial valuation, and the rates shown for the fiscal years ending 2019 and 2020 are based on the June 30, 2017 actuarial valuation. We have performed projections to determine an estimated contribution rate as of June 30, 2019 and June 30, 2021 for the years ending 2021, 2022, and 2023. The projection assumes an annual return on assets of 7.00%, a level population, and that future Plan experience exactly matches all actuarial assumptions.

Amortization Schedule Unfunded Accrued Liability

Description	Original Amount	Outstanding Balance as of June 30, 2017	BOY 2017/2018 Amortization Payment	Outstanding Balance as of June 30, 2018	BOY 2018/2019 Amortization Payment	Years Remaining June 30, 2018
2013 Original Unfunded	$47,444,210	$49,283,616	$2,930,715	$49,597,604	$3,018,636	25 years
2014 Experience (Gain) / Loss	($11,410,367)	($11,147,009)	($874,064)	($10,992,051)	($900,286)	16 years
2015 Experience (Gain) / Loss	($2,887,846)	($2,851,402)	($214,773)	($2,821,193)	($221,217)	17 years
2016 Experience (Gain) / Loss	($3,567,074)	($3,549,205)	($257,562)	($3,522,058)	($265,288)	18 years
2017 Experience (Gain) / Loss	($7,018,390)	($7,018,390)	($492,005)	($6,983,232)	($506,765)	19 years
2018 Experience (Gain) / Loss	($2,581,001)			($2,581,001)	($180,934)	20 years
Total		$24,717,610	$1,092,311	$22,698,069	$944,146	

Assumptions for all Participants

The basis for the assumptions is the Virginia Retirement System Experience Study for the Four-Year Period July 1, 2012 to June 30, 2016 issued February 21, 2018 and presented and adopted by the Board at its April 2017 meeting. These assumptions comply with Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations* and ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations.*

1. Investment Return Rate	7.00% per annum, compounded annually, net of investment expenses.
2. Inflation Assumption	2.50% per year.
3. Actuarial Cost Method	Entry age normal cost method. Actuarial gains and losses are reflected in the unfunded actuarial accrued liability. See Section IV for a detailed explanation.
4. Funding Period	The legacy unfunded actuarial accrued liability, the unfunded actuarial accrued liability as of June 30, 2013, is amortized over a closed 30 year period beginning June 30, 2013. The amortization period of the legacy unfunded will decrease by one in each subsequent valuation until reaching 0 years. The actuarial gains and losses and other changes in the unfunded due to benefit and actuarial assumption and method changes for each valuation subsequent to the June 30, 2013 valuation will be amortized over a closed 20 year period. See the Amortization Schedule for more detail. The amortization payment includes an adjustment of 1.019233 to account for the passage of time from the valuation date to the date the contribution is made.
5. Additional Funding Charge	The Additional Funding Charge is the contribution rate needed, if necessary, to allow the local system to use the Investment Return Rate as its Single Equivalent Interest Rate (SEIR) under GASB Statement No. 67. To determine the SEIR, the Fiduciary Net Position (FNP) must be projected into the future for as long as there are anticipated benefits payable under the plan's provision applicable to the membership and beneficiaries of the system on the Measurement Date. If the FNP is projected to not be depleted at any point in the future, the long term expected rate of return on plan investments expected to be used to finance the benefit payments may be used as the SEIR. If the FNP is projected to be depleted, an Additional Funding Charge is developed to avoid depletion.
6. Payroll Growth Rate	3.00% per annum.
7. Asset Valuation Method	The method of valuing assets is intended to recognize a "smoothed" market value of assets. Under this method, the difference between actual return on market value from investment experience and the expected return on market value is recognized over a five-year

Assumptions for all Participants (Continued)

period. The resulting actuarial value of assets cannot be less than 80% or more than 120% of the market value of assets. The actuarial value is calculated in aggregate for all Political Subdivisions and then allocated to each individual employer based on market value of assets. More details of this calculation can be found in Schedule B – Development of Actuarial Value of Assets, in the Report on the Actuarial Valuation for the Virginia Retirement System. As of the valuation date, the total market value of assets for the Virginia Retirement System Political Subdivisions is \$20,302,821,000. The resulting actuarial value of assets is \$20,137,904,000. The market value of assets for the Hampton Roads Sanitation District is \$207,354,975, which is 1.0213% of the total. The actuarial value of assets assigned to the Hampton Roads Sanitation District is the same percent of the total actuarial value of assets for the Virginia Retirement Systems Political subdivisions, or \$205,670,641.

8. Cost-of-Living Increase

2.50% per year compounded annually for Plan 1 members receiving benefits or vested as of January 1, 2013 and 2.25% compounded annually for all other members.

9. Percent Electing a Deferred Termination Benefit

Terminating members are assumed to elect a return of contributions or a deferred annuity, whichever is most valuable benefit at the time of termination. Termination benefits are assumed to commence at normal retirement.

10. Marriage Assumption

100% of active employees are assumed to be married, with males two years older than females.

11. Employer Contribution to DC Hybrid Plan

The valuation assumes an average employer defined contribution rate of 2.30% for members in the Hybrid Plan as reported by VRS for the prior fiscal year.

12. Service Related Disability

The service related disability benefits do not include an adjustment for Social Security or Worker's Compensation benefits.

13. Administrative Expenses

The employer contribution rate includes a rate for anticipated non-investment expenses based on actual prior year experience.

14. Modified Cash Refund

Under the modified cash refund annuity, the form of payment requires that the total benefit received by the member and his or her estate cannot be less than the total contributions made by the member while he or she was an active participant. For members in pay status, the modified cash refund was estimated to be in effect for three years after retirement.

15. Changes Since Previous Valuation

For changes, if any, in actuarial assumptions and methods refer to the cover letter of this report.

Assumptions for Participants with General Employees Benefit Coverage

1. Mortality Rates — 15% of deaths are assumed to be service related.

a. Pre-Retirement — RP-2014 Employee Rates to age 80, Healthy Annuitant Rates at ages 81 and older projected with scale BB to 2020; males 95% of rates; females 105% of rates

b. Post-Retirement — RP-2014 Employee Rates to age 49, Healthy Annuitant Rates at ages 50 and older projected with scale BB to 2020; males set forward 3 years; females 1.0% increase compounded from ages 70 to 90

c. Post-Disablement — RP-2014 Disabled Mortality Rates projected with scale BB to 2020; males set forward 2 years, 110% of rates; females 125% of rates

	Deaths Per 100 Members					
	Male Participants			Female Participants		
Age	Pre Retirement	Post Retirement	Post Disablement	Pre Retirement	Post Retirement	Post Disablement
20	0.04	0.05	0.92	0.02	0.02	0.27
25	0.05	0.04	0.85	0.02	0.02	0.29
30	0.04	0.05	0.90	0.02	0.02	0.37
35	0.05	0.06	1.04	0.03	0.03	0.48
40	0.06	0.08	1.37	0.04	0.04	0.67
45	0.09	0.13	1.99	0.07	0.06	1.11
50	0.16	0.50	2.34	0.11	0.27	1.46
55	0.26	0.67	2.64	0.17	0.35	1.76
60	0.43	0.89	2.95	0.24	0.49	2.00
65	0.73	1.28	3.50	0.36	0.75	2.43
70	1.20	2.02	4.54	0.62	1.21	3.28
75	2.01	3.31	6.22	1.05	2.07	4.77
80	3.37	5.66	8.96	1.80	3.62	7.10

Mortality improvement is anticipated under the post-retirement mortality assumption as projected with scale BB.

Assumptions for Participants with General Employees Benefit Coverage (Continued)

2. Retirement Rates

The following rates of retirement are assumed for members eligible to retire from Plan 1.

	Retirements Per 100 Members							
	First Eligible for Reduced Retirement		Reduced Retirement		First Eligible for Unreduced Retirement		Unreduced Retirement	
Age	Male	Female	Male	Female	Male	Female	Male	Female
50	5.0	5.5						
51	5.5	5.5	4.0	4.0				
52	5.5	5.5	4.0	4.5				
53	5.5	5.5	4.0	4.5				
54	5.5	5.5	4.0	4.5				
55	5.5	7.0	5.0	5.5	14.0	12.0	10.0	10.0
56	5.5	6.0	5.0	5.5	14.0	12.0	10.0	10.0
57	9.0	6.0	5.5	5.5	11.0	10.0	10.0	10.0
58	9.0	6.0	5.5	5.5	11.0	10.0	10.0	10.0
59	10.0	6.0	5.5	5.5	12.0	15.0	10.0	10.0
60	10.0	8.5	6.0	7.5	12.0	15.0	10.0	10.0
61	15.0	8.5	10.0	7.5	25.0	20.0	22.0	17.5
62	13.0	19.0	17.0	17.0	35.0	20.0	30.0	25.0
63	13.0	11.0	15.0	15.0	20.0	20.0	25.0	25.0
64	20.0	11.0	15.0	15.0	27.0	25.0	25.0	15.0
65					27.0	28.0	30.0	35.0
66					27.0	28.0	30.0	30.0
67					27.0	17.5	25.0	22.0
68					27.0	17.5	25.0	22.0
69					27.0	30.0	25.0	22.0
70					27.0	30.0	25.0	22.0
71					27.0	30.0	25.0	22.0
72					27.0	30.0	25.0	22.0
73					27.0	30.0	25.0	22.0
74					27.0	30.0	25.0	22.0
75					100.0	100.0	100.0	100.0

Assumptions for Participants with General Employees Benefit Coverage (Continued)

3. Retirement Rates

The following rates of retirement are assumed for members eligible to retire from Plan 2 and Hybrid Members.

	Retirements Per 100 Members							
	First Eligible for Reduced Retirement		Reduced Retirement		First Eligible for Unreduced Retirement		Unreduced Retirement	
Age	Male	Female	Male	Female	Male	Female	Male	Female
50					10.0	6.0		
51					10.0	6.0		
52					10.0	6.0	8.0	10.0
53					10.0	12.0	8.0	10.0
54					10.0	12.0	10.0	10.0
55					14.0	12.0	10.0	10.0
56					14.0	12.0	10.0	10.0
57					11.0	10.0	10.0	10.0
58					11.0	10.0	10.0	10.0
59					12.0	15.0	10.0	10.0
60	10.0	8.5			12.0	15.0	10.0	10.0
61	15.0	8.5	10.0	7.5	25.0	20.0	22.0	17.5
62	13.0	19.0	17.0	17.0	35.0	20.0	30.0	25.0
63	13.0	11.0	15.0	15.0	20.0	20.0	25.0	25.0
64	20.0	11.0	15.0	15.0	27.0	25.0	25.0	15.0
65					27.0	28.0	30.0	35.0
66					27.0	28.0	30.0	30.0
67					27.0	17.5	25.0	22.0
68					27.0	17.5	25.0	22.0
69					27.0	30.0	25.0	22.0
70					27.0	30.0	25.0	22.0
71					27.0	30.0	25.0	22.0
72					27.0	30.0	25.0	22.0
73					27.0	30.0	25.0	22.0
74					27.0	30.0	25.0	22.0
75					100.0	100.0	100.0	100.0

Assumptions for Participants with General Employees Benefit Coverage (Continued)

4. Disability Rates

As shown below for selected ages. 15% of disability cases are assumed to be service related.

Age	Disabilities Per 1000 Members: Male Participants	Female Participants
20	0.05	0.01
25	0.09	0.01
30	0.22	0.01
35	0.52	0.24
40	1.30	0.58
45	2.71	1.27
50	4.29	2.74
55	5.85	4.83
60	6.56	6.40
65	6.56	6.56

5. Termination Rates

The following withdrawal rates are used based on age and years of service (for causes other than death, disability, or retirement).

Terminations Per 100 Members

	Male Members – Years of Service										
Age	0	1	2	3	4	5	6	7	8	9	10+
25	25.1	23.0	20.9	18.4	15.7	13.4	12.0	10.8	10.0	10.0	10.0
30	22.2	20.3	18.3	16.2	14.1	12.4	11.1	10.2	9.5	9.0	9.0
35	20.6	18.2	16.2	14.3	12.8	11.4	10.3	9.6	8.8	7.8	6.5
40	19.6	16.5	14.3	12.7	11.5	10.5	9.6	8.8	8.1	6.8	4.6
45	18.4	14.9	12.7	11.4	10.6	9.9	9.1	8.2	7.4	6.2	4.6
50	17.1	13.7	12.0	10.6	10.4	9.7	8.9	8.1	6.8	6.2	4.6
55	16.1	13.0	12.0	10.5	10.4	9.7	8.9	8.1	6.5	6.2	4.6
60	15.4	12.9	12.0	10.5	10.4	0.0	0.0	0.0	0.0	0.0	0.0
65	15.4	12.9	12.0	10.5	10.4	0.0	0.0	0.0	0.0	0.0	0.0

	Female Members – Years of Service										
Age	0	1	2	3	4	5	6	7	8	9	10+
25	27.4	25.7	23.4	20.4	17.5	15.5	13.8	12.0	10.7	10.6	10.6
30	24.3	22.7	21.1	19.1	17.1	15.3	13.6	12.0	10.7	9.9	9.9
35	22.3	20.2	18.7	17.2	15.8	14.3	12.8	11.6	10.4	9.1	7.6
40	20.8	18.2	16.5	15.2	14.1	13.0	11.8	10.7	9.8	8.3	5.3
45	19.5	16.6	14.6	13.2	12.3	11.6	10.7	9.7	9.0	7.6	5.3
50	18.2	15.3	13.2	11.7	10.7	10.3	9.9	9.4	8.5	7.6	5.3
55	16.9	14.5	12.4	10.9	10.0	9.3	9.3	9.3	8.4	7.6	5.3
60	16.0	14.1	12.3	10.9	10.0	0.0	0.0	0.0	0.0	0.0	0.0
65	15.6	14.0	12.3	10.9	10.0	0.0	0.0	0.0	0.0	0.0	0.0

Assumptions for Participants with General Employees Benefit Coverage (Continued)

6. Salary Increase Rates

The following salary increase rates are used. The Total Annual Rate of Increase consists of an inflation rate of 2.50%, a real wage inflation component of 1.00%, and a variable merit component that is based on years of service.

Years of Service	Total Annual Rate of Increase
1	5.35%
2	5.35%
3	4.75%
4	4.45%
5	4.45%
6	4.45%
7	4.35%
8	4.25%
9	4.00%
10	4.00%
11-19	3.65%
20 or more	3.50%

Section IV – Actuarial Cost Method

1. The valuation is prepared on the projected benefit basis, which is used to determine the present value of each member's expected benefit payable at retirement, disability, termination from service or death. The calculations are based on the member's age, years of service, sex, compensation, expected future salary increases, and an assumed future interest earnings rate (currently 7.00%). The calculations consider the probability of a member's death or termination of employment prior to becoming eligible for a benefit and the probability of the member terminating with a service, disability, or survivor's benefit. The present value of the expected benefits payable to active members is added to the present value of the expected future payments to current benefit recipients to obtain the present value of all expected benefits payable to the present group of members and survivors.

2. The employer contributions required to support the benefits of the political subdivisions participating in VRS are determined following a level funding approach and consist of a normal contribution and an accrued liability contribution.

3. 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 normal cost rate has been developed to cover the cost of new hires during the fiscal year and has also been adjusted to reflect the expected allocation of Plan 1, Plan 2, and Hybrid membership as of the fiscal year in which the contributions are being made.

4. The unfunded accrued liability is determined by subtracting the current assets and the present value of prospective employer normal contributions and member contributions from the present value of expected benefits to be paid from the Plan. The accrued liability contribution amortizes the balance of the unfunded accrued liability over a period of years from the valuation date and includes a timing adjustment to reflect the period between the rate setting date and the time employers will actually make contributions.

Section V – Summary of Benefit Provisions

1. Effective Date	January 1, 1960
2. Plan Year	Twelve-month period ending June 30th.
3. Administration	Virginia Retirement System (VRS) is administered by a Board of Trustees.
4. Type of Plan	VRS is a qualified governmental defined benefit retirement plan. For Governmental Accounting Standards Board purposes, it is considered an agent multiple-employer PERS with separate cost-sharing pools for each locality.
5. Eligibility	All full-time, salaried, permanent employees of the Commonwealth of Virginia or of any participating Virginia city, county, town or political subdivision or of any local Virginia school boards are eligible to become members of VRS.
Plan 1:	Members hired prior to July 1, 2010, and who were vested as of January 1, 2013.
Plan 2:	Members hired on or after July 1, 2010 but prior to January 1, 2014, or members hired prior to July 1, 2010 and who were not vested as of January 1, 2013, or members eligible for enhanced hazardous duty benefits that are hired on or after July 1, 2010.
Hybrid:	Members hired on or after January 1, 2014 or by member election. There is no Hybrid plan for members with enhanced hazardous duty benefits.
6. Employee Contributions	
Defined Benefit:	Active members in Plan 1 and Plan 2 contribute 5% of their creditable compensation per year. Active members in the Hybrid Plan contribute 4% of their creditable compensation per year. The employer may "pick-up" the member's assessments under the provisions of Internal Revenue Code Section 414(h).
Defined Contribution:	Active members in the Hybrid Plan are required to contribute 1% of their creditable compensation per year to the defined contribution component of the Hybrid Plan and employers also contribute a required 1% on their behalf. Active members can make additional voluntary contributions of up 4% of their creditable compensation. The employer will match 100% of the first 1% of voluntary contributions plus 50% of additional voluntary contributions up to a maximum match of 2.5%.
7. Creditable Compensation	Annual salary minus any overtime pay, payments of a temporary nature, or payments for extra duties.
8. Service	Employees receive credit of one month of service for each month a contribution is made on their behalf to VRS. A member may also purchase credit for certain periods, such as time spent in the military, by paying a purchase rate established by the VRS Board. Special rules and limits govern the purchase of additional service.

9. Average Final Compensation (AFC)

Plan 1:	The average of the member's highest 36 consecutive months of salary.
Plan 2 & Hybrid:	The average of the member's highest 60 consecutive months of salary.

10. Optional Forms — There are optional forms of payment available on an actuarially equivalent basis, as follows:

a. 100% Survivor Option	Upon the member's death, 100% of the benefit continues to the contingent annuitant.
b. 50% Survivor Option	Upon the member's death, 50% of the benefit continues to the contingent annuitant.
c. Leveling Option	A temporarily increased retirement allowance payable to a date specified by the member and a reduced retirement allowance (on an actuarially equivalent basis) payable after the specified date for the member's remaining lifetime.
d. Partial Lump Sum Option	The member may elect to receive a lump sum payment equal to the sum of 12, 24, or 36 payments of the standard monthly life annuity. The member's monthly benefit will be actuarially reduced to reflect the lump sum payment. The member may then elect to receive the reduced monthly annuity under any of the other optional forms of payment.

Actuarial equivalence is based on tables adopted by the Board of Trustees.

11. Cost-of-Living Increase

Plan 1:	Members qualify for cost-of-living increase on July 1 of the second calendar year after retirement. Automatic cost-of-living increases are calculated as the first 3% of the Consumer Price Index increase plus half of each percentage increase from 3% to 7%.
Plan 2 & Hybrid:	Members qualify for cost-of-living increase on July 1 of the second calendar year after retirement. Automatic cost-of-living increases are calculated as the first 2% increase of the Consumer Price Index plus half of each percent from 2% to 4%, with the maximum cost-of-living increase of 3%.
Plan 1, 2, and Hybrid:	The COLA is deferred for one full calendar year after the member reaches unreduced retirement age. The deferred COLA does not apply to employees within five years of eligibility for unreduced retirement as of January 1, 2013 and to members who retire with twenty or more years of service.

12. Changes Since Previous Valuation — For changes, if any, in benefit provisions since the previous valuation refer to the cover letter of this report.

Benefit Provisions for Participants with General Employees Benefit Coverage

1. Normal Retirement

a. Eligibility	Plan 1: A member may retire upon Normal Retirement on or after age 65 with credit for five years of service. Plan 2 & Hybrid: A member may retire upon Normal Retirement after reaching Social Security Normal Retirement Age plus five years of service.
b. Annual Benefit	Plan 1: 1.70% of average final compensation (AFC) times years of service. Plan 2: 1.70% of average final compensation (AFC) times years of service up to January 1, 2013 plus 1.65% of AFC times years of service from January 1, 2013. Hybrid: 1.00% of average final compensation (AFC) times years of service.
c. Payment Form	Benefits are paid as a monthly life annuity, with a guarantee that if the payments do not exceed the member's contributions plus interest, determined as of the date at retirement, the balance will be paid in a lump sum to the member's beneficiary. Optional forms of payment are available; see above.

2. Early Retirement

a. Eligibility	Plan 1: A member may retire early after reaching age 50 with at least 10 years of service, or age 55 with at least five years of service credit. Plan 2 & Hybrid: A member may retire early after reaching age 60 with five years of service, or upon the sum of their age and their service being 90 (Rule of 90).
b. Annual Benefit	Plan 1: Calculated the same as the normal retirement benefit, using actual service at retirement and multiplied by a reduction factor. No reduction applies if the member has credit for thirty years of service at retirement and is at least age 55. The reduction is 0.5% per month for the first 60 months and 0.4% per month for the next 60 months. This reduction is applied for each month that the retirement age precedes 65, or if more favorable, for each month the service at retirement is less than 30. Plan 2 & Hybrid: Calculated the same as the normal retirement benefit, using actual service at retirement and multiplied by an actuarial equivalent reduction factor similar to Plan 1. No reduction is applied if the sum of the member's age and service is equal to 90.
c. Payment Form	Same as for Normal Retirement above.

Benefit Provisions for Participants with General Employees Benefit Coverage (Continued)

3. Disability Retirement – For members in Plan 1 and Plan 2

a. Eligibility — A member is eligible from the first day of employment.

b. Annual Benefit — For members with less than five years of service credit, the minimum guaranteed benefit. For members with greater than five years of service credit, the greater of the minimum guaranteed benefit and 1.70% of AFC times service credit (1.65% for Plan 2 members). Benefit is reduced by Worker's Compensation (if any).

c. Minimum Guaranteed Benefit

i. Workers Compensation Guarantee

66 2/3% of AFC if member does not qualify for primary Social Security and 50% of AFC if member qualifies for primary Social Security.

ii. Special Retirement Allowance Guarantee

50% of AFC if member does not qualify for primary Social Security and 33 1/3% of AFC if member qualifies for primary Social Security.

d. Service Credit — If disability occurs before age 60, service is the smaller of 1) twice actual service, and 2) rendered service plus the number of years remaining between age at disability and age 60.

e. Payment Form — The disability benefit commences immediately upon the member's retirement. Benefits cease upon recovery or reemployment. Disability benefits are payable as a monthly life annuity with a guarantee that, at the member's death, the sum of the member's contributions plus interest as of the date of retirement will be paid in a lump sum to the member's beneficiary. 100% and 50% Survivor Options are also permitted for disability retirement. (A refund of the member's contribution account is paid out for a work-related disability.)

4. Disability Retirement – For members in Hybrid Plan

Provisions applying to Hybrid members: In lieu of the above benefits, these members will be covered by the Virginia Local Disability Program (VLDP) or, if the employer opted-out of VLDP during the election period, a comparable plan. Under VLDP (or a comparable plan), these members will receive a deferred benefit payable at normal retirement from this plan. The deferred benefit will be computed like a normal retirement benefit. For this calculation, a member's creditable service will include the period of disability, and the Average Final Compensation will be adjusted to reflect increases in the cost-of-living between the date of disability and the date of normal retirement. If the member dies while disabled before normal retirement, a death benefit will be determined as though the employee were an active member.

Benefit Provisions for Participants with General Employees Benefit Coverage (Continued)

5. Deferred Termination Benefit

a. Eligibility	A member with at least five years of service who does not withdraw his/her contributions from the fund is eligible for a deferred termination benefit.
b. Annual Benefit	Same as normal retirement benefit, but both AFC and service are determined at the time the member leaves active employment. For Plan 1 members, benefits may commence unreduced at age 65 or at age 55 with at least thirty years of service. Reduced benefits may commence at or after age 55 with more than five years of service or age 50 with at least ten years of service. For Plan 2 members, benefits may commence unreduced at Social Security Normal Retirement Age. Reduced benefits may commence at or after age 60 with more than five years of service. For valuation purposes, it is assumed that benefits will commence at Normal Retirement.
c. Payment Form	The form of payment is the same as for Normal Retirement above.
d. Death Benefit	The beneficiary of a member who dies after leaving active service but before retiring is entitled to receive a lump sum distribution of the deceased member's contribution account.

6. Withdrawal (Refund) Benefit

a. Eligibility	All members leaving covered employment with less than five years of service are eligible. Optionally, vested members (those with five or more years of service) may withdraw their contributions plus interest in lieu of the deferred benefits otherwise due.
b. Benefit	The member who withdraws receives a lump-sum payment of his/her employee contributions, plus the interest credited on these contributions. Interest is credited at 4%.

7. Death Benefit

a. Eligibility	Death must have occurred while an active or inactive, non-retired member.
b. Benefit	Upon the death of a nonvested member, a refund of the member's contributions and interest is paid. Upon the death of a vested member, if death occurs while in active service the qualifying survivor of the member is entitled to receive a benefit determined as though the member retired, elected the 100% Survivor Option, then died. If the member dies before reaching age 55, the member is assumed to be 55 for benefit calculation purposes. The qualifying survivor may elect to receive a refund of the contributions plus interest in lieu of the monthly benefit. If the death occurs while inactive, benefits payable are described in item 5(d) above.
c. Work-Related Death	Qualifying survivor would receive 50% of AFC if beneficiary does not qualify for Social Security survivor benefits, and 33 1/3% of AFC if beneficiary qualifies for Social Security survivor benefits. This benefit is reduced by Worker's Compensation. In addition, a refund of the member's contribution account is paid to the beneficiary.

Section VI – Data Summary

	June 30, 2018
1. Active Members	
a. Average Age	44.6
b. Average Vesting Service	14.1
c. Average Entry Age	30.5
d. Average Pay	$63,919
2. Members Retiring in Fiscal Year	**2018**
a. Average Age at Retirement	60.0
b. Average Service at Retirement	25.9
c. Average AFC at Retirement	$64,200
d. Average Benefit as Percent of AFC	44.09%
e. Average Benefit at Retirement	$28,308
f. Average Social Security Benefit at 62	$16,668