Segal Consulting

New Hampshire Retirement System

LIMITED SCOPE AUDIT OF 5-YEAR EXPERIENCE STUDY: JULY 1, 2010 - JUNE 30, 2015

May 31, 2019

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May 31, 2019

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

Re: **Limited Scope Audit of the New Hampshire Retirement System 2010-2015 Experience Study**

Dear Mr. Murphy:

We are pleased to present the results of our audit of the 5-Year Experience Study covering the period July 1, 2010 through June 30, 2015 for the New Hampshire Retirement System (NHRS or System). The purpose of this audit is to conduct a review of the actuarial methods, assumptions, and procedures used by the System's actuary, Gabriel Roeder Smith & Company (GRS), in developing recommendations for actuarial assumptions to be employed by NHRS. Our audit also includes a review of the Experience Study report.

This review was conducted under the supervision of Tammy Dixon, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA, and Kathleen 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,

Tammy F. Dixon, FSA, MAAA, EA
Vice President and Actuary

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

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Limited Scope Audit of the 2010-2015 Experience Study 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 actuarial audit of the 5-Year Experience Study for the period ending June 30, 2015 performed by Gabriel Roeder Smith & Company (GRS). This report is separate from, but supplements, the full scope actuarial audit of the June 30, 2017 Actuarial Valuation that Segal also completed.

This actuarial audit has a specified, limited scope in its review. A full scope audit would have required the collection of six years' worth of data and replication of the 5-Year Experience Study from start to finish. This limited scope audit reviews the analysis already performed, without a full parallel verification of the results. We have assumed that the exposures and decrement counts (*i.e.,* number of deaths, retirements, etc.) were properly determined.

Segal reviewed the Experience Study report, the methodologies used to set the assumptions, and the recommendations that GRS provided. We considered the reasonableness of the proposed actuarial assumptions and methods in the context of our own experience, and those of other state and local pension systems.

Overall, it is our opinion that the methodologies used to examine the System's assumptions and methods are reasonable and comply with the Actuarial Standards of Practice. With that said, Segal does have suggested modifications for NHRS to consider before finalizing the assumptions for the next experience study. We also offer ideas for improving the quality and understanding of the Experience Study report.

The following is a summary of our key conclusions:

1. In our opinion, the 5-Year Experience Study for the period ending June 30, 2015 conforms to the appropriate Standards of Practice as promulgated by the Actuarial Standards Board.

2. The procedures used to analyze the assumptions are reasonable and in line with what Segal would have done if we had been the actuary for NHRS.

3. The material recommended economic and demographic assumptions appear to be reasonable. Some of the proposed rates for demographic assumptions are not between the rate observed during the study period and the prior assumed rate, and could potentially have been adjusted further. See Section II for additional details.

4. The actuarial cost method (individual entry age normal) also meets actuarial standards, and is the most commonly used method among public sector plans.

5. In our opinion, the asset valuation method, with five-year smoothing, is reasonable and meets actuarial standards.

These items and our recommendations are described in more detail throughout this report.

Section I: Recommendations for Economic Assumptions

Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations* (ASOP No. 27), provides guidance for setting economic assumptions used in actuarial valuations. GRS references ASOP No. 27 in their Experience Study report, and appears to have taken the guidance into account when making its recommendations for the economic assumptions.

On February 29, 2016, the Pension Task Force (PTF) of the Actuarial Standards Board (ASB) released a report summarizing its opinions on various proposals to change pension standards related to public pension plans. The New Hampshire Experience Study was published on March 11, 2016 and GRS had limited opportunity to take account of the PTF Report. However, we have considered this document in our review of the Experience Study.

As part of our review, we also compared the recommended set of economic assumptions to those used by a peer group of 180 pension plans covering state and local employees, the Public Plans Data (PPD). The PPD is maintained by the Center for Retirement Research at Boston College in partnership with the Center for State and Local Government Excellence and the National Association of State Retirement Administrators (NASRA). The current database is populated with information from CAFRs through the 2018 fiscal year. We also compared the NHRS assumptions to those reported in the February 2019 NASRA Issue Brief: *Public Pension Plan Investment Return Assumptions*, which includes data through December 31, 2018.

Economic assumptions have a significant effect on the development of System liabilities. Changes to these assumptions can substantially alter the results determined by the actuary. The goal is to have a consistent set of economic assumptions that appropriately reflect expected future economic trends. However, economic assumptions are uncertain, and, as a result, there may be a reasonable range of potential recommendations. Different actuaries will apply different professional judgment and may choose different reasonable assumptions.

The primary economic assumptions that affect the NHRS funding requirements are:

- Investment rate of return
- Wage inflation
- Price inflation
- Merit and longevity pay increases
- End of career payments
- Payroll growth and size of the active population
- Administrative expenses

Investment Rate of Return

The investment rate of return assumption is used to determine the present value of expected future benefit payments. The investment rate of return may also be referred to as the discount rate assumption.

Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance in developing economic assumptions. This ASOP was adopted in September 2013 and is applicable for actuarial valuations with measurement dates on or after September 30, 2014.

Excerpt from Actuarial Standard of Practice (ASOP) No. 27:

The investment return assumption reflects the anticipated returns on the plan's current and, if appropriate for the measurement, future assets. This assumption is typically constructed by considering various factors including, but not limited to, the time value of money; inflation and inflation risk; illiquidity; credit risk; macroeconomic conditions; and growth in earnings, dividends, and rents.

In developing a reasonable assumption for these factors and in combining the factors to develop the investment return assumption, the actuary may consider a broad range of data and other inputs, including the judgment of investment professionals.

3.8.1 Data

The actuary should review appropriate investment data. These data may include the following:

a) *current yields to maturity of fixed income securities such as government securities and corporate bonds;*
b) forecasts of inflation, GDP growth, and total returns for each asset class;
c) *historical and current investment data including, but not limited to, real and nominal returns, the inflation and inflation risk components implicit in the yield of inflation-protected securities, dividend yields, earnings yields, and real estate capitalization rates; and*
d) *historical plan performance.*

The actuary may also consider historical and current statistical data showing standard deviations, correlations, and other statistical measures related to historical or future expected returns of each asset class and of inflation. Stochastic simulation models or other analyses may be used to develop expected investment returns from this statistical data.

A key feature of ASOP 27 is the "building block" approach to setting assumptions. The "building block" approach uses the actuary's best estimate for the key components of economic assumptions: inflation, the risk-free rate of return, and the expected return premium (or risk premium) for each asset class. The actuary begins with a reasonable range for each component, and then selects a specific point within the range based on historical data, System specific data and the expectation concerning the future economic environment.

Building the Assumption

GRS recommended lowering the assumed rate below the previous 7.75% assumption, and showed the impact of using assumptions of 7.00%, 7.25% and 7.50%. As requested by the Board, GRS provided a range of reasonable assumptions for the Board's consideration. For purposes of our independent review, we will comment on the 7.25% investment return assumption used in the June 30, 2017 Actuarial Valuation.

GRS studied the capital market assumptions for each asset class provided by eight national investment consulting firms. The time horizon for the capital market assumptions varied amongst the investment consulting firms. Based on the assumptions received from the investment consulting firms and the target asset allocations from the System's Investment Policy, GRS used their Capital Market Assumption Modeler to reach an average expected real return of 4.79%. The actuary's assumed 2.5% price inflation assumption was added to the investment firms' average expected real return of 4.79% to arrive at an average expected nominal arithmetic return of 7.29%.

We tested the average 4.79% real rate of return generated by the GRS Capital Market Assumption Modeler for reasonableness, using SegalMarco's capital market assumptions and the System's target asset allocations as outlined in the GRS Experience Study report. Based on SegalMarco's 2016 capital market assumptions for a 20-year investment horizon, the median real rate of return was 4.43%. Adding the SegalMarco's 2016 price inflation assumption of 2.00% yields the median net investment return of 6.43%. If the SegalMarco median real rate of return were combined with the 2.50% price inflation assumption used by GRS, the median net investment return would be 6.93%. The difference in the time horizons for the assumptions used by GRS and Segal accounts for some of the difference in the expected returns.

Our review of the price inflation assumption is provided later in this report.

Benchmarks

The trend among public retirement systems is to lower the investment return assumption, particularly given the outlook for a low inflation environment. The NASRA February 2019 Issue Brief reports that more than 30% of plans reduced their assumed rate of return since February of 2018.

The average return assumption (weighted by plan size) for public sector retirement systems in the 2019 PPD data was 7.28%.

The median investment return assumption reported in the NASRA February 2019 Issue Brief is 7.25%. The net investment return assumptions range from 5.25% to 8.0%, with an average 7.27% average return.

The 7.25% assumption used for the June 30, 2017 valuation is in line with national benchmarks.

We believe the range of 7.00% to 7.50% for the investment rate of return assumption was reasonable at the time the Experience Study was prepared and that the Board's selection of the 7.25% assumption at the middle of the range was appropriate. We note the NHRS Board reviewed materials from NEPC, Alliance Bernstein, and the February 2016 NASRA Issue Brief

on Public Pension Plan Investment Return Assumptions, in addition to the GRS Experience Study, in setting its assumed rate of return assumption.

The GRS Experience Study report notes that the average expected nominal return of 7.29% represents the "*average* future expected return….However, in any given year it is less than 50% likely that this return will be achieved." **We recommend that GRS show the median (i.e. 50th percentile) expected return over the same time period. As noted by GRS, the median would be lower than the average expected return of 7.29%. The median is a critical value because there is a 50% probability that the actual annualized return exceeds the median value and a 50% probability that the actual annualized return falls below the median value, over the given time horizon. To provide a more complete picture of investment risk, we also recommend showing the 25th and 75th percentile expected returns. Using an example where the median return is 7.0%, the 25th percentile return is 5.5% and the 75th percentile return is 8.5%, another way to view this information is that there is a 50% probability that the expected return will be between 5.5% and 8.5%. Finally, for each of the investment return assumptions shown in the experience study, we recommend showing the probability of achieving that assumption over the given time horizon.**

Because expected returns vary over different time horizons, **we suggest that the time horizon for each manager in the investment survey be shown. In addition, we suggest that GRS consider showing results over different time horizons.**

Wage Inflation

Wage inflation is the portion of total salary increases due to macroeconomic factors such as productivity, price inflation, and labor market conditions. GRS recommended reducing the wage inflation from 3.75%, and showed the impact of lowering the assumptions to 3.50%, 3.25% and 3.00%. As requested by the Board, GRS provided a range of reasonable assumptions for the Board's consideration.

For purposes of our independent review, we will comment on the wage inflation rate of 3.25% used in the June 30, 2017 actuarial valuation. The wage inflation rate of 3.25% applies to all groups.

ASOP No. 27 suggests the actuary review appropriate inflation data in developing the assumed inflation component. This data may include consumer price indexes, the implicit price deflator, forecasts of inflation, yields on government securities of various maturities, and yields on nominal and inflation-indexed debt. GRS reviewed both long-term and more recent Social Security Administration data.

Because one component of the wage inflation assumption is price inflation, GRS examined the spread between average pay increases and price inflation during the study period. The Experience Study report showed a five-year summary of increases in average pay for each group – Employees, Teachers, Police, and Fire – and compared wage inflation and the underlying price inflation. The spreads of -0.3% to 0.2% of wage inflation over price inflation from 2010 through 2015 was lower than historical trends. GRS noted that they did not expect this pattern to persist and that a spread of 0.75% of wages over prices is reasonable.

We agree that the long-term 0.75% spread between wage inflation and price inflation, which represents real wage increases, is reasonable and the resulting wage inflation assumption of 3.25% selected by the Board is reasonable.

Price Inflation

GRS recommended reducing the price inflation from 3.0%, but they discouraged reducing the price assumption below 2%. GRS noted that price inflation assumptions of 2.75%, 2.50% and 2.25% would all be reasonable. GRS recommended the same inflation assumption for all four groups, which is logical since it is an overarching assumption for NHRS.

For purposes of our independent review, we will comment on the price inflation assumption of 2.50% used in the June 30, 2017 actuarial valuation.

The 2.50% assumption is consistent with the average annual intermediate inflation rate of 2.6% used by the Social Security Administration Office of the Chief Actuary. The NASRA Issue Brief reports the average inflation assumption to be 2.8%.

We believe the assumption of 2.50% for price inflation selected by the Board is reasonable.

Merit and Longevity Pay Increases

GRS recommended lowering the merit and longevity pay increases for Employees with three or more years of service and generally raising the pay increase assumptions for Teachers, Police, and Fire. The pay rates proposed by GRS are service-based and appear reasonable.

End of Career Pay Increases

GRS recommended reducing the load on normal, early, and vesting retirement for the impact of the late-career pay increases (such as end of career pay for severance, longevity, unused sick time, and unused vacation time). The loads for Employees, Teachers, Police, and Fire are 7.5%, 5.0%, 11.5% and 11.5%, respectively. The Experience Study report included available data for members with three complete years of service and with six complete years of service prior to retirement. Based on that data, we agree that the end-of-career assumption is reasonable.

NHRS no longer recognizes all forms of late-career pay for members hired after July 1, 2011 or members who were not in vested status as of January 1, 2012 and no load is applied for those members.

Payroll Growth and Size of Active Population

The payroll growth assumption represents the expected annual increase in total covered payroll from one year to the next. This assumption is used to determine the annual payment needed to amortize the unfunded actuarial accrued liability and the solvency medical subsidy contributions. To the extent that actual payroll increases are less than the assumed, fewer dollars will go toward paying off the unfunded liability than anticipated and future amortization payments will be larger (the converse is also true).

The payroll growth assumption is comprised of the real wage inflation assumption and the active population growth. Because GRS recommended lowering the wage inflation assumption, a lower payroll growth assumption was also recommended.

GRS reviewed both U.S. Census Bureau and New Hampshire population projections compared to the actual number of active participants in each group. GRS recommended assuming a level future active population for Employees, Police, and Fire, and an annual decline of 0.25% for Teachers. The Board selected a payroll growth assumption equal to the wage inflation assumption of 3.25% for purposes of determining the amortization payment of unfunded liabilities for Employees, Police, and Fire. For Teachers, the Board selected a payroll growth assumption of 2.75% which represents a 3.25% wage inflation assumption and an annual population decline of 0.50%.

We find that the development of the payroll growth assumptions is reasonable.

We recommend that GRS include a numerical assessment of funding risks if actual payroll growth is lower than assumed.

Administrative Expenses

NHRS includes an explicit administrative expense rate of 0.35% of payroll that is added to the normal cost for all groups. We agree this is a reasonable assumption.

Medical Subsidy

GRS recommended using the wage inflation assumption adopted by the Board (3.25%) as the discount rate for GASB Statement No. 43. We believe this is a reasonable approach.

GRS recommended using the assumed rate of return on investments adopted by the Board (7.25%) to determine the solvency contribution rate. Because the assets held for the medical subsidy are invested with the pension assets, we believe this is a reasonable approach.

Section II: Recommendations for Demographic Assumptions

The demographic assumptions used to value the System reflect the expected occurrence of various events among participants. The assumptions should reflect specific characteristics of the System and produce reasonable results. A reasonable assumption is one that is expected to model the contingency being measured and not expected to produce significant gains and losses. The types of demographic assumptions used to measure pension obligations include, but are not limited to the following:

- Mortality
- Withdrawal (termination of employment)
- Disability retirement
- Service and early retirement
- Others, including forfeitures and marriage assumptions.

Actuarial Standard of Practice No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations* (ASOP No, 35) provides guidance for setting noneconomic assumptions used in actuarial valuations. The standard recommends that the actuary follow a general process for selecting demographic assumptions.

The first step of this general process is to identify the types of assumptions to use. The actuary should consider relevant System provisions that will affect timing and value of any potential benefit payments, all contingencies that give rise to benefits or loss of benefits, and the characteristics of the covered group.

The next step in the process is to identify the relevant assumption universe. The assumption universe may include prior experience studies or general studies of trends relevant to the specific type of demographic assumption and System experience to the extent that it is credible.

The third step in the process is to consider the assumption format. The format may include different tables for different segments of the covered population (such as different turnover rates for municipal employees versus public safety).

The final step in the process is to select the assumptions and evaluate the reasonableness of each assumption. The specific experience of the System should be incorporated but not given undue weight if recent experience is attributable to a phenomenon that is unlikely to continue. For example, if recent rates of termination were due to a one-time reduction in workforce it may be unreasonable to assume that such rates will continue.

Overall, the methodology that GRS used to review experience and set proposed assumptions is similar to the approach that Segal would take for an experience review. We agree that consideration of the prior 5-Year Experience Study trends as part of the consideration for recognition of the most recent 5-year trends is appropriate.

In a later section of this audit report, Segal provides commentary on the format of the report with respect to the demographic assumptions. The findings below deal solely with assumption setting.

Mortality

Assumed mortality rates play a key role in determining a pension plan's liabilities, as they enable the actuary to anticipate the duration over which benefits will be paid. Post-retirement mortality assumptions are especially important. In the aggregate, the System is large enough to have credible mortality experience among non-disabled annuitants. However, the experience is not fully credible when broken into each participant group.

GRS used a credibility procedure in accordance with ASOP No. 25, *Credibility Procedures*, to assign partial credibility for each group. **We suggest GRS consider combining male and female experience for the Police and Fire groups when performing the next experience study and use the same adjustments for both genders.** This will provide some basis for adjusting the female mortality rates where female experience is very limited, rather than assuming for Police and Fire that male and female experience is totally uncorrelated.

GRS recommended mortality assumptions for all groups from the RP-2014 family of mortality tables. In particular, the assumption for all groups for death after retirement is the RP-2014 Healthy Annuitant Mortality Table and for death before retirement is the RP-2014 Employee Mortality Table. These tables are adjusted by group for credibility. Future mortality improvement is assumed for all groups by applying Scale MP-2015 fully generational to the RP-2014 tables adjusted to the base year of 2006.

Because the disabled life experience was not credible, GRS recommended the RP-2014 Disabled Retiree Mortality Table with the same generational mortality improvement scale and the same adjustments by group for credibility.

GRS also recommended no change in the weighting of ordinary and accidental deaths.

We find that the development of the mortality assumptions is reasonable.

As you know, the Society of Actuaries has released annual updates to the MP projections scales, In addition, in the fall of 2018, the Society of Actuaries (SOA) released mortality tables based on the experience of public sector plan participants for the first time. **We recommend consideration of newer MP improvement scales and the public sector tables, adjusted to reflect the System's experience, at the time of the next experience review.**

Withdrawal

The withdrawal assumption is comprised of service-based rates covering the first five years of employment and age-based rates thereafter. Withdrawal rates developed in the experience review were set such that the rates generally produce fewer expected terminations relative to the actual experience over the review period. In addition, the service period was reviewed and left unchanged. We believe the new withdrawal assumptions to be reasonable.

GRS recommended rates that are generally closer to the actual experience than to the prior assumed rates, as we would anticipate. We agree that economic conditions may have yielded fewer withdrawals than would normally be anticipated.

We observed that for certain groups and ages, the proposed rate is not between the crude observed rates and previous rates. We suggest refinements could have been made.

We understand that in some situations, this result may occur due to smoothing of rates, but that does not seem to apply here. Examples include:

Group	Sex	Age	Service	Crude Rate	Previous Rate	Proposed Rate
Employees	Male	< 30	5 +	0.0669	0.0500	0.0720
Employees	Male	40-44	5 +	0.0358	0.0500	0.0504
Employees	Female	< 30	5 +	0.1071	0.0800	0.0720
Employees	Female	30-34	5 +	0.0751	0.0620	0.0558
Employees	Female	35-39	5 +	0.0519	0.0560	0.0504
Teachers	Male	< 30	5 +	0.0296	0.0350	0.0400
Teachers	Male	45-49	5 +	0.0291	0.0350	0.0260
Teachers	Male	50-54	5 +	0.0242	0.0350	0.0200
Police	Both	< 30	5 +	0.0504	0.0400	0.0547
Police	Both	30-34	5 +	0.0331	0.0400	0.0458
Police	Both	55-59	5+	0.0201	0.0400	0.0181
Police	Male	n/a	3	0.0938	0.0900	0.1000
Police	Female	n/a	2	0.1811	0.1700	0.2000

Disability Retirement

NHRS's disability rates are low, particularly for Group I, and the liability for future disability retirements from active status is a small fraction of the total liability. In addition, the experience data is of limited credibility since the number of disability retirements over the 5-year period is small. We agree with GRS that this assumption is not as critical as other assumptions and believe the new assumptions are reasonable.

As noted above for some of the proposed withdrawal rates, we observed that for Teachers, the proposed disability rate is not between the crude observed rate and previous rate. **We suggest refinements could have been made. We also suggest providing rationale for the proposed disability rates in the next experience study.**

Service and Early Retirement

Retirement liability is by far the most significant portion of the liability for active employees, and therefore the assumed rates of retirement are important. In general, we believe the retirement rates proposed by GRS are reasonable.

In the Fire retirement experience summary, the proposed rate is not between the crude observed rates and previous rates for ages 50, 55, 60 and 61. **We suggest refinements could have been made.**

In the Police and Fire groups, while we observe that there is no experience for members hired on or after July 1, 2011 or were not in vested status as of January 1, 2012, the assumptions appear to be reasonable based on expected pent up demand for Early Retirement.

Other Assumptions

There are a variety of assumptions and methods that do not necessarily fall into the economic or demographic categories, and GRS has summarized those in a separate section of their Experience Study. Segal recommends that more analysis be provided for several of them.

Forfeitures

GRS makes an assumption to anticipate that some vested members will take a return of contributions rather than wait to receive an annuity at retirement age. **We suggest that the data supporting this assumption be included in the next experience study. Alternatively, a simpler approach would be to determine the liability for vested terminated participants as the greater of the value of accumulated contributions or the deferred annuity.**

Marriage Assumption

Marriage rates are used in actuarial valuations to estimate the number of participants eligible for survivor benefits. Typically, an actuary will use this assumption for pre-retirement lives to estimate how many individuals will be married upon death or retirement. For those already in pay status, a form of payment generally is used to establish whether or not an individual has an eligible beneficiary.

The marriage assumptions previously differed for Group I and Group II. GRS recommended that 60% of both male and female members are married, with male spouses three years older than female spouses, and included an analysis supporting their recommendation. We believe these assumptions are reasonable.

Service Purchases

GRS recommended adding one month of service for all active participants in consideration of potential subsidized service purchases in the future. **We suggest that the data supporting this assumption be included in the next experience study.**

Section III: Recommendations for Actuarial Methods

In October of 2014, the Conference of Consulting Actuaries Public Plans Community (CCA PPC) prepared a White Paper on Public Pension Funding Policy that supports a level cost allocation method as the basis for public plan funding policies. More recently, the Pension Task Force commissioned by the Actuarial Standards Board also made suggestions for public plan standards of practice. In particular, the PTF suggested that a reasonable actuarially determined contribution meets the following requirements:

- ASOP Nos. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, 27 and 35 are met
- Each member's normal cost should be based on the benefit structure applicable to that member
- The amortization payments should be greater than the nominal interest on the unfunded liability or pay off the unfunded liability in a reasonable period of time.

Fundamentally, the contribution requirement has two components:

- Normal cost – the allocation to the coming year of pension costs for active employees in that year.
- Amortization of the unfunded actuarial accrued liability (UAAL) – the coming year's payment toward pension costs allocated to prior years for which assets are not yet on hand.

The methods used for NHRS are in line with the CCA PPC White Paper and PTF suggestions.

Actuarial Cost Method

The funding method employed is the traditional entry age normal (EAN) actuarial cost method and is the method used by the majority of the retirement systems in the Public Funds Survey. The traditional entry age normal (EAN) actuarial cost method determines the normal cost for an individual by calculating the level percent of pay that, if contributed each year over that person's career, would accumulate with interest to the amount projected to be needed to pay that person's pension benefits.

We find the current method to be reasonable. In addition, it is the same cost method required to determine liabilities under GASB accounting standards and therefore provides consistency among the various liability measures used in the valuation. We concur with the recommendation to maintain the method.

Asset Valuation Method

An essential part of the public sector budgeting process is that material budget items, including pension contributions, should have a level cost pattern from year to year to the extent possible. An asset valuation method should establish a reasonable methodology for recognizing investment gains and losses and should limit the potential volatility that may result in increased contributions due to investment results.

The actuary's guide for determining the reasonableness of an asset smoothing method is ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit.

Excerpt from Actuarial Standard of Practice (ASOP) No. 44:

3.3 Selecting Methods Other Than Market Value

If the considerations in Section 3.2 have led the actuary to conclude that an asset valuation method other than market value may be appropriate, the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:

a) *The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*

b) *The asset valuation method is likely to produce actuarial values of assets that, in the actuary's professional judgment, satisfy both of the following:*

1. *The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.*

2. *Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.*

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period.

Two key principles arise from ASOP No. 44. First, an acceptable asset smoothing approach must create asset values that fall within a reasonable range around market value, and second, that gains and losses are recognized in a reasonable period of time. In lieu of satisfying both of these principles, a smoothing method could satisfy the requirements if, in the actuary's professional judgment, the range around market value is sufficiently narrow or the differences are recognized in a sufficiently short period.

The actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected actuarial value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected actuarial value. The actuarial value of assets is tied to market value, and the method treats gains and losses the same. There is no systematic bias that would consistently produce an actuarial value of assets that is greater than or less than market value. In addition, the five-year smoothing

period is a reasonable time over which to recognize the market results. We concur with the GRS recommendation to maintain the method.

Pension Amortization Method

The UAAL of the NHRS is amortized over a closed period that was originally 30 years and that ends with the fiscal year ending June 30, 2039. Amortization payments are calculated to remain level as a percentage of payroll. Under this method, in the early years, the UAAL will increase. We note that projections of the UAAL are included in the 2017 actuarial valuation report that indicate the UAAL is currently projected to decline and be fully funded by 2039 if future experience matches the economic and demographic assumptions and recommended contributions are made.

Pension Funding Target

The NHRS funding objective is 100% funding of the actuarial liabilities. We agree this is the appropriate objective for all pension plans.

Medical Subsidy Funding Policy

Benefits provided by NHRS are funded on a pay-as-you-go basis. Medical subsidy benefits provided by statute are fixed amounts based on a declining population. Employer contributions rates are determined for each member classification separately such that expected assets in each of the four subtrusts will exceed the expected benefit payment for the year by at least 20%.

We believe that pay-as-you-go funding with a 20% solvency margin is a reasonable funding policy at this point in time given that the benefit is a fixed amount and the population is declining.

The June 30, 2017 GRS actuarial valuation assumes 25% of members who opted-out of coverage will opt-in in the future. **We suggest the next experience study show the data relevant to the opt-in assumption.**

Section IV: Recommendations for Experience Study Reports

Our findings with respect to specific sections GRS Experience Study report are summarized as follows.

Section A Overview and Summary of Results

The disclosure of investment and liability experience gains and losses was disclosed for each year of the study period and trends were discussed at a high level. This is helpful to the reader in understanding the magnitude of deviations between actual and assumed experience, and trends that may have emerged over the five years can be recognized. **We recommend that major sources of gains and losses be identified in the next experience study.**

The Expected Impact of Proposed Changes reflects only the recommend changes in the demographic assumptions. **We suggest that this title be changed to the Expected Impact of Proposed Changes in the Demographic Assumptions. We also suggest that the Fire group summary include an explanation to enhance the reader's understanding where the assumption changes reduce the Normal Cost but increase the Unfunded Actuarial Accrued Liability.**

The Effect of Alternate Assumptions reflects the impact of the alternative economic assumptions in addition to the proposed changes in the demographic assumptions. We suggest that this title be changed to The Effect of Alternate Economic Assumptions in Addition to the Proposed Changes in the Demographic Assumptions. The summaries compare the 2013 valuation results with the results from the 2015 valuation and experience study. In the first column of the proposed assumptions, the title in the first row (labeled Demographic Assumptions) is "Current" and in the second row (labeled Economic Assumptions) is "(7.75%/3.75%)". However, the results are based on the proposed demographic assumptions and the prior (or "current") economic assumptions. **We suggest clarification of the headings when the next experience study is performed.**

Section B Economic Assumptions

Section B presents the economic assumptions, and begins with a review of Actuarial Standard of Practice No. 27, which provides guidance for the setting of these assumptions. This is valuable background for the reader, and indicates that GRS was aware of the scope of the project and the standards for setting assumptions. This section notes that investment risk is not reflected when using a single investment return rate. **Investment risk could be evaluated by reviewing a stochastic projection of investment returns and considering the impact of using a single rate at the 25th or 75th percentile.**

GRS included a discussion of market-consistent measurements of the benefits. We agree with the conclusion that market-consistent measurements would not meet the statutory objective of contribution stability. The Pension Task Force suggests a discussion of the sometimes-competing interests of benefit security and generational equity, as well as disclosure of a solvency (market-consistent) value of liabilities. As you may know, the Actuarial Standards Board has issued an Exposure Draft that would require this disclosure in valuation reports.

There is significant analysis provided in this section regarding the capital market assumptions and Social Security Administration data that were considered in the setting of the investment return, wage and price inflation, and payroll growth assumptions. **We suggest the analysis could also include benchmarks from the NASRA Public Fund Survey or other similar surveys.**

Sections C through F Demographic Assumptions

Section C presents the non-mortality[1] demographic assumptions for Employees. Sections D, E, and F present the non-mortality demographic assumptions for Teachers, Police, and Fire, respectively. Each section begins by summarizing the findings for withdrawal, disability, service retirement, and early retirement experience over the 5-year study period, with references to the detailed analysis provided later in the section. Overall, we find the demographic assumption sections to be excellent, including a written summary of what was observed during the study period.

We suggest Actuarial Standard of Practice No. 35, which provides guidance for the setting of these assumptions, be summarized as an introduction (see the Economic Assumptions section). This is valuable background for the reader.

With respect to the display of the detail, the graphs provide the current and proposed assumptions in one place. GRS may want to add text to refer the reader to Section J that provides a comprehensive listing of the assumptions for each group. In addition, it would enhance the reader's understanding of the recommendations if the current and proposed assumptions were included together in Section J.

Section G Mortality Experience

Since the mortality assumption is a key demographic assumption in determining the present value of NHRS liabilities, we suggest this section be placed ahead of the other demographic assumptions in the next experience study report.

[1] Section G presents the mortality experience for all groups.

Section V: Conclusions and Summary of Recommendations

We concluded that GRS followed and adhered to Actuarial Standards of Practice promulgated by the Actuarial Standards Board.

For your convenience, we have summarized all of the suggestions made throughout our limited scope audit in the order in which they appear:

We recommend that GRS show the median (i.e. 50th percentile) expected return over the same time period. As noted by GRS, the median would be lower than the average expected return of 7.29%. The median is a critical value because there is a 50% probability that the actual annualized return exceeds the median value and a 50% probability that the actual annualized return falls below the median value, over the given time horizon. To provide a more complete picture of investment risk, we also recommend showing the 25th and 75th percentile expected returns. Using an example where the median return is 7.0%, the 25th percentile return is 5.5% and the 75th percentile return is 8.5%, another way to view this information is that there is a 50% probability that the expected return will be between 5.5% and 8.5%. Finally, for each of the investment return assumptions shown in the experience study, we recommend showing the probability of achieving that assumption over the given time horizon.

We suggest that the time horizon for each manager in the investment survey be shown and that GRS consider showing results over different time horizons.

We recommend that GRS include a numerical assessment of funding risks if actual payroll growth is lower than assumed.

We suggest GRS consider combining male and female experience for the Police and Fire groups when performing the next experience study.

We recommend consideration of newer MP improvement scales and the public sector tables, adjusted to reflect the System's experience, at the time of the next experience review.

We observed that for certain groups and ages, the proposed withdrawal rate is not between the crude observed rates and previous rates.

We suggest providing rationale for the proposed disability rates in the next experience study.

We suggest refinements could have been made in the Fire retirement rates at ages 50, 55, 60 and 61.

We suggest that the data supporting the Forfeitures assumption be included in the next Experience Study. Alternatively, a simpler approach would be to determine the liability for vested terminated participants as the greater of the value of accumulated contributions or the deferred annuity.

We suggest that the data supporting the Service Purchases assumption be included in the next experience study.

We suggest the next experience study review the experience relevant to the opt-in assumption.

We recommended that major sources of gains and losses be included in the next experience study.

We suggest that the Fire group summary include an explanation to enhance the reader's understanding where the assumption changes reduce the Normal Cost but increase the Unfunded Actuarial Accrued Liability.

We suggest clarification of the headings in the Effect of Alternative Assumptions table when the next experience study is performed.

We suggest that investment risk could be evaluated by reviewing a stochastic projection of investment returns and considering the impact of using a single rate at the 25th or 75th percentiles.

We suggest the non-economic assumptions analysis include benchmarks from NASRA, Center for Retirement Research PPD or other similar surveys.

We suggest Actuarial Standard of Practice No. 35, which provides guidance for the setting of these assumptions, be summarized as an introduction.

Since the mortality assumption is a key demographic assumption in determining the present value of NHRS liabilities, we suggest this section be placed ahead of the other demographic assumptions in the next experience study report.