Segal Consulting

NEW HAMPSHIRE RETIREMENT SYSTEM

Full Scope Audit of the Actuarial Valuation as of June 30, 2017

May 31, 2019

Segal Consulting

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May 31, 2019

Mr. Gerard Murphy
Director of Finance
New Hampshire Retirement System
54 Regional Drive
Comcord, NH 03301-8502

Re: Full Scope Audit of the New Hampshire Retirement System Actuarial Valuation as of June 30, 2017

Dear Mr. Murphy:

We are pleased to present the results of our audit of the Actuarial Valuation as of June 30, 2017 for the New Hampshire Retirement System (NHRS or System). The purpose of this audit is to replicate the results of the June 30, 2017 actuarial valuation and to review the actuarial methods, assumptions, and procedures employed by NHRS and their actuary, Gabriel Roeder Smith & Company (GRS).

This review will include opinions on the following:

- The appropriateness of the demographic and financial information used by GRS in the NHRS Valuation Report;
- The reasonableness and consistency of actuarial valuation assumptions, methods and procedures, taking into account Actuarial Standards of Practice, NHRS experience, and the appropriateness of the assumptions given the NHRS structure and funding objectives;
- Whether the GRS valuation results reflect the requirements set forth in state statutes and Board policies;
- Whether the GRS valuation results are reasonable, including an analysis of contribution rates and accrued liabilities; and
- Whether the valuation was performed by qualified actuaries and in accordance with principles and practices prescribed by the Actuarial Standards Board.

The review of the assumptions and methods used by GRS in the June 30, 2017 actuarial valuation is included in our report dated May 31, 2019 on the Limited Scope Audit of the 5-Year Experience Study: July 1, 2010 – June 30, 2015.

This review was conducted under the supervision of Kathleen A. Riley, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries and an Enrolled Actuary under ERISA. This review was conducted in accordance with the standards of practice prescribed by the Actuarial Standards Board.

The assistance of the NHRS staff and GRS is gratefully acknowledged.

We appreciate the opportunity to serve as an independent actuarial advisor for NHRS and we are available to answer any questions you may have on this report.

Sincerely,

Kathleen A. Riley, FSA, MAAA, EA
Senior Vice President and Actuary

Chad Brown

Chad W. Brown, FSA, MAAA, EA
Consulting Actuary

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Full Scope Audit of the Actuarial Valuation as of June 30, 2017 for the New Hampshire Retirement System

May 31, 2019

Executive Summary

The New Hampshire Retirement System (NHRS or System) retained Segal Consulting (Segal) to conduct an independent review of the System's actuarial calculations, process, assumptions and methodology reflected in the June 30, 2017 actuarial valuation performed by Gabriel Roeder Smith & Company (GRS). The review of the assumptions and methods used by GRS in the June 30, 2017 valuation is included in our separate report on the limited scope audit of the NHRS 2010-2015 Experience Study.

The main objectives for this engagement included:

1. A review of the demographic and financial information;
2. A review of the reasonableness and consistency of actuarial assumptions, methods and procedures
3. An evaluation of whether the valuation reflects state statutes and Board policies;
4. Replication of the valuation to confirm reasonableness and accuracy of contribution rates and accrued liabilities;
5. An evaluation of whether the valuation was performed in accordance with Actuarial Standards of Practice (ASOPs); and
6. An assessment of the quality of the valuation report.

The objective of an actuarial audit of any valuation is to provide validation that the liabilities and costs of the System are reasonable and being calculated as intended. This peer review includes a full replication of the actuarial valuation results, plus a review of the key components in the valuation process that encompass the derivation of the liabilities and costs for NHRS. These key components include the data, the benefits valued, the actuarial assumptions and funding method used, and the asset valuation method employed. The valuation report and select valuation output for a number of active, terminated vested, and pay status test lives provide the detail necessary to validate each of these key components.

We reviewed all information supplied to us by NHRS, including participant data files, financial statements, and sample benefit calculations for recent retirees. We also requested and reviewed additional information from GRS, including test lives and documentation of procedures beyond those disclosed in the valuation report.

Summary of Findings

This peer review validates the findings of the June 30, 2017 actuarial valuation. Segal was able to match the valuation results and the test life output within an acceptable range. The data appears complete and we were able to closely match the participant counts reported by GRS. We concluded the valuation was performed in accordance with the actuarial standards of practice promulgated by the Actuarial Standards Board (ASB).

For pension, our replication of the valuation produced results that are 0.8% lower than GRS for the total Actuarial Present Value of Projected Benefits, 2.2% lower for retirees and beneficiaries, 0.3% higher for inactive and vested deferred members and 0.6% higher for active members. For medical subsidy, our replication of the valuation produced results that are 0.2% lower than GRS for the total Actuarial Present Value of Projected Benefits. Differences less than 5% are generally considered a reasonable match. The results are well within that tolerance. Additional detail on the replication of the valuation can be found in Section I.

With that said, Segal did find some areas where the valuation could be improved with regard to the accuracy of liability calculations. Our key recommendations are as follows:

1. After reviewing the pay status test lives, we determined that GRS used the retiree's contribution account value at retirement, without reducing the balance for payments received prior to the valuation date, to determine the value of any future "cash refund" lump sum that may be payable. **We recommend that GRS calculate the retiree's remaining contribution account balance as of the valuation date to determining the value of any future "cash refund" lump sum.**

   We estimate that the current methodology overstates retiree liabilities by approximately $52 million, or 0.7% of retiree liabilities and 0.3% of the total Actuarial Present Value of Projected Benefits.

2. After reviewing the terminated vested test lives, we determined that the transition rules applicable to members hired prior to July 1, 2011, but who were not vested as of January 1, 2012, were not being used to determine eligibility for retirement, resulting in a slight overstatement of liabilities. In addition, we determined that time elapsed between the date of termination and the valuation date was not used to determine eligibility for retirement, resulting in an understatement of liabilities. **We recommend that GRS program these plan provisions.**

   We estimate that the current methodology understates vested deferred liabilities by approximately $2.5 million, or 0.9% of vested deferred liabilities and 0.02% of the total Actuarial Present Value of Projected Benefits.

3. After reviewing the active test lives, we determined that the assumed forfeiture percentage was not being applied as described in the valuation report. We are not sure whether the intended assumption was the one described in the valuation report or the one used in the programming. **In either case, the report language or the programming should be updated to be consistent with the other.**

   If the assumption described in the valuation report was the intended assumption, we estimate that the Actuarial Present Value of Projected Benefits for active participants was overstated by approximately $4.8 million, or 0.1% of the active subtotal and 0.03% of the total Actuarial Present Value of Projected Benefits.

These recommendations for improvement, as well as other recommendations, are discussed in the following sections of this audit report.

Section I: Valuation Results

Liability Replication

In replicating the results of the NHRS valuation as of July 1, 2017, we found that, overall, GRS has a sound valuation process. We matched the valuation results and the test life output within an acceptable range. A comparison of the valuation results is displayed on the following page. Differences less than 5% are generally considered a reasonable match. The results are well within that tolerance.

Please note that Segal's results throughout this section do not include the effect of the programming recommendations presented later in this section. The results shown represent the closest match of GRS results based on our reading of their valuation report, the test life information provided, and their responses to our follow-up questions.

Pension

Total Plan

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$7,607,048,274	$7,650,982,613	0.6%
– Retirement	6,199,399,972	6,240,540,207	0.7%
– Disability	240,350,766	242,995,194	1.1%
– Termination and Death	1,167,297,536	1,167,447,212	0.0%
• Normal Cost	9.89%	10.74%	8.6%
• Actuarial Accrued Liability (AAL)	$5,618,894,021	$5,540,110,956	-1.4%
Inactive and Vested Deferred Members	$274,115,019	$275,054,197	0.3%
Retirees and Beneficiaries	$7,315,440,334	$7,153,185,107	-2.2%
Total			
• Actuarial Present Value of Projected Benefits	$15,196,603,627	$15,079,221,917	-0.8%
• Actuarial Accrued Liability (AAL)	13,208,449,374	12,968,350,260	-1.8%

Actuarial firms each have their own software programs for calculating normal costs and liabilities. Even with the same actuarial assumptions and cost method, it is unlikely that any two firms will perform calculations in exactly the same way. For example, even though GRS and Segal both assumed mid-year decrements (besides the retirement decrement for Teachers), the application of that methodology was different between the two firms. Ultimately, we are able to approximate the GRS mid-year methodology.

Differences in the determination of the Normal Cost and the Actuarial Present Value of Future Normal Cost are very common. As can be seen in the chart above, the replication of the total Actuarial Present Value of Projected Benefits was within 0.8%. However, the replication of the Normal Cost was 8.6% higher and the replication of the total Actuarial Accrued Liability was 1.8% lower. Given the very close match of the Actuarial Present Value of Projected Benefits, we consider the overall match results to be reasonable.

Pointing out software differences should not be construed as an indication that one firm or the other is "correct." We do so only to provide complete disclosure.

The results by subgroup are shown below:

Employees

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$2,615,462,557	$2,630,779,994	0.6%
– Retirement	2,107,629,587	2,128,760,588	1.0%
– Disability	75,759,051	74,150,968	-2.1%
– Termination and Death	432,073,919	427,868,438	-1.0%
• Normal Cost	8.57%	8.93%	4.3%
• Actuarial Accrued Liability (AAL)	$1,940,791,059	$1,926,182,059	-2.3%
Inactive and Vested Deferred Members	$126,844,033	$127,257,576	0.3%
Retirees and Beneficiaries	$2,272,435,799	$2,186,874,397	-3.8%
Total			
• Actuarial Present Value of Projected Benefits	$5,014,742,389	$4,944,911,967	-1.4%
• Actuarial Accrued Liability (AAL)	4,340,070,891	4,240,314,032	-2.3%

Teachers

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$2,973,634,633	$2,996,722,278	0.8%
– Retirement	2,481,905,032	2,507,922,769	1.0%
– Disability	53,193,025	51,923,413	-2.4%
– Termination and Death	438,536,576	436,876,096	-0.4%
• Normal Cost	8.51%	9.85%	15.8%
• Actuarial Accrued Liability (AAL)	$2,228,224,889	$2,219,761,840	-0.4%
Inactive and Vested Deferred Members	$116,210,208	$116,688,557	0.4%
Retirees and Beneficiaries	$2,819,228,419	$2,757,821,505	-2.2%
Total			
• Actuarial Present Value of Projected Benefits	$5,909,073,260	$5,871,232,340	-0.6%
• Actuarial Accrued Liability (AAL)	5,163,663,516	5,094,271,902	-1.3%

Police

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$1,343,024,134	$1,346,705,131	0.3%
– Retirement	1,038,389,653	1,032,374,568	-0.6%
– Disability	76,389,141	80,374,597	5.2%
– Termination and Death	228,245,340	233,955,966	2.5%
• Normal Cost	16.24%	17.53%	7.9%
• Actuarial Accrued Liability (AAL)	$970,196,717	$932,810,794	-3.9%
Inactive and Vested Deferred Members	$27,164,521	$27,175,992	0.0%
Retirees and Beneficiaries	$1,526,761,108	$1,516,861,390	-0.6%
Total			
• Actuarial Present Value of Projected Benefits	$2,896,949,763	$2,890,742,513	-0.2%
• Actuarial Accrued Liability (AAL)	2,524,122,346	2,476,848,176	-1.9%

Fire

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$674,926,950	$676,775,210	0.3%
– Retirement	571,475,700	574,482,282	0.0%
– Disability	35,009,549	36,546,216	4.4%
– Termination and Death	68,441,701	68,746,712	0.4%
• Normal Cost	17.80%	19.25%	8.2%
• Actuarial Accrued Liability (AAL)	$479,681,356	$461,356,263	-3.8%
Inactive and Vested Deferred Members	$3,896,257	$3,932,072	0.9%
Retirees and Beneficiaries	$697,015,008	$691,627,815	-0.8%
Total			
• Actuarial Present Value of Projected Benefits	$1,375,838,215	$1,372,335,097	-0.3%
• Actuarial Accrued Liability (AAL)	1,180,592,621	1,156,916,150	-2.0%

Medical Subsidy

Total Plan

	GRS	Segal	Ratio of Segal/GRS
Active Members			
• Actuarial Present Value of Projected Benefits	$139,488,146	$138,900,926	-0.4%
– Employees – State	0	0	0.0%
– Employees – Political Subdivisions	0	0	0.0%
– Teachers	0	0	0.0%
– Police and Fire	139,488,146	139,488,146	-0.4%
• Actuarial Accrued Liability (AAL)	127,871,910	106,288,066	-16.9%
Retirees and Beneficiaries			
• Actuarial Present Value of Projected Benefits	$568,676,429	$568,156,685	-0.1%
– Employees – State	67,701,241	67,721,232	0.0%
– Employees – Political Subdivisions	53,651,633	53,167,340	-0.9%
– Teachers	241,519,017	240,723,437	-0.3%
– Police and Fire	205,804,538	206,544,676	0.4%
Total			
• Actuarial Present Value of Projected Benefits	$708,164,575	$707,057,611	-0.2%
• Actuarial Accrued Liability (AAL)	696,548,339	674,444,751	-3.2%

Test Life Output

We requested specific test lives in order to compare the benefit amounts projected in the valuation against our understanding of the NHRS benefits summarized in the valuation report and to assist in the matching of the overall results. A review of test lives generally permits the auditing actuary to understand the retained actuary's valuation programming on a micro basis.

We were provided with results for 34 test lives, including 18 active members seven terminated vested members, nine retirees and beneficiaries, and six test lives for the medical subsidy. The key characteristics of these test lives, as well as a comparison of the Actuarial Present Value of Projected Benefits between GRS and Segal are outlined below.

We were ultimately able to replicate all test life results within a reasonable tolerance, as shown in the charts below.

Active Test Lives

Group	Description	GRS PVB	Segal PVB	Percent Difference
Employees	• Hired before 7/1/2011, vested as of 1/1/2012	$98,333	$101,876	3.6%
	• Hired before 7/1/2011, not vested as of 1/1/2012	81,152	79,431	-2.1%
	• Hired after 7/1/2011	44,704	44,652	-0.1%
Teachers	• Hired before 7/1/2011, vested as of 1/1/2012	$346,545	$350,138	1.0%
	• Hired before 7/1/2011, not vested as of 1/1/2012	205,437	200,770	-2.3%
	• Hired after 7/1/2011	66,974	68,798	2.7%
Police	• Hired before 7/1/2011, vested as of 1/1/2012	$347,104	$347,408	0.1%
	• Hired before 7/1/2011, 8-10 YOS as of 1/1/2012	212,409	211,570	-0.4%
	• Hired before 7/1/2011, 6-8 YOS as of 1/1/2012	331,769	331,374	-0.1%
	• Hired before 7/1/2011, 4-6 YOS as of 1/1/2012	322,455	323,920	0.5%
	• Hired before 7/1/2011, 0-4 YOS as of 1/1/2012	162,672	162,885	0.1%
	• Hired after 7/1/2011	160,764	167,174	4.0%
Fire	• Hired before 7/1/2011, vested as of 1/1/2012	$713,204	$714,004	0.1%
	• Hired before 7/1/2011, 8-10 YOS as of 1/1/2012	218,507	218,977	0.2%
	• Hired before 7/1/2011, 6-8 YOS as of 1/1/2012	277,027	276,355	-0.2%
	• Hired before 7/1/2011, 4-6 YOS as of 1/1/2012	270,361	271,367	0.4%
	• Hired before 7/1/2011, 0-4 YOS as of 1/1/2012	179,246	178,067	-0.7%
	• Hired after 7/1/2011	131,839	135,171	2.5%
Total Active Test Life Suite:		$4,170,502	$4,183,937	0.3%

Terminated Vested Test Lives

Group	Description	GRS	Segal	Percent Difference
Employees	• Hired before 7/1/2011, vested as of 1/1/2012	$46,940	$46,966	0.1%
	• Hired after 7/1/2011	48,514	45,313	-6.6%
Teachers	• Hired after 7/1/2011	101,804	101,875	0.1%
Police	• Hired before 7/1/2011, vested as of 1/1/2012	103,336	104,887	1.5%
	• Hired after 7/1/2011	130,363	132,394	1.6%
Fire	• Hired before 7/1/2011, vested as of 1/1/2012	51,130	51,556	0.8%
	• Hired after 7/1/2011	124,923	126,596	1.3%
Total Terminated Vested Test Life Suite:		$4,170,502	$4,183,937	0.3%

Pay Status Test Lives

Group	Description	GRS	Segal	Percent Difference
Employees	• Nondisabled, Straight Life Annuity	$728,749	$726,416	-0.3%
	• Nondisabled, Straight Life Annuity	818,991	827,456	1.0%
Teachers	• Nondisabled, Straight Life Annuity	951,952	946,928	-0.5%
	• Nondisabled, 100% J&S	735,664	739,851	0.6%
Police	• Nondisabled, 50% J&S w/ Popup (Cash Refund	152,377	153,095	0.5%
	• Nondisabled, 100% J&S	1,036,530	1,033,363	-0.3%
	• Nondisabled, 50% J&S w/ Popup (Cash Refund)	55,214	55,461	0.4%
Fire	• Nondisabled, 100% Joint & Survivor	312,842	310,502	-0.7%
	• Disabled, Straight Life Annuity	681,009	677,360	-0.5%
Total Pay Status Test Life Suite:		$4,170,502	$4,183,937	0.3%

Medical Subsidy Test Lives

Group	Description	GRS	Segal	Percent Difference
Employees	• Nondisabled Surviving Spouse	$62,766	$62,659	-0.2%
Teachers	• Nondisabled Surviving Spouse	39,164	39,377	0.5%
Police	• Active, Hired before 6/30/2000	75,527	76,455	1.2%
	• Disabled Retiree	53,455	53,889	0.8%
Fire	• Active, Hired before 6/30/2000	94,089	94,510	0.4%
	• Disabled Retiree	74,966	74,767	-0.3%
Total Medical Subsidy Test Life Suite		$399,967	$401,657	0.4%

We note that the total pay status test life suite matched within 0.3% and that the individual test lives within this suite matched within -0.7% and 1.0%, compared to a -2.2% match for all retirees and beneficiaries. The match of the retiree and beneficiary liability for the Employee and Teacher groups was -3.8% and -2.2%, respectively. Segal has discussed this discrepancy with GRS, but GRS did not have any suggestions as to the source of the discrepancy. Given that the pay status test lives are closely matching GRS and that retiree liabilities typically produce a very close match, NHRS may want to investigate this difference at a later date. We would be happy to compare retiree liabilities on an individual basis with GRS to determine the cause of the discrepancy.

Contribution Rates

We were able to replicate the methodology used to determine the amortization payments on the unfunded actuarial accrued liability, and consequently, the total and employer contribution rates, as a percentage of payroll.

Recommendations

As mentioned previously, the results presented throughout this section represent the closest match of GRS results based on our reading of their valuation report, the test life information provided, and their responses to our follow-up questions. Given that we were able to replicate their results closely, we are confident that we understand GRS's programming methodology. With that in mind, we offer the following suggestions to improve the accuracy of the results:

1. RSA 100-A:11 provides that the excess, if any, of the payments to a retired member and survivor, if applicable, over the accumulated contributions at retirement, will be paid to a named beneficiary or the member's estate. A review of the pay status test lives indicates that for current retirees, the retiree's contribution account value at retirement, without reducing the balance for payments received prior to the valuation date, are used to determine the value of any future "cash refund" lump sum that may be payable. **We recommend that GRS calculate the retiree's remaining contribution account balance as of the valuation date to determining the value of any future "cash refund" lump sum.**

   We estimate that the current methodology overstates retiree liabilities by approximately $52 million, or 0.7% of retiree liabilities and 0.3% of the total Actuarial Present Value of Projected Benefits.

2. After reviewing the terminated vested test lives, we determined that the transition rules applicable to members hired prior to July 1, 2011, but who are not vested as of January 1, 2012, were not being used to determine eligibility for retirement, resulting in a slight overstatement of liabilities. **We recommend incorporating the transition rules into the determination of the retirement age.**

   We estimate that the overstatement of terminated vested participant liabilities is approximately $0.5 million, or 0.2% of terminated vested participant liabilities and 0.003% of the total Actuarial Present Value of Projected Benefits.

In addition, we determined that time elapsed between the date of termination and the valuation date was not used to determine eligibility for retirement, resulting in an understatement of liabilities. **We recommend that GRS program this plan provision.**

We estimate that the current methodology understates vested deferred liabilities by approximately $2.5 million, or 0.9% of vested deferred liabilities and 0.02% of the total Actuarial Present Value of Projected Benefits.

3. After reviewing the active test lives, we determined that the assumed forfeiture percentage was not being applied as described in the valuation report. The GRS report notes that the forfeiture assumption for vested members who quit before retirement and elect a refund of their accumulated contribution is 25% at first vesting eligibility, grading to 0% at first retirement eligibility. GRS later confirmed that their programming assumes 25% of members who quit before retirement with 10-15 years of service will elect the refund of contributions and forfeit their pension. We are not sure whether the intended assumption was the one described in the valuation report or the one used in the programming. In either case, the report language or the programming should be updated to be consistent with the other.

   If the assumption described in the valuation report was the intended assumption, we estimate that the Actuarial Present Value of Projected Benefits for active participants was overstated by approximately $4.8 million, or 0.1% of the active subtotal and 0.03% of the total Actuarial Present Value of Projected Benefits.

Section II: Demographic and Financial Information

Demographic Data Review

Actuarial Standard of Practice (ASOP) No. 23, *Data Quality*, is the guiding standard used by actuaries to ensure that the information upon which actuarial calculations are based is sufficient for its intended purpose. The ASOP does not require the actuary to audit the data; the accuracy and comprehensiveness of the data is the responsibility of those supplying it. However, the actuary should review the data for reasonableness and consistency. If the actuary believes that there are questionable or inconsistent data values that could have a material impact on the analysis, the actuary should consider further steps, when practical, to improve the quality of the data.

The actuary should also comply with the requirements of ASOP No. 41, *Actuarial Communications*, to indicate the source of the data, to describe (at a high level) the process used to evaluate the data, and to disclose any adjustments or modifications made to it.

Segal Consulting was provided with the data file that NHRS sent to GRS for purposes of the June 30, 2017 actuarial valuation. GRS stated that the data as provided by NHRS was used for valuation purposes, with no additional adjustments needed. However, during this audit, it was determined that GRS does make some modifications to the data for valuation purposes, including specific group exclusions.

In compliance with the ASOPs, GRS provides the source of the data used in the valuation in the cover letter and discloses that reasonableness checks were completed as part of the valuation process. Section D of the valuation report, a section entitled "Participant Data," summarizes the data received. We suggest an explicit disclosure of any data that was not used.

Overall, we have found no reason to doubt the substantial accuracy of the information on which the valuation was based. The data was comprehensive and largely complete as provided by NHRS, and the follow-up communications between the actuary and System staff were reasonable. We confirmed, wherever possible, that any NHRS responses were incorporated into the valuation data file. We acknowledge that NHRS has protected employees' personal information by masking part of the Social Security number in the actuarial file and instead uses a different unique identifier ("Entity") to allow tracking of participants from year to year, which is commendable.

We were able to substantially match the participant counts, average age and service, and average salary and total payroll, and average and total retirement benefits with those shown in GRS's valuation report. We believe the slight differences in average salary and total payroll are due to different calculations to annualize salary for new hires. The participant information shown in the GRS report and our duplication of this information is summarized at the end of this section.

Our comments and suggestions regarding the participant data are as follows:

1. We note that for active and terminated vested participants with service in Group I and II, one record is provided for each individual, with separate accrued benefits shown for periods of

service with each group. However, if a participant in pay status has service in more than one group, multiple records are provided. In addition, if a retiree purchased additional service, the benefit associated with the purchased service is shown in a separate record. We determined there were 2,577 retirees with two or more records. For those 2,577 retirees, there were 5,212 records, meaning that the participant counts for those in-pay were inflated by 2,635 additional records. (1,702 of the additional records were associated with service purchases, while the remainder were retirees with benefits in more than one group.) The result of the overstatement is that the ratio of actives to retirees, often used as a barometer for the relative maturity of a pension plan, is slightly understated. In addition, although the scope of our audit did not include a review of GASB accounting results, GRS should ensure that these duplicates are excluded when determining the averaged expected remaining service lifetime used for the pension expense calculation. We understand the need to accurately allocate liabilities to the correct group. However, we recommend also showing the number of in-pay individuals across all plans.

2. GRS stated that that the data files as provided by NHRS were used for the valuation, and there were no separate scrubbed data files. During our review, GRS indicated that the following updates had been made to the data files for valuation purposes:

   - 102 active participants reported with a zero salary were excluded from the valuation. **For situations where data is missing, we recommend reviewing these records with NHRS, and possibly valuing them with an average value for similar participants with known information, rather than excluding them entirely.**
   - 7 terminated vested participants were excluded from the valuation because the annual benefit amount is less than $100. **We recommend reviewing these records with NHRS and determining whether these are valid records. We also suggest the exclusion should be noted in the report.**
   - 2,897 medical subsidy records were excluded from the valuation since they have a blank subsidy amount and are not Teachers or Employees under the age of 60 at the valuation date. Such participants are not eligible to receive a benefit, so the exclusion is valid.

3. During our review of the active participants eligible for the post-retirement medical subsidy, we determined that 2,646 active employees in the Police and Fire plans with a contribution basis date prior to July 1, 2005 should be included, compared to 2,636 in GRS's report. We have reviewed this difference with GRS and they agree with our number. GRS will update their method for determining the eligible group for the June 30, 2018 valuation.

4. In the course of checking the data summaries in the report, we found two values that appear to have been switched in the Pension Executive Summary (page 3). The number of Non-Vested Inactive Terminations for Teachers should be 3,113 and the number of Non-Vested Inactive Terminations for Fire should be 43.

Summary of Data

A comparison of the participant counts is shown on the following pages:

Active Members

	GRS	Segal	Difference
Employees			
• Number	24,478	24,477	0.00%
• Average age	49.2	49.2	0.0
• Average service	11.1	11.1	0.0
• Average salary	$48,187	$48,446	0.54%
• Total payroll supplied, annualized	$1,179,518,298	$1,185,803,296	0.53%
Teachers			
• Number	17,617	17,617	0.00%
• Average age	46.1	46.1	0.0
• Average service	13.5	13.5	0.0
• Average salary	$60,932	$60,998	0.11%
• Total payroll supplied, annualized	$1,073,446,998	$1,074,595,418	0.11%
Police			
• Number	4,151	4,151	0.00%
• Average age	39.1	39.1	0.0
• Average service	11.0	11.0	0.0
• Average salary	$70,104	$70,799	0.99%
• Total payroll supplied, annualized	$291,003,704	$293,885,961	0.99%
Fire			
• Number	1,640	1,641	0.06%
• Average age	41.3	41.3	0.0
• Average service	13.2	13.2	0.0
• Average salary	$75,392	$75,738	0.46%
• Total payroll supplied, annualized	$123,642,532	$124,285,903	0.52%
Total			
• Number	47,886	47,886	0.00%
• Average age	46.9	46.9	0.0
• Average service	12.1	12.1	0.0
• Average salary	$55,708	$55,936	0.41%
• Total payroll supplied, annualized	$2,667,611,532	$2,678,570,578	0.41%

Inactive Members

	GRS	Segal	Difference
Terminated employees entitled to benefits but not yet in pay status			
• Number	2,281	2,281	0.00%
• Average age	52.0	51.8	-0.2
Non-vested inactive members who have a remaining contribution balance			
• Number	10,477	10,477	0.00%
Service Retirees			
• Number	31,186	31,186	0.00%
• Annual benefits	$639,679,378	$639,682,672	0.00%
• Average benefit	$20,512	$20,512	0.00%
• Average age	70.0	70.2	0.2
Disability Retirees			
• Number	1,600	1,600	0.00%
• Annual benefits	$31,739,977	$31,739,968	0.00%
• Average benefit	$19,837	$19,837	0.00%
• Average age	64.0	64.0	0.0
Beneficiaries			
• Number	2,908	2,908	0.00%
• Annual benefits	$41,692,950	$41,692,950	0.00%
• Average benefit	$14,337	$14,337	0.00%
• Average age	73.9	73.9	0.0

Post-Retirement Medical Subsidy

	GRS	Segal	Difference
Employees (State) - Retirees	1,709	1,709	0.00%
Employees (Political Subdivision) - Retirees	1,210	1,210	0.00%
Teachers - Retirees	4,278	4,278	0.00%
Police and Fire - Retirees	2,808	2,808	0.00%
Police and Fire - Actives	2,636	2,646	0.38%

Section III: State Statutes and Board Policies

We reviewed New Hampshire Title VI, Public Officers and Employees, Chapter 100-A, as amended, to confirm that GRS correctly identified the benefits to be valued in a consistent manner based on the Summary of Plan Provisions in the accounting report. We also reviewed the GRS valuation methodology for compliance with Chapter 100-A:16, which sets forth the statutory Method of Financing.

Comments on the Plan Provision Summary

1. The description of the plan provisions in the GRS reports are generally consistent with the applicable statute.

2. It would be helpful to the reader to use consistent language when referring to the three participant “tiers” within each group. Currently, the distinction between tiers is worded slightly differently across different benefit provisions.

3. The Group I *Earnable Compensation* summary should be revisited.

   a. The first paragraph covering members who have attained vested status prior to January 1, 2012 does not mention “compensation for extra and special duty” but the second paragraph covering all other members does specifically acknowledge “compensation for extra and special duty.” Since “compensation for extra and special duty” is recognized for employees hired prior to July 1, 2011, it would be clearer as a new paragraph.

   b. The reference in the second paragraph to “active members … who are not in vested status on or after January 1, 2012” is confusing. The statute more aptly says “members who have not attained vested status prior to January 1, 2012.”

   c. The first sentence in the second paragraph says “holiday and vacation pay, sick pay, and longevity pay” are included for members who began service before July 1, 2011 and have not attained vested status prior to January 1, 2012 and members who began service on or after July 1, 2011. However, Section 100-A:1, XVII(b)(1) and (4) do not appear to provide for holiday, vacation, and sick pay for these members.

   d. The effective date for Earnable Compensation would be clearer as a new paragraph.

   e. We suggest the IRC Section 401(a)(17) annual compensation limit be referenced.

4. Under Group I *Ordinary Disability, Benefit*, the first sentence should more accurately read “If age 60 or older, the Service Retirement Benefit as calculated under benefit provisions for members hired prior to July 1, 2011.”

5. The Group 1 *Vested Termination* summary should specify that the reduced early service retirement benefit begins at age 60 “if the member has 30 years of creditable service” for members hired after July 1, 2011.

6. When a “refund of accumulated contributions” is referenced in Group 1 *Vested Termination*, we suggest clarifying that this refers to member contributions only, rather than both member and employer contributions.

7. The Group 1 *Maximum Benefit* summary distinguishes between members who were “hired prior to July 1, 2009” and “members who commenced service on or after July 1, 2009 or are non-vested as of January 1, 2012.” The former group should more accurately read “hired prior to July 1, 2009 *or have attained vested status prior to January 1, 2012*” while the latter group should read “members who commenced service on or after July 1, 2009 *and* are non-vested as of January 1, 2012.” As the summary is currently written, a participant hired prior to July 1, 2009 and non-vested as of January 1, 2012 falls within both groups.

8. Under Group 1 *Refunds*, the second condition for death in service other than accidental death should be expanded to add “if at the time of death, the member is not eligible for a service retirement.” See Section 100-A:11, I(b).

9. Under Group 1 *Refunds*, the third condition for death prior to age 60 should clarify the member’s accumulated contribution “at the time of death” are payable. See Section 100-A:11, I(c).

10. The statutory reference under Group I *Member Contributions* should be RSA 100-A:16, II(g) rather than (h).

11. We suggest the same revisions to Group II plan provisions as described in items 3, 6, 7, 8, 9, and 10 for Group I.

12. The Group II *Service Retirement* summary shows eligibility at “age 50 with 25 years of creditable service or age 60” for members hired on or after July 1, 2011. Age 50 should be age 52.5. In addition, members who began service before July 1, 2011 and have not attained vested status prior to January 1, 2012 have a maximum of 40.5 years of creditable service.

13. The Group II summary has the Early Retirement provisions embedded in the Service Retirement section, whereas the Group I summary includes a separate section for *Early Retirement* . We suggest making the format consistent between the two groups. We find a separate section easier to read, but note the statute itself does not specifically define Early Retirement.

14. The Group II *Service Retirement* summary describes a minimum annual service retirement allowance of $10,000 that is provided to members at age 45 with 20 years of service. While this is correct for members who have attained vested status prior to January 1, 2012, the age and service requirement is different for other members.

15. The second paragraph under the Group II *Post Retirement Death* summary for members “retired on or after April 1, 1987” should be expanded to note that the benefit payable to the surviving spouse is only payable if the member had 20 years of service.

16. Under the Group II *Optional Forms*, it does not appear that the Option 4 survivor benefit is limited to 50%.

Comments on the Funding Policy Summary

The description in Section F of the GRS actuarial valuation report is generally consistent with Section 100-A:16 of the statute.

We note that the statute no longer refers to an amortization period of “30 years or the maximum period allowed by standards adopted by the Government Accounting Standards Board (GASB), whichever is less” and now allows for 20-year amortization of changes in the unfunded liability after June 30, 2017. We recognize the statute may have been revised after the valuation report was completed. If not yet done, the NHRS Actuarial Funding Policy and Section F of future actuarial valuation report should be updated to reflect these changes in the statute.

Section IV: Review of Actuarial Standards of Practice

ASOP No. 4

Actuarial Standard of Practice (ASOP) No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, is the umbrella standard for actuaries performing pension plan valuations. It provides guidance to the actuary for measuring and disclosing pension plan obligations. Actuaries should assess the plan sponsor's funding policy and disclose rationale for the procedures used. In general, we find the GRS actuaries have met the standards of ASOP No. 4 and the procedures used to determine required contribution rates are reasonable.

Disclosures required by ASOP No. 4 include the intended purpose of the measurement, a summary of the plan provisions, data, and assumptions, a description of the normal cost method used, the amortization method, funded status using both an actuarial value and market value, and disclaimers about future measurements.

ASOP No. 4 directs actuaries to other actuarial standards for guidance on assumptions and methods. Our audit of the GRS Experience Study includes commentary on the guidance provided by ASOP No. 27 (Economic Assumptions), No. 35 (Non-Economic Assumptions) and No. 44 (Asset Valuation Methods). We generally found GRS to have met these standards.

ASOP No. 23

ASOP No. 23, *Data Quality*, provides guidance to the actuary reviewing data. An audit of the data is not required but the data should be reviewed for reasonableness given the purpose of the measurement being performed. In addition, the actuary should disclose any questionable data that may have a significant affect on the results and any assumptions made for missing or questionable data. In general, we find the GRS actuaries have met the standards of ASOP No. 23.

ASOP No. 41

ASOP No. 41, *Actuarial Communications,* recognizes that complete disclosure of all supporting information is neither practical nor necessary. Section 3.2 of ASOP 41 states that the actuary should "identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report."

In general, we found the GRS description of assumptions and methods to be clear and comprehensive.

Other suggestions for improved communication in the actuarial report can be found in Section V.

ASOP No. 51

ASOP No. 51, *Assessment and Disclosure of Risk*, is effective for valuations with measurement dates on or after November 1, 2018. While not required for the June 30, 2017 actuarial valuation prepared by GRS, they did include some basic risk measures (see page 29) and a discussion of Risk Management in Section F. This discussion highlights Board policies for managing the Funding Risk, Demographic and Investment Risk, Asset Liability Studies, and Benefit Risk.

Beginning with the June 30, 2019 actuarial valuation, we would anticipate GRS will be identifying material risks and providing additional information about the risks of actual future measurements deviating from expected due to experience deviating from the assumptions. We also suggest that the risk measures presented on page 29 include a discussion of how these measures evaluate risk and any trends that may be developing.

NHRS Funding Policy

The Actuarial Funding Policy in Section F of the actuarial report includes a statement of "Overall Conformance with Professional Standards of Practice." The Board may wish to expand the policy to require the actuary to meet the Qualification Standards of the American Academy of Actuaries.

Section V: Review of Valuation Report

GRS generally provides a comprehensive actuarial valuation report, which includes sufficient information for an individual to gain a clear understanding of the financial picture of the System.

In addition to the suggestions noted earlier in this audit, we offer the following additional comments and suggestions with respect to increasing the usefulness and understanding of the valuation report:

1. It would be helpful to have a description of the interaction between the pension and medical subsidy plans in the Introductory Section. In particular, GRS should clarify whether the assets are separate or commingled. In the Other Highlights paragraph on page 1, the asset gain was reported for the combined pension and medical subsidy assets. However, elsewhere the medical subsidy is described as pay-as-you-go. We also note that in the Results of the Valuation section, the text below the tables on page 11 seems to transition to the medical subsidy plans without being clearly identified.

2. The Highlights include a footnote with the grand total contribution rates for NHRS (State and Political Subdivisions combined). We suggest GRS either discuss why these rates are meaningful, or eliminate the footnote.

3. The Executive Summary of Contribution Rates concludes on page 6 with the Estimated Dollar Amount of Contributions for Fiscal Year 2020 and Fiscal Year 2021. It is not clear if this is Employer Contributions or Total Contributions.

4. The Comparison of Pension Liabilities by Type on page 8 includes a band labeled “Casualty” that should be explained.

5. It would be helpful to indicate on the Historical Pension Funded Status chart on page 9 when any material assumption or plan changes occurred, or the impact of other significant experience (for example the reduction in assets from 2008 to 2009).

6. The Variability of Future Contribution Rates on page 14 states that the level percent of payroll amortization assumes the plan will remain open to new hires and the active membership will remain level, and discloses that to the extent this doesn’t occur, there may be variability in future rates. We suggest that this concept could be discussed further using the recent decline in the number of active Teachers and the change in the Teacher’s payroll growth assumption.

7. The actuarial experience is reviewed in Comment #1, including a reference to additional information on page 28. Although the information on page 28 provides a breakdown of the total gain between pension and medical subsidy, we suggest GRS disclose the primary sources of non-investment experience gains and losses.

8. In Comment #2, the normal cost rates are shown for members hired on or after July 1, 2011. It would be useful for users of the report to see the normal cost rates for participants hired prior to July 1, 2011.

10. In Comment #3, GRS advises the medical subsidy benefits continue to warrant close monitoring and discloses that each subaccount is assumed to maintain a 20% margin each year. We suggest GRS may want to comment on the appropriateness of the 20% margin.

11. Ten-year projections are shown assuming all assumptions are met. We suggest showing longer projections to demonstrate that the unfunded liability will be paid off. We also suggest showing alternative projections to demonstrate the risk of investment losses, lower than anticipated payroll growth, or unfavorable retirement experience.

12. In developing the contribution rates, it would be helpful to the reader to show projected payroll for each group in addition to the contribution rate as a percent of payroll. A comparison of the prior year's projected contributions in dollars to actual dollars of contributions made would be helpful in monitoring funding progress.

13. Projections of the unfunded liability payoff are shown on both a level percent of payroll amortization and a level dollar amortization. We suggest commentary explaining the different approach and why it is included would be helpful to the reader.

14. The Summary of Membership Data on page 52 includes a comparison with the prior year's figures. Including a comparison to the prior year's information for each participant group and showing certain statistics over a longer period of time would provide the reader with useful trend information.

Section VI: Conclusions

Based on our review of the NHRS June 30, 2017 actuarial valuation, it is evident that steps have been taken to resolve the imbalance between the System's benefit levels and the resources available to pay for them. The benefits for recent and future hires are less generous than those previously provided to the employees, and the NHRS Funding Policy outlines an actuarially calculated contribution with a reasonable amortization period for the unfunded liabilities.

To reiterate our comments in the Executive Summary, the GRS appears to have reasonably valued the expected liability of the System based on their stated assumptions and methods. GRS has applied the funding methodology appropriately to develop a contribution recommendation for the System, and the valuation report conforms to accepted actuarial principles and practices.

In this audit, we have noted areas that we believe will refine the liability calculations and will improve the usefulness and clarity of the System's annual actuarial valuation report. We are available to discuss any aspect of our review with the NHRS Board of Trustees, NHRS Staff, or the System's actuary.

Segal Consulting is independent of Gabriel Roeder Smith & Company, and we are not aware of any conflict of interest that would impair the objectivity of our actuarial audit of their work.