# Actuarial Review of the 2020 Accounting Disclosures for the North Carolina Office of the State Auditor

November 2020

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November 20, 2020

Ms. Amy Senogles, CPA
Financial Audit Supervisor
Office of the State Auditor
2 S. Salisbury St.
20601 Mail Service Center
Raleigh, North Carolina 27699-0600

**Re: North Carolina Actuarial Review of 2020 Accounting Disclosures**

Dear Ms. Senogles:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this report of an Actuarial Review of the 2020 Accounting Disclosures related to the North Carolina Retirement System. We are grateful to the Office of the State Auditor for their responsiveness and assistance throughout the actuarial review process. In addition, we wish to thank the consultants of Cavanaugh Macdonald Consulting (CavMac) and Segal Consulting for their cooperation and assistance with this project.

This project is separated into two engagements. This is a report covering the work of the first engagement. A report covering the work of the second engagement will be issued in early 2021. The first engagement is described as follows:

> Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2020:
>
> - The Teachers and State Employees Retirement System of North Carolina (TSERS);
> - The Local Governmental Employees Retirement System of North Carolina (LGERS);
> - The Register of Deeds Supplemental Pension Fund of North Carolina (RODSPF);
> - The North Carolina Retiree Health Benefits Plan (RHB); and
> - The Disability Income Plan of North Carolina (DIPNC).
>
> The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:
>
> 1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
> 2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
> 3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

The purpose of this report is to provide the results of our actuarial review, described above, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

This report was prepared at the request of the Office of the State Auditor of North Carolina (OSA) for the purposes stated above. It may not be suitable for other purposes. This report may be shared with parties other than the OSA, but only with the OSA's permission and only in its entirety. GRS is not responsible for unauthorized use of this report.

In our opinion, the assumptions and methods used in the 2019 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and are in compliance with practices promulgated by the Actuarial Standards. The intended audience is the OSA. The authors of this report are available to answer questions.

The signing individuals are independent of the plan sponsor.

This report was prepared using our proprietary models (valuation model, capital markets model, etc.) and related software which, in our professional judgment, have the capabilities to provide results that are consistent with the purposes of the review. We performed tests to ensure that the models reasonably represent that which is intended to be modeled. We have also relied on the GRS actuaries and Internal Software, Training, and Processes Team who developed and maintain the model.

Abra D. Hill and Jeffrey T. Tebeau are Members of the American Academy of Actuaries (MAAA) as indicated, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,

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KGA/ADH/JTT:dj

# EXECUTIVE SUMMARY

# Executive Summary

## Background

Gabriel, Roeder, Smith & Company (GRS) was engaged by the Office of the State Auditor to review calculations related to the 2020 disclosures the State will include in its Comprehensive Annual Financial Report (CAFR).

This report covers the work of the first engagement. A report covering the work of the second engagement will be issued in early 2021. The first engagement is described as follows:

> Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2020:
>
> - The Teachers and State Employees Retirement System of North Carolina (TSERS);
> - The Local Governmental Employees Retirement System of North Carolina (LGERS);
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> - The North Carolina Retiree Health Benefits Plan (RHB); and
> - The Disability Income Plan of North Carolina (DIPNC).
>
> The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:
>
> 1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
> 2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
> 3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

The purpose of this report is to provide the results of our actuarial review, described above, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

The balance of this report is organized as follows:

Section 1 – Experience Study Review

- Review of Recommended Demographic Assumptions; and
- Review of Recommended Actuarial Methods.

Section 2 – Review of Economic Assumptions

Section 3 – Review of the Respective Valuation Reports Containing the Underlying Calculations for the GASB Valuations

- Test Lives Exhibits; and
- Comments Regarding Test Lives Review.

Section 4 – Review of the Respective GASB Reports

- Content Review; and
- Calculations Review.

Section 5 – Comments and Conclusions

- Comments;
- Conclusions; and
- Recommendations for future years.

## Conclusion

In our opinion, the assumptions and methods used in the December 31, 2019 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and comply with practices promulgated by the Actuarial Standards.

Based on our test lives review and our review of the funding and GASB reports, we certify that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures (with the exception of the disclosure requirements discussed herein).

# SECTION 1

## EXPERIENCE STUDY REVIEW

# Experience Study

The Experience Studies appear to be on a five-year cycle and have not changed since we reviewed them in our 2019 report (with the exception of a few specific health insurance related assumptions addressed in the RHB section). We are therefore incorporating our comments regarding the demographic assumptions from our 2019 report, largely unchanged. Any changes in assumptions that were made in the valuations outside of the Experience Study process will be commented on in Section 2.

## Review of Recommended Demographic Assumptions

**TSERS**

The TSERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2015 through December 31, 2019. We were provided the most recently completed experience study, dated October 22, 2015, covering the period January 1, 2010 through December 31, 2014. TSERS has since updated their economic assumptions. We have therefore only reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

*Non-Mortality Demographic Assumptions*

The non-mortality demographic assumptions were reviewed in the experience study dated October 22, 2015 and covering the five-year period ending on December 31, 2014. We have reviewed that report and find that the recommended assumptions are reasonable, based on TSERS actual experience (as detailed in that report). When reviewing demographic experience, actuaries are guided by Actuarial Standards of Practice (ASOP) Statement Number 35. ASOP 35 provides that non-mortality demographic assumptions should take into consideration historical experience, future expectations, the actuary's professional judgement, the purpose of the measurement and should not result in significant bias (unless a bias is explicitly intended to cover adverse risk or plan provisions that are difficult to model). The experience study report reviewed demonstrates that these guidelines were followed in the development of the recommended assumptions. ASOP 35 also discusses non-decrement demographic assumptions such as assumptions related to option elections and/or option factors that are based on interest and mortality that differs from valuation assumptions. The experience study was silent on this aspect of the plan (as is the funding valuation). We recommend that future experience studies include an analysis of whether or not a liability adjustment is needed related to option elections/factors.

We find the recommended assumptions (which were in use for the December 31, 2019 funding valuation) to be reasonable for use in the funding and GASB valuations.

*Mortality Assumptions*

ASOP 35 states that the actuary should generally consider at least the following when setting mortality assumptions: pre- and post-mortality; potentially different mortality for different employee classifications (if appropriate); adjustments for mortality improvement that occurs from the period studied (in the experience study) to the measurement period (the date of the valuation); and mortality improvements after the measurement date. The experience study started with nationally published mortality tables and made adjustments based on TSERS actual experience. The common industry conventional is, that for any group's actual mortality experience to be given full credibility, there should be enough covered

participants to result in at least 1,000 actual deaths during the five-year period studied. The experience study demonstrates that the teachers and general employees groups were large enough to give their experience full credibility. In addition, the report demonstrates that considerations for setting mortality assumptions promulgated in ASOP 35 were followed.

We find the recommended assumptions (which were in use for the December 31, 2019 funding valuation) to be reasonable for use in the funding and GASB valuations.

**LGERS**

The LGERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2015 through December 31, 2019. We were provided the most recently completed experience study, dated October 22, 2015, covering the period January 1, 2010 through December 31, 2014. LGERS has since updated their economic assumptions. We have therefore only reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

*Non-Mortality Demographic Assumptions*

The non-mortality demographic assumptions were reviewed in the experience study dated October 22, 2015 and covering the five-year period ending on December 31, 2014. We have reviewed that report and find that the recommended assumptions are reasonably based on LGERS actual experience (as detailed in that report). The experience study report reviewed, demonstrates that these ASOP 35 guidelines were followed in the development of the recommended assumptions. We recommend that future experience studies include an analysis or whether or not a liability adjustment is needed related to option elections/factors.

We find the recommended assumptions (which were in use for the December 31, 2019 funding valuation) to be reasonable for use in the funding and GASB valuations.

*Mortality Assumptions*

The experience study started with nationally published mortality tables and made adjustments based on LGERS actual experience when the group size was large enough to warrant credible experience. The experience study demonstrates that the general employees groups were large enough to give their experience full credibility and that the Male Firefighters and Rescue Squad Workers were not large enough to give their experience credibility. The report is silent as to the process used to assign credibility for the Male Law Enforcement Officers, which was large enough for partial credibility, but not full credibility. For beneficiaries, the report indicates that LGERS and TSERS beneficiaries were combined to provide additional credibility. In general, the report demonstrates that considerations for setting mortality assumptions promulgated in ASOP 35 were followed. We recommend that future experience studies address how partial credibility is assigned for the Male Law Enforcement Officers.

We find the recommended assumptions (which were in use for the December 31, 2019 funding valuation) to be reasonable for use in the funding and GASB valuations.

**RODSPF and DIPNC**

The RODSPF and DIPNC experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2015 through December 31, 2019. We were provided the most recently completed experience study, dated January 1, 2016, covering the period January 1, 2010 through December 31, 2014.

The demographic assumptions for the RODSPF are the same as those for LGERS. Please see our aforementioned comments.

Except for rates of disability and recovery or death from disabled status, the demographic assumptions for the DIPNC are the same as those for TSERS. Please see our aforementioned comments. Disability and recovery or death from disabled status for DIPNC.

The report provided to us for review showed neither the details of the current assumptions nor the actual experience. There were brief comments regarding the credibility of the experience and a qualitative description of how the proposed assumptions were set based on a weighted average of a national table and actual experience using a 35% credibility factor for rates of disability (rates of termination of disability are indicated to be from a nationally published table). While the process to determine these proposed rates that was described is reasonable and in compliance with ASOPs, there is insufficient detail in the reports to determine if the recommended rates are reasonable. We recommend that future experience studies include the level of detail that compares actual, expected and proposed rates by age so that another actuary can opine on the reasonability of the recommendations.

**RHB**

Non-health related demographic assumptions are the same as those used for the pension valuations. Specific health related demographic assumptions, such as participation, enrollment and migration assumptions are disclosed in the GASB 74 reports. These assumptions are reported to be based on actual experience as well as future plan sponsor expectation as disclosed in the most recent financial report.

We find these assumptions to be reasonable for use in the GASB valuation. Currently, no funding valuation for the RHB is performed.

## Review of Recommended Actuarial Methods

**TSERS, LGERS, RODSPF**

The funding and GASB valuations both use the Entry Age Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The asset method for GASB is market value.

We find the methods used for the funding valuation to be in compliance with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to those prescribed by the GASB pronouncements.

**DIPNC**

The funding uses the Aggregate Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The funding method for GASB valuation is the Entry Age Actuarial Cost method. The asset method used for the GASB valuation is market value.

We find the methods used for the funding valuation to be in compliance with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to those prescribed by the GASB pronouncements.

**RHB**

The actuarial cost method for the GASB valuation is the Entry Age Actuarial Cost method. The asset method is the market value.

We find the methods used for the GASB valuation to be in accordance with those prescribed by the GASB pronouncements.

In summary, we find the demographic assumptions used for the funding and GASB valuations to be reasonable.

# SECTION 2

## REVIEW OF ECONOMIC ASSUMPTIONS

The key economic assumptions are:

1. **Assumed Rate of Inflation** – The rate of price inflation (as measured by the Consumer Price Index for all Urban consumers) which underlies the remainder of the economic assumptions.
2. **Assumed Rate of Investment Return** – The expected annual rate of return on System assets, net of expenses, over a long-term period. This is also the rate at which projected future benefits under the system are discounted to the present.
3. **Assumed Rate of Increase in Compensation** – The rate at which a member's annual salary is assumed to increase each year, which impacts the level of member benefits.

## ASOP No. 27

Pension actuaries are required to comply with Actuarial Standard of Practice No. 27 (ASOP No. 27) in setting economic assumptions, including the assumed investment return rate.

According to the ASOP No. 27 applicable to actuarial valuations with a measurement date on or after September 30, 2014, each economic assumption selected by the actuary should be reasonable. For this purpose, an assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic).

Also, according to ASOP No. 27, the actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions reasonable for a given measurement. The actuary should also recognize that different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a narrow range of reasonable assumptions may develop both for an individual actuary and across actuarial practice.

## Inflation

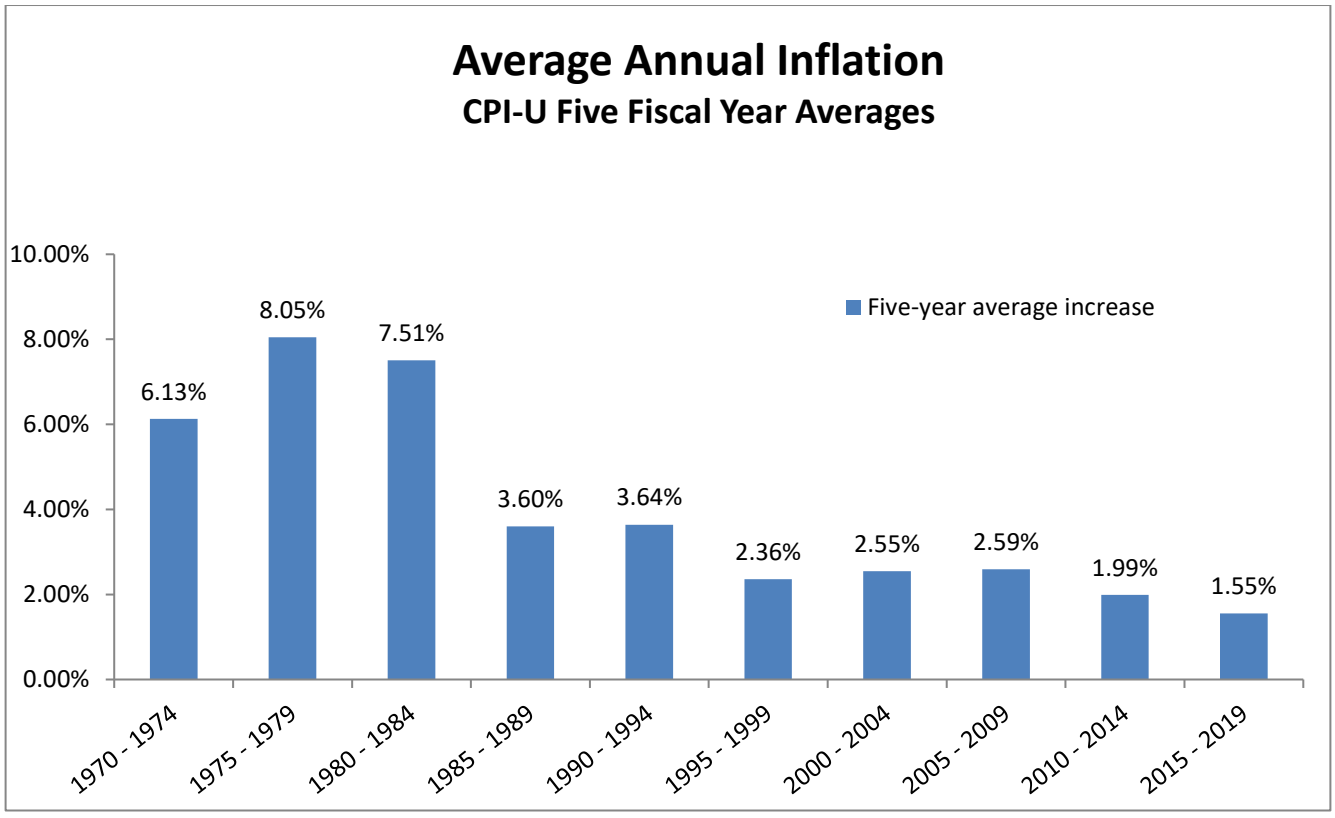
By "inflation," we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions. It not only impacts investment return, but also salary increases.

Over the five-year period from 2015 through 2019, the CPI-U has increased at an average rate of 1.55 percent.

The table on the following page shows the average inflation over various periods, ending December 31, 2019.

| Calendar Year | Average Annual Increase in CPI-U |
|---|---|
| 2015 | 0.12 % |
| 2016 | 1.26 % |
| 2017 | 2.13 % |
| 2018 | 2.44 % |
| 2019 | 1.81 % |
| | |
| 3-Year Average | 2.13 % |
| 5-Year Average | 1.55 % |
| 10-Year Average | 1.77 % |
| 20-Year Average | 2.17 % |
| 30-Year Average | 2.44 % |
| 40-Year Average | 3.20 % |
| 50-Year Average | 3.96 % |

The following graph shows the average inflation over five-year periods over the last 50 years:




As the above graph illustrates, the high inflation of the 1970s and 1980s is well in the past. The geometric average price inflation was 2.44% per year over the last 30 years, ending December 31, 2019; 2.17% over the last 20 years and 1.77% over the last 10 years.

## Future Inflation Expectations

Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic assumptions. Therefore, it is important not to give undue weight to recent experience. We must also consider future expectations for inflation as well.

One measure of future inflation is the spread between yields on U.S. Treasuries and U.S. TIPS. (Treasury Inflation-Protected Securities, or TIPS, provide protection against inflation. The principal of a TIPS increases with inflation and decreases with deflation, as measured by the Consumer Price Index. When a TIPS matures, you are paid the adjusted principal or original principal, whichever is greater.)

The spread between yields on U.S. Treasuries and U.S. TIPS varies depending on the maturity selected. Moreover, there may be other influences on the result such as a risk premium on Treasuries and a liquidity premium on TIPS.

For 30-year Treasuries as of June 1, 2020, this measure of inflation expectation is 1.71 percent.

We also surveyed the inflation assumption used by a number of well-known independent investment consulting firms. In our sample of thirteen firms, the inflation assumption ranged from 1.75 percent to 2.30 percent, with an average of 2.09 percent.

Another point of reference is the Social Security Administration's (SSA) 2020 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term ultimate intermediate annual inflation rate assumption of 2.4 percent. The Social Security Trustees report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS.

The table on the following page presents a summary of inflation rate forecasts from various professional experts.

| Forward-Looking Price Inflation Forecasts[a] | |
|---|---|
| **Congressional Budget Office**[b] | |
| 5-Year Annual Average | 2.46% |
| 10-Year Annual Average | 2.38% |
| **Federal Reserve Bank of Philadelphia**[c] | |
| 5-Year Annual Average | 2.00% |
| 10-Year Annual Average | 2.14% |
| **Federal Reserve Bank of Cleveland**[d] | |
| 10-Year Expectation | 1.23% |
| 20-Year Expectation | 1.58% |
| 30-Year Expectation | 1.81% |
| **Federal Reserve Bank of St. Louis**[e] | |
| 10-Year Breakeven Inflation | 1.18% |
| 20-Year Breakeven Inflation | 1.55% |
| 30-Year Breakeven Inflation | 1.55% |
| **U.S. Department of the Treasury**[f] | |
| 10-Year Breakeven Inflation | 1.24% |
| 20-Year Breakeven Inflation | 1.41% |
| 30-Year Breakeven Inflation | 1.71% |
| 50-Year Breakeven Inflation | 1.84% |
| 100-Year Breakeven Inflation | 1.93% |
| **Social Security Trustees**[g] | |
| Ultimate Intermediate Assumption | 2.40% |

[a]End of the Second Quarter, 2020. Version 2020-07-23 by Gabriel, Roeder, Smith & Company.
[b]*The Budget and Economic Outlook: 2020 to 2030*, Release Date: January 2020, Consumer Price Index (CPI-U), Percentage Change from Fourth Quarter to Fourth Quarter, 5-Year Annual Average (2020 - 2024), 10-Year Annual Average (2020 - 2029).
[c]*Survey of Professional Forecasters, Second Quarter 2020,* Release Date: May 15, 2020, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2020 - 2024), 10-Year Annual Average (2020 - 2029).
[d]Inflation Expectations, Model output date: June 1, 2020.
[e]The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: June 1, 2020.
[f]*The Treasury Breakeven Inflation (TBI) Curve*, Monthly Average Rates, June 2020.
[g]*The 2020 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds*, April 22, 2020, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2024 and later.

Taking all of this information into consideration, we believe that the 3.0% price inflation assumption currently used in the funding and GASB valuations is too high. We believe that a price inflation assumption in the range of 1.75% to 2.50% is supportable by historical experience and future expectations. That being said, price inflation is the starting point for the other economic assumptions, such as the investment rate of return, wage increases, and health trend rates. If a price inflation assumption is too high and it results in an investment rate of return that is also too high, the resulting valuations can be too optimistic and/or contributions that may be too low (if using a level percent of pay contribution determination method). However, if the investment rate of return assumption is not too high, then a price inflation that is higher than future expectations support can actually add a margin for adverse experience when measuring liabilities. It is important not to just look at this assumption in isolation.

## Investment Return

The investment return assumption, also referred to as the valuation interest rate, is one of the principal assumptions in any actuarial valuation. It is used to discount future expected benefit payments back to the valuation date, which ultimately determines the liability (i.e., present value of benefits) of the retirement plan. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

For TSERS and LGERS, this assumption was adjusted after the respective experience studies. For RODSPF and DIPNC, this assumption was set in the respective experience studies. For the RHB, this assumption is set by the State (and is currently the same as TSERS and LGERS). However, because the RHB is not a funded plan, this assumption is not the discount rate. Rather, the discount rate is based on the Bond Buyer 20-year GO index.

The assumed rate of investment return for TSERS and LGERS December 31, 2019 funding valuations was 7.0%. Based on the reported asset allocation (and the target allocation shown in the CAFR) and a 2.50% price inflation assumption (an assumption in GRS' preferred range), we believe this assumption is reasonable for use as the assumed rate of return for the funding valuations and the expected long-term rate of return for the GASB valuations, based on the information provided for this review. We have tested this assumption using our 2019 Capital Markets Assumption Model and the reported asset allocation in the December 31, 2019 reports. It is important to note that for both LGERS and TSERS, a large portion (approximately 30%, each) of their asset allocation (as reported in the December 31, 2019 valuations) is in the "other" category. This category is footnoted to indicate it covers real estate, alternatives, inflation and credit. We recommend this category be further subdivided since these categories do not all have the same future expectations. Subdividing this category would allow an auditor (or other user of the report) to perform a more robust analysis to determine if the assumption continues to be appropriate. RODSPF and DIPNC use an assumed of investment return of 3.75%. Since these funds are primarily invested in fixed income vehicles, we believe this is a reasonable assumption for funding and for the long expected rated of return for GASB, based on a 2.50% inflation assumption (an assumption in GRS' preferred range).

We have also tested the investment return assumption against our 2020 Capital Markets Assumption Model. In 2020, the capital market assumptions used by the consultants who provide that information to us have continued a pattern of decreasing. Based on our 2020 model, the 7.0% assumption is at the top of the range we would consider to be reasonable using the current NCRS asset allocation. If capital market assumptions continue their downward trend and the NCRS asset allocation remains largely similar in 2021, we may not be able to continue to consider the 7.0% rate of investment return as reasonable in future reviews.

## Wage inflation, Payroll Growth and Pay Increases

These items were studied as part of the TSERS and LGERS experience studies. These respective experience studies provide enough detail to demonstrate that the recommended assumptions (which were used in the December 31, 2019 funding valuations) are reasonable. However, given the above comments on price inflation, we recommend that the payroll growth assumption be lowered for future valuations.

**RHB Trend Rates**

The trend rates used for the GASB valuation of the RHB are similar to the trend rates that GRS currently uses, but end in an ultimate rate higher than what GRS currently uses. However, we believe they are reasonable. We note there were some changes in the trend rate for Prescription Drugs (the select and ultimate rates were reset) and the Medicare Advantage Plans (trend was eliminated prior to 2026 due to savings resulting from an RFP). In addition, the health insurer fee and excise tax were removed. While we have not performed a detailed analysis of these changes, they all appear to be reasonable.

**Summary**

In summary, except for the price inflation assumption used for the pension valuations, we find the economic assumptions to be reasonable for funding and GASB. With regard to the price inflation assumption, we find that when considering the other economic assumptions, this assumption adds conservatism and a margin for adverse experience which is acceptable under the ASOPs for the development of the liabilities. However, we also find that the investment rate of return of 7.0% is harder to defend as a reasonable expectation. We recommend that if the trend of reducing capital market assumptions continues and the asset allocation does not change, the investment rate of return be lowered for the December 31, 2020 funding valuations and subsequent GASB calculations.

# SECTION 3

## A REVIEW OF THE RESPECTIVE VALUATION REPORTS CONTAINING THE UNDERLYING CALCULATIONS FOR THE GASB VALUATIONS

# Test Lives Review

## TSERS

## Actives

GRS requested test life information on 11 active cases. Two cases were listed as vested terminated members and another case was listed as disabled (valued with active). The active cases are shown below:

| Test Case | Age | Service | Reported Pay | Sex | Valuation Result | GRS | CavMac | % Diff | Normal Cost As a % of 12/31 Pay 2018 | Normal Cost As a % of 12/31 Pay 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 39.3267 | 8.5378 | $ 43,619.98 | F | EAAL | $ 53,251 | $ 56,935 | -6.47% | | |
| Teacher | | | | | PVB | 115,641 | 114,510 | 0.99% | n/a | 10.71% |
| | | | | | NC | 5,312 | 4,671 | 13.72% | | |
| | | | | | PVFS | 544,528 | 536,014 | 1.59% | n/a | 12.18% |
| 2 | 54.1107 | 2.6667 | 1,020,562.29 | M | EAAL | 146,885 | 136,313 | 7.76% | | |
| General | | | | | PVB | 380,227 | 428,420 | -11.25% | 3.25% | 3.62% |
| | | | | | NC | 37,643 | 36,902 | 2.01% | | |
| | | | | | PVFS | 6,595,416 | 7,853,500 | -16.02% | 3.48% | 3.69% |
| 3 | 31.4045 | 4.4545 | 44,766.35 | F | EAAL | 23,985 | 23,225 | 3.27% | | |
| Teacher | | | | | PVB | 82,634 | 83,125 | -0.59% | 10.72% | 10.82% |
| | | | | | NC | 5,039 | 4,846 | 3.99% | | |
| | | | | | PVFS | 545,600 | 542,508 | 0.57% | 11.18% | 11.26% |
| 4 | 59.1189 | 4.1667 | 99,036.68 | M | EAAL | 79,081 | 75,083 | 5.33% | | |
| General | | | | | PVB | 145,956 | 146,320 | -0.25% | 14.23% | 14.42% |
| | | | | | NC | 15,377 | 14,280 | 7.68% | | |
| | | | | | PVFS | 442,458 | 477,696 | -7.38% | 15.19% | 15.53% |
| 5 | 40.6831 | 17.8333 | 66,509.52 | F | EAAL | 198,859 | 202,490 | -1.79% | | |
| General | | | | | PVB | 238,661 | 250,261 | -4.64% | 7.95% | 7.91% |
| | | | | | NC | 4,789 | 5,261 | -8.98% | | |
| | | | | | PVFS | 568,325 | 590,492 | -3.75% | 7.20% | 7.20% |
| 6 | 56.7746 | 18.0000 | 41,867.33 | M | EAAL | 129,158 | 133,144 | -2.99% | | |
| Teacher | | | | | PVB | 155,428 | 164,172 | -5.33% | 12.18% | 12.31% |
| | | | | | NC | 4,882 | 5,153 | -5.26% | | |
| | | | | | PVFS | 233,824 | 249,254 | -6.19% | 11.69% | 11.66% |
| 7 | 66.2077 | 14.5000 | 19,342.49 | F | EAAL | 48,718 | 51,098 | -4.66% | | |
| General | | | | | PVB | 58,216 | 61,443 | -5.25% | n/a | 15.02% |
| | | | | | NC | 2,757 | 2,906 | -5.12% | | |
| | | | | | PVFS | 62,273 | 60,145 | 3.54% | n/a | 14.25% |
| 8 | 33.0821 | 0.9167 | 26,910.00 | M | EAAL | 3,195 | 2,989 | 6.91% | | |
| General | | | | | PVB | 31,093 | 29,555 | 5.20% | n/a | 9.66% |
| | | | | | NC | 2,936 | 2,600 | 12.90% | | |
| | | | | | PVFS | 278,249 | 282,289 | -1.43% | n/a | 10.91% |
| Total Test Cases | | | | | EAAL | 683,132 | 681,276 | 0.27% | | |
| | | | | | PVB | 1,207,856 | 1,277,806 | -5.47% | | |
| | | | | | NC | 78,735 | 76,620 | 2.76% | | |
| | | | | | PVFS | 9,270,673 | 10,591,897 | -12.47% | | |

We were not able to replicate the active TSERS calculation for the case that was reported as currently receiving DPNIC benefits, since the underlying salary information was not available on the data file. We have therefore excluded that case.

# TSERS

## Retirees

GRS requested test life information on 14 retiree cases. The retiree cases are shown below:

| Test Case | Age | Option Code | Current Monthly Benefit | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1 - Law Enforcement** | 83.71 | OPT3 | $1,051.79 | M | **EAAL/PVB** | $ 86,912 | $ 86,284 | 0.73% |
| **2 - General** | 74.04 | MAX | 281.00 | F | **EAAL/PVB** | 30,179 | 30,363 | -0.61% |
| **3 - General** | 82.54 | OPT63 | 1,610.64 | F | **EAAL/PVB** | 137,207 | 140,046 | -2.03% |
| **4 - Teacher** | 62.46 | MAX | 3,499.43 | F | **EAAL/PVB** | 499,833 | 503,351 | -0.70% |
| **5 - General** | 76.62 | OPT62 | 718.35 | F | **EAAL/PVB** | 89,778 | 89,681 | 0.11% |
| **6 - General** | 65.88 | MAX | 365.78 | F | **EAAL/PVB** | 48,264 | 48,189 | 0.16% |
| **7 - General (disabled)** | 55.88 | OPT62 | 1,621.65 | M | **EAAL/PVB** | 253,269 | 252,459 | 0.32% |
| **8 - Teacher** | 68.38 | MAX | 1,476.94 | M | **EAAL/PVB** | 179,862 | 181,765 | -1.05% |
| **9 - Teacher** | 66.29 | OPT62 | 1,795.69 | M | **EAAL/PVB** | 261,791 | 262,447 | -0.25% |
| **10 - Teacher (disabled)** | 59.88 | OPT2 | 1,656.99 | F | **EAAL/PVB** | 254,506 | 253,857 | 0.26% |
| **11 - Teacher (disabled)** | 67.04 | OPT62 | 1,231.57 | M | **EAAL/PVB** | 170,009 | 170,780 | -0.45% |
| **12 - Teacher (disabled)** | 56.79 | MAX | 1,349.73 | M | **EAAL/PVB** | 162,185 | 162,595 | -0.25% |
| **13 - General** | 56.79 | MAX | 778.77 | F | **EAAL/PVB** | 117,788 | 118,782 | -0.84% |
| **14 - General** | 66.96 | OPT62 | 2,966.47 | F | **EAAL/PVB** | 512,081 | 505,274 | 1.35% |
| **Total Test Cases** | | | | | **EAAL/PVB** | 2,803,664 | 2,805,873 | -0.08% |

# TSERS

## Terminated Vested

GRS requested test life information on 11 terminated vested cases. CavMac indicated that one of those members was disabled (and should be valued as active). The remaining terminated vested cases, and two terminated cases originally requested with the actives (one vested and one non-vested), are shown below:

| Test Case | Age | Service | Accumulated Contributions | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 61.2159 | 14.1667 | $ 37,443.13 | M | **EAAL/PVB** | $ 74,886 | $ 74,886 | 0.00% |
| **2** | 38.3470 | 9.7727 | 30,955.50 | M | **EAAL/PVB** | 61,911 | 61,911 | 0.00% |
| **3** | 48.1886 | 8.9166 | 38,660.65 | F | **EAAL/PVB** | 77,321 | 77,321 | 0.00% |
| **4** | 65.1025 | 6.4167 | 37,513.14 | F | **EAAL/PVB** | 75,026 | 75,026 | 0.00% |
| **5** | 57.4906 | 11.5833 | 67,013.95 | M | **EAAL/PVB** | 134,028 | 134,028 | 0.00% |
| **6** | 51.6490 | 5.8636 | 10,975.06 | F | **EAAL/PVB** | 21,950 | 21,950 | 0.00% |
| **7** | 51.1831 | 16.250 | 61,668.96 | M | **EAAL/PVB** | 123,338 | 123,338 | 0.00% |
| **8** | 44.5246 | 16.0000 | 110,273.39 | F | **EAAL/PVB** | 220,547 | 220,547 | 0.00% |
| **9** | 39.1381 | 11.8455 | 35,144.99 | F | **EAAL/PVB** | 70,290 | 70,290 | 0.00% |
| **10** | 38.1995 | 5.0122 | 13,773.51 | F | **EAAL/PVB** | 27,547 | 27,547 | 0.00% |
| **11*** | 31.8415 | 1.4167 | 4,587.34 | M | **EAAL/PVB** | 9,175 | 9,175 | 0.00% |
| **12** | 22.7555 | 3.0000 | 3,687.85 | F | **EAAL/PVB** | 7,376 | 7,376 | 0.00% |
| **Total Test Cases** | | | | | **EAAL/PVB** | 903,395 | 903,395 | 0.00% |

** Non-vested termination with TSERS, but also valued as active with LGERS.*

## Total TSERS

### (Actives, Retirees, and Terminated Vested)

| Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|
| **EAAL** | $4,390,191 | $4,390,544 | -0.01% |
| **PVB** | 4,914,915 | 4,987,074 | -1.45% |

# LGERS

## Actives

GRS requested test life information on 10 active cases. One case was listed as terminated vested. The remaining active cases are shown below:

| Test Case | Age | Service | Reported Pay | Sex | Valuation Result | GRS | CavMac | % Diff | Normal Cost As a % of 12/31 Pay 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 33.7132 | 12.4167 | $60,377.80 | M | **EAAL** | $ 122,289 | $ 115,061 | 6.28% | | **CavMac** | |
| Law Enforcement | | | | | **PVB** | 191,969 | 194,495 | -1.30% | 11.56% | 12.31% | 12.02% |
| | | | | | **NC** | 6,830 | 7,255 | -5.86% | | **GRS** | |
| | | | | | **PVFS** | 645,756 | 654,090 | -1.27% | 11.37% | 11.34% | 11.31% |
| **2** | 92.1627 | 23.5833 | 46,230.91 | M | **EAAL** | 88,163 | 84,256 | 4.64% | | **CavMac** | |
| Law Enforcement | | | | | **PVB** | 88,163 | 84,256 | 4.64% | n/a | n/a | n/a |
| | | | | | **NC** | 0 | 0 | | | **GRS** | |
| | | | | | **PVFS** | 0 | 0 | | n/a | n/a | n/a |
| **3** | 44.2214 | 20.5000 | 71,854.63 | M | **EAAL** | 282,953 | 287,015 | -1.42% | | **CavMac** | |
| Law Enforcement | | | | | **PVB** | 344,454 | 345,058 | -0.18% | n/a | n/a | 11.60% |
| | | | | | **NC** | 9,238 | 8,334 | 10.85% | | **GRS** | |
| | | | | | **PVFS** | 497,604 | 494,832 | 0.56% | n/a | n/a | 12.86% |
| **4** | 31.8415 | 5.4165 | 10,423.11 | M | **EAAL** | 7,769 | 4,995 | 55.54% | | **CavMac** | |
| General | | | | | **PVB** | 14,819 | 24,808 | -40.27% | n/a | n/a | 15.26% |
| | | | | | **NC** | 603 | 1,590 | -62.08% | | **GRS** | |
| | | | | | **PVFS** | 129,640 | 129,564 | 0.06% | n/a | n/a | 5.79% |
| **5** | 39.3854 | 13.7500 | 69,000.70 | F | **EAAL** | 146,174 | 155,048 | -5.72% | | **CavMac** | |
| Fire & Rescue | | | | | **PVB** | 235,924 | 242,063 | -2.54% | 12.39% | 11.81% | 11.99% |
| | | | | | **NC** | 8,811 | 8,271 | 6.53% | | **GRS** | |
| | | | | | **PVFS** | 739,994 | 720,446 | 2.71% | 12.80% | 12.77% | 12.77% |
| **6** | 45.4127 | 25.5000 | 71,542.82 | M | **EAAL** | 358,173 | 378,423 | -5.35% | | **CavMac** | |
| Fire & Rescue | | | | | **PVB** | 395,936 | 422,069 | -6.19% | 10.56% | 10.68% | 11.05% |
| | | | | | **NC** | 7,166 | 7,907 | -9.37% | | **GRS** | |
| | | | | | **PVFS** | 389,838 | 388,925 | 0.23% | 10.01% | 10.02% | 10.02% |
| **7** | 54.8321 | 20.0833 | 50,932.77 | M | **EAAL** | 177,764 | 179,524 | -0.98% | | **CavMac** | |
| Fire & Rescue | | | | | **PVB** | 214,689 | 219,551 | -2.21% | 12.62% | 13.12% | 13.36% |
| | | | | | **NC** | 6,499 | 6,805 | -4.50% | | **GRS** | |
| | | | | | **PVFS** | 300,253 | 293,375 | 2.34% | 12.76% | 12.81% | 12.76% |
| **8** | 35.3799 | 9.6667 | 61,152.28 | U | **EAAL** | 81,601 | 89,370 | -8.69% | | **CavMac** | |
| Fire & Rescue | | | | | **PVB** | 169,870 | 174,362 | -2.58% | 12.04% | 11.57% | 11.50% |
| | | | | | **NC** | 7,541 | 7,030 | 7.27% | | **GRS** | |
| | | | | | **PVFS** | 759,785 | 738,866 | 2.83% | 12.36% | 12.38% | 12.33% |
| **9** | 59.7187 | 14.4167 | 30,636.82 | F | **EAAL** | 84,347 | 80,688 | 4.54% | | **CavMac** | |
| General | | | | | **PVB** | 101,502 | 100,612 | 0.88% | 13.45% | 15.01% | 14.63% |
| | | | | | **NC** | 3,949 | 4,483 | -11.92% | | **GRS** | |
| | | | | | **PVFS** | 134,179 | 129,452 | 3.65% | 13.35% | 13.32% | 12.89% |
| **Total Test Cases** | | | | | **EAAL** | 1,349,233 | 1,374,379 | -1.83% | | | |
| | | | | | **PVB** | 1,757,326 | 1,807,276 | -2.76% | | | |
| | | | | | **NC** | 50,637 | 51,676 | -2.01% | | | |
| | | | | | **PVFS** | 3,597,049 | 3,549,551 | 1.34% | | | |

# LGERS

## Retirees

GRS requested test life information on 12 retiree cases. Those 12 retiree cases are shown below:

| Test Case | Age | Option Code | Current Monthly Benefit | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| 1 - Law Enforcement | 69.62 | MAX | $1,129.62 | M | EAAL/PVB | $ 128,942 | $ 127,554 | 1.09% |
| 2 - General | 72.04 | OPT62 | 2,451.86 | F | EAAL/PVB | 338,233 | 340,405 | -0.64% |
| 3 - General | 70.21 | MAX | 1,279.95 | F | EAAL/PVB | 153,846 | 154,598 | -0.49% |
| 4 - General | 72.88 | OPT62 | 861.66 | F | EAAL/PVB | 110,380 | 110,405 | -0.02% |
| 5 - General | 81.79 | MAX | 1,943.90 | F | EAAL/PVB | 151,952 | 150,012 | 1.29% |
| 6 - General | 66.12 | MAX | 360.39 | F | EAAL/PVB | 47,360 | 47,461 | -0.21% |
| 7 - Law Enforcement | 58.38 | OPT63 | 2,943.97 | M | EAAL/PVB | 447,023 | 446,407 | 0.14% |
| 8 - General | 69.96 | MAX | 1,101.97 | F | EAAL/PVB | 133,498 | 133,154 | 0.26% |
| 9 - General | 56.21 | OPT4 | 3,029.60 | M | EAAL/PVB | 320,388 | 323,072 | -0.83% |
| 10 - Law Enforcement | 54.12 | OPT62 | 4,792.63 | M | EAAL/PVB | 785,379 | 782,130 | 0.42% |
| 11 - Fire | 73.46 | OPT2 | 1,319.25 | M | EAAL/PVB | 189,885 | 186,958 | 1.57% |
| 12 - General | 74.12 | MAX | 1,442.55 | F | EAAL/PVB | 154,736 | 156,296 | -1.00% |
| Total Test Cases | | | | | EAAL/PVB | 2,961,622 | 2,958,451 | 0.11% |

## Terminated Vested

GRS requested test life information on 10 Terminated Vested cases. Those 10 cases, and one case originally requested with the actives, are shown below:

| Test Case | Age | Service | Accumulated Contributions | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| 1 - Fire & Rescue | 58.2719 | 18.4166 | $87,756.93 | M | EAAL/PVB | $ 175,514 | $ 175,514 | 0.00% |
| 2 - Fire & Rescue | 39.4605 | 7.7500 | 21,902.07 | M | EAAL/PVB | 43,804 | 43,804 | 0.00% |
| 3 - Fire & Rescue | 36.2801 | 8.3333 | 31,447.60 | M | EAAL/PVB | 62,895 | 62,895 | 0.00% |
| 4 - Fire & Rescue | 38.4127 | 7.4166 | 25,877.50 | F | EAAL/PVB | 51,755 | 51,755 | 0.00% |
| 5 - Fire & Rescue | 65.0411 | 10.5000 | 33,899.34 | M | EAAL/PVB | 67,799 | 67,799 | 0.00% |
| 6 - General | 42.1025 | 7.4167 | 16,282.35 | F | EAAL/PVB | 32,565 | 32,565 | 0.00% |
| 7 - General | 52.3799 | 10.3332 | 34,970.02 | F | EAAL/PVB | 69,940 | 69,940 | 0.00% |
| 8 - General | 60.3580 | 8.2500 | 32,810.90 | M | EAAL/PVB | 65,622 | 65,622 | 0.00% |
| 9 - General | 53.7351 | 12.0000 | 52,416.56 | F | EAAL/PVB | 104,833 | 104,833 | 0.00% |
| 10 - General* | 64.0602 | 0.4166 | 925.38 | M | EAAL/PVB | 1,851 | 1,851 | 0.00% |
| 11 - Law Enforcement | 32.2077 | 11.4167 | 37,991.35 | M | EAAL/PVB | 75,983 | 75,983 | 0.00% |
| Total Test Cases | | | | | EAAL/PVB | 752,561 | 752,561 | 0.00% |

** Non-vested termination with LGERS, but also valued as active with TSERS (disability case).*

# Total LGERS

## (Actives, Retirees, and Terminated Vested)

| Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|
| **EAAL** | $5,063,416 | $5,085,391 | -0.43% |
| **PVB** | 5,471,509 | 5,518,288 | -0.85% |

# RODSPF

## Actives

GRS requested test life information on 10 active cases. CavMac indicated that one of the cases was not on the ROD file. The remaining active cases are shown below:

| Test Case | Age | Service | Reported Pay | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 78.7050 | 33.2500 | $57,573.92 | F | **EAAL** | $ 159,090 | $ 159,089 | 0.00% |
| | | | | | **PVB** | 159,090 | 159,089 | 0.00% |
| | | | | | **NC** | 0 | 0 | |
| | | | | | **PVFS** | 0 | 0 | |
| **2** | 41.9659 | 14.9167 | 58,593.50 | F | **EAAL** | 17,023 | 28,315 | -39.88% |
| | | | | | **PVB** | 76,966 | 128,856 | -40.27% |
| | | | | | **NC** | 4,333 | 8,562 | -49.39% |
| | | | | | **PVFS** | 818,351 | 686,423 | 19.22% |
| **3** | 56.3212 | 19.5833 | 86,332.00 | F | **EAAL** | 182,699 | 164,662 | 10.95% |
| | | | | | **PVB** | 239,870 | 235,702 | 1.77% |
| | | | | | **NC** | 10,169 | 11,607 | -12.39% |
| | | | | | **PVFS** | 495,898 | 520,245 | -4.68% |
| **4** | 76.4018 | 9.0000 | 73,045.36 | M | **EAAL** | 104,191 | 97,547 | 6.81% |
| | | | | | **PVB** | 125,216 | 115,717 | 8.21% |
| | | | | | **NC** | 10,786 | 9,336 | 15.53% |
| | | | | | **PVFS** | 152,112 | 142,211 | 6.96% |
| **5** | 38.0548 | 3.0833 | 48,244.03 | F | **EAAL** | 17,569 | 16,977 | 3.49% |
| | | | | | **PVB** | 80,876 | 79,825 | 1.32% |
| | | | | | **NC** | 4,484 | 4,265 | 5.14% |
| | | | | | **PVFS** | 705,041 | 700,172 | 0.70% |
| **6** | 65.0329 | 15.0833 | 51,144.80 | M | **EAAL** | 63,853 | 62,159 | 2.73% |
| | | | | | **PVB** | 134,587 | 117,464 | 14.58% |
| | | | | | **NC** | 9,902 | 8,773 | 12.87% |
| | | | | | **PVFS** | 391,506 | 322,386 | 21.44% |
| **7** | 62.9495 | 12.1667 | 44,478.44 | F | **EAAL** | 104,725 | 77,271 | 35.53% |
| | | | | | **PVB** | 177,998 | 148,075 | 20.21% |
| | | | | | **NC** | 12,744 | 11,068 | 15.14% |
| | | | | | **PVFS** | 268,521 | 284,848 | -5.73% |
| **8** | 36.6831 | 8.4167 | 95,706.39 | M | **EAAL** | 51,284 | 54,672 | -6.20% |
| | | | | | **PVB** | 116,630 | 122,674 | -4.93% |
| | | | | | **NC** | 4,385 | 4,394 | -0.20% |
| | | | | | **PVFS** | 1,493,358 | 1,498,137 | -0.32% |
| **9** | 55.6804 | 1.0833 | 59,615.92 | F | **EAAL** | 10,444 | 9,022 | |
| | | | | | **PVB** | 75,237 | 67,510 | 11.45% |
| | | | | | **NC** | 8,833 | 7,501 | 17.76% |
| | | | | | **PVFS** | 435,589 | 446,813 | -2.51% |
| **Total Test Cases** | | | | | **EAAL** | 710,878 | 669,714 | 6.15% |
| | | | | | **PVB** | 1,186,470 | 1,174,912 | 0.98% |
| | | | | | **NC** | 65,636 | 65,505 | 0.20% |
| | | | | | **PVFS** | 4,760,376 | 4,601,236 | 3.46% |

# RODSPF

## Retirees

GRS requested test life information on 11 retiree cases. CavMac indicated that one of the individuals died during the year. The remaining retiree cases are shown below:

| Test Case | Age | Option Code* | Current** Monthly Benefit | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 74.12 | OPT62 | $1,903.46 | F | **EAAL/PVB** | $ 202,471 | $ 203,455 | -0.48% |
| **2** | 66.29 | MAX | 5,145.26 | M | **EAAL/PVB** | 232,035 | 233,926 | -0.81% |
| **3** | 72.46 | MAX | 3,994.53 | F | **EAAL/PVB** | 216,622 | 220,090 | -1.58% |
| **4** | 71.54 | OPT63 | 1,645.20 | F | **EAAL/PVB** | 224,149 | 220,090 | 1.84% |
| **5** | 65.88 | MAX | 794.63 | F | **EAAL/PVB** | 267,361 | 265,974 | 0.52% |
| **6** | 86.62 | OPT63 | 2,229.91 | M | **EAAL/PVB** | 82,366 | 79,804 | 3.21% |
| **7** | 77.71 | MAX | 4,357.65 | M | **EAAL/PVB** | 143,959 | 141,071 | 2.05% |
| **8** | 61.71 | OPT63 | 3,954.55 | F | **EAAL/PVB** | 295,310 | 293,079 | 0.76% |
| **9** | 61.29 | MAX | 1,129.01 | M | **EAAL/PVB** | 265,910 | 267,605 | -0.63% |
| **10** | 53.12 | OPT4 | 3,516.69 | F | **EAAL/PVB** | 343,623 | 344,196 | -0.17% |
| **Total Test Cases** | | | | | **EAAL/PVB** | 2,273,806 | 2,269,289 | 0.20% |

** ROD benefits are paid for the life of the member only (MAX), regardless of beneficiary/option election for benefits paid from other plans.*

*** Benefit listed is LGERS benefit; ROD benefits are valued at $1,500 monthly.*

## Terminated Vested

GRS requested test life information for two terminated vested cases. CavMac indicated that they were "not on file", but terminated vested in LGERS.

## Total RODSPF

### (Actives and Retirees)

| Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|
| **EAAL** | $2,984,684 | $2,939,003 | 1.55% |
| **PVB** | 3,460,276 | 3,444,202 | 0.47% |

# DIPNC

## Actives

GRS requested test life information on 10 active cases. Those 10 active cases are shown below:

| Test Case | Age | Service | Reported Pay | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 67.9906 | n/a | $187,685.92 | M | **EAAL** | $ (137) | $ (768) | -82.16% |
| | | | | | **PVB** | 598 | 461 | 29.72% |
| | | | | | **NC** | 170 | 341 | -50.15% |
| | | | | | **PVFS** | 647,283 | 612,370 | 5.70% |
| **2** | 49.2159 | 20.3000 | 23,795.05 | F | **EAAL** | 148 | 205 | -27.80% |
| | | | | | **PVB** | 430 | 474 | -9.28% |
| | | | | | **NC** | 34 | 29 | 17.24% |
| | | | | | **PVFS** | 204,855 | 218,555 | -6.27% |
| **3** | 39.3267 | 8.5378 | 43,619.98 | F | **EAAL** | 367 | 223 | 64.57% |
| | | | | | **PVB** | 1,127 | 967 | 16.55% |
| | | | | | **NC** | 61 | 45 | 35.56% |
| | | | | | **PVFS** | 577,354 | 734,202 | -21.36% |
| **4** | 26.0861 | 3.4545 | 38,118.60 | F | **EAAL** | 78 | 34 | 129.41% |
| | | | | | **PVB** | 389 | 206 | 88.83% |
| | | | | | **NC** | 22 | 12 | 83.33% |
| | | | | | **PVFS** | 559,917 | 545,487 | 2.65% |
| **5** | 53.3157 | 14.5556 | 37,429.14 | F | **EAAL** | 305 | 379 | -19.53% |
| | | | | | **PVB** | 1,021 | 1,148 | -11.06% |
| | | | | | **NC** | 82 | 82 | 0.00% |
| | | | | | **PVFS** | 341,709 | 351,615 | -2.82% |
| **6** | 35.7406 | 10.8484 | 45,908.20 | F | **EAAL** | 346 | 208 | 66.35% |
| | | | | | **PVB** | 841 | 569 | 47.80% |
| | | | | | **NC** | 36 | 25 | 44.00% |
| | | | | | **PVFS** | 662,802 | 679,027 | -2.39% |
| **7** | 24.5465 | 2.2727 | 38,712.01 | F | **EAAL** | 60 | 35 | 71.43% |
| | | | | | **PVB** | 358 | 179 | 100.00% |
| | | | | | **NC** | 22 | 10 | 120.00% |
| | | | | | **PVFS** | 1,202,254 | 538,976 | 123.06% |
| **8** | 47.9550 | 17.4545 | 68,722.50 | M | **EAAL** | 550 | 608 | -9.54% |
| | | | | | **PVB** | 1,244 | 1,293 | -3.79% |
| | | | | | **NC** | 69 | 67 | 2.99% |
| | | | | | **PVFS** | 722,336 | 708,147 | 2.00% |
| **9** | 77.5794 | 39.5000 | 74,644.97 | F | **EAAL** | 0 | 122 | -100.00% |
| | | | | | **PVB** | 0 | 122 | -100.00% |
| | | | | | **NC** | 0 | 0 | |
| | | | | | **PVFS** | 0 | 0 | |
| **10** | 67.2433 | 9.9167 | 28,946.65 | M | **EAAL** | (131) | (197) | -33.50% |
| | | | | | **PVB** | 0 | 255 | -100.00% |
| | | | | | **NC** | 36 | 113 | -68.14% |
| | | | | | **PVFS** | 100,873 | 109,108 | -7.55% |
| **Total Test Cases** | | | | | **EAAL** | 1,586 | 849 | 86.81% |
| | | | | | **PVB** | 6,008 | 5,674 | 5.89% |
| | | | | | **NC** | 532 | 724 | -26.52% |
| | | | | | **PVFS** | 5,019,383 | 4,497,487 | 11.60% |

# DIPNC

## Retirees

GRS requested test life information on 10 retiree cases. Those 10 retiree cases are shown below:

| Test Case | Age | Disability Start Date | Current Monthly Benefit | Sex | Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 59.99 | 11/2003 | 1,258.07 | F | **EAAL/PVB** | $ 63 | $ 640 | -90.16% |
| **2** | 61.44 | 4/2008 | 2,734.17 | M | **EAAL/PVB** | 0 | 0 | n/a |
| **3** | 59.61 | 8/2009 | 2,661.25 | F | **EAAL/PVB** | 5,722 | 6,901 | -17.08% |
| **4** | 51.35 | 11/2012 | 1,840.77 | F | **EAAL/PVB** | 55,805 | 54,523 | 2.35% |
| **5** | 49.35 | 2/2018 | 2,171.35 | F | **EAAL/PVB** | 48,097 | 32,657 | 47.28% |
| **6** | 67.54 | 4/1981 | 702.90 | F | **EAAL/PVB** | 92,906 | 94,434 | -1.62% |
| **7** | 52.54 | 1/2011 | 3,172.86 | F | **EAAL/PVB** | 143,683 | 139,857 | 2.74% |
| **8** | 59.27 | 6/2007 | 1,197.37 | F | **EAAL/PVB** | 13,214 | 24,165 | -45.32% |
| **9** | 52.10 | 11/1999 | 1,970.44 | M | **EAAL/PVB** | 21,619 | 21,546 | 0.34% |
| **10** | 59.19 | 8/2019 | 1,342.25 | F | **EAAL/PVB** | 9,387 | 9,050 | 3.72% |
| **Total Test Cases** | | | | | **EAAL/PVB** | 390,496 | 383,773 | 1.75% |

## Terminated Vested

Terminated vested members of TSERS are not eligible for DIPNC benefits, therefore none were requested.

## Total DIPNC

### (Actives and Retirees)

| Valuation Result | GRS | CavMac | % Diff |
|---|---|---|---|
| **EAAL** | $392,082 | $384,622 | 1.94% |
| **PVB** | 396,504 | 389,447 | 1.81% |

# RHB

GRS requested test life information on 10 active, 12 retiree and 10 terminated vested cases. Segal previously indicated that they do not run valuations seriatim. Instead, they group the data into smaller categories, run each group as if it was an individual record, and then gross the results up by the number in the group. Segal was very helpful and worked with us to identify testing that GRS would be comfortable in using instead of individual records when we first began reviewing these reports (in 2018). Each test record in the following displays actually represents a group of members.

## Actives

| Test Case | Age | Service | Reported Pay | Sex | Valuation Result | GRS | Segal | % Diff |
|---|---|---|---|---|---|---|---|---|
| **1** | 58.46 | 23.58 | $ 55,000 | F | **EAAL** | $ 65,630 | $ 70,425 | -6.81% |
| **Teachers** | | | | | **PVB** | 86,471 | 95,011 | -8.99% |
| | | | | | **NC** | 5,574 | 5,899 | -5.51% |
| | | | | | **PVFS** | 205,483 | 229,235 | -10.36% |
| **2** | 54.69 | 14.00 | 45,759 | M | **EAAL** | 39,340 | 41,441 | -5.07% |
| **General** | | | | | **PVB** | 79,309 | 79,505 | -0.25% |
| | | | | | **NC** | 4,669 | 4,235 | 10.25% |
| | | | | | **PVFS** | 396,508 | 411,286 | -3.59% |
| **3** | 35.39 | 14.90 | 46,215 | M | **EAAL** | 139,177 | 122,251 | 13.85% |
| **General** | | | | | **PVB** | 298,576 | 294,663 | 1.33% |
| | | | | | **NC** | 12,097 | 12,332 | -1.91% |
| | | | | | **PVFS** | 613,347 | 646,123 | -5.07% |
| **4** | 33.08 | 0.92 | 26,910 | M | **EAAL** | 6,527 | 6,775 | -3.66% |
| **General** | | | | | **PVB** | 94,409 | 95,415 | -1.05% |
| | | | | | **NC** | 5,653 | 5,726 | -1.27% |
| | | | | | **PVFS** | 406,289 | 416,580 | -2.47% |
| **5** | 55.26 | 16.30 | 16,021 | F | **EAAL** | 42,112 | 43,099 | -2.29% |
| **Other** | | | | | **PVB** | 80,386 | 83,067 | -3.23% |
| | | | | | **NC** | 5,127 | 4,815 | 6.48% |
| | | | | | **PVFS** | 122,021 | 132,986 | -8.24% |
| **6** | 49.99 | 4.17 | 19,469 | F | **EAAL** | 13,385 | 12,764 | 4.87% |
| **Other** | | | | | **PVB** | 49,408 | 46,642 | 5.93% |
| | | | | | **NC** | 2,739 | 2,549 | 7.45% |
| | | | | | **PVFS** | 260,093 | 258,768 | 0.51% |
| **7** | 33.68 | 9.25 | 64,020 | F | **EAAL** | 93,924 | 89,384 | 5.08% |
| **Other** | | | | | **PVB** | 226,414 | 211,789 | 6.91% |
| | | | | | **NC** | 7,582 | 6,982 | 8.59% |
| | | | | | **PVFS** | 1,136,706 | 1,122,328 | 1.28% |
| **Total Test Cases** | | | | | **EAAL** | 400,095 | 386,139 | 3.61% |
| | | | | | **PVB** | 914,973 | 906,092 | 0.98% |
| | | | | | **NC** | 43,441 | 42,538 | 2.12% |
| | | | | | **PVFS** | 3,140,447 | 3,217,306 | -2.39% |

# RHB

## Retirees

| | Test Case | Age | Sex | Valuation Result | GRS | Segal | % Diff |
|---|---|---|---|---|---|---|---|
| 1 | General | 90.59 | F | EAAL/PVB | $ 5,874 | $ 5,861 | 0.22% |
| 2 | General | 83.02 | F | EAAL/PVB | 10,879 | 10,898 | -0.17% |
| 3 | General | 75.76 | M | EAAL/PVB | 19,090 | 18,597 | 2.65% |
| 4 | General | 71.04 | F | EAAL/PVB | 25,627 | 25,143 | 1.92% |
| 5 | General | 71.29 | M | EAAL/PVB | 25,776 | 25,906 | -0.50% |
| 6 | General | 66.77 | M | EAAL/PVB | 33,559 | 32,483 | 3.31% |
| 7 | General | 65.62 | F | EAAL/PVB | 34,786 | 33,170 | 4.87% |
| 8 | General (disabled) | 66.09 | F | EAAL/PVB | 26,527 | 26,031 | 1.91% |
| 9 | General | 60.26 | M | EAAL/PVB | 105,465 | 108,446 | -2.75% |
| 10 | General | 62.53 | F | EAAL/PVB | 67,313 | 59,845 | 12.48% |
| 11 | General | 66.97 | F | EAAL/PVB | 32,456 | 31,479 | 3.10% |
| 12 | Teachers/Other | 73.20 | M | EAAL/PVB | 25,446 | 25,485 | -0.15% |
| | Total Test Cases | | | EAAL/PVB | 412,798 | 403,344 | 2.34% |

## Terminated Vested

| | Test Case | Age | Service | Sex | Valuation Result | GRS | Segal | % Diff |
|---|---|---|---|---|---|---|---|---|
| 1 | Teacher | 41.27 | 8.0 | F | EAAL/PVB | $ 122,891 | $ 123,359 | -0.38% |
| 2 | Teacher | 35.17 | 7.6 | F | EAAL/PVB | 15,917 | 25,644 | -37.93% |
| 3 | Teacher | 50.81 | 7.9 | F | EAAL/PVB | 11,476 | 17,370 | -33.93% |
| 4 | Teacher | 46.61 | 18.4 | F | EAAL/PVB | 105,788 | 103,814 | 1.90% |
| 5 | Law Enforcement | 45.70 | 18.4 | M | EAAL/PVB | 115,888 | 119,023 | -2.63% |
| 6 | General | 62.61 | 6.2 | F | EAAL/PVB | 62,758 | 60,519 | 3.70% |
| 7 | General (disabled) | 62.01 | 13.4 | M | EAAL/PVB | 30,802 | 31,052 | -0.81% |
| | Total Test Cases | | | | EAAL/PVB | 465,520 | 480,781 | -3.17% |

# Total RHB

## (Actives, Retirees, and Terminated Vested)

| Valuation Result | GRS | Segal | % Diff |
|---|---|---|---|
| **EAAL** | $1,278,413 | $1,270,264 | 0.64% |
| **PVB** | 1,793,291 | 1,790,217 | 0.17% |

# Test Lives Comments

We believe that the test lives are close enough to state that the liabilities shown in the funding valuations are reasonable and an appropriate representation of the liabilities, based on the current assumptions. When performing a full replication valuation, we generally consider replication a successful match if the replication is within the following tolerances (in plan total):

| | |
|---|---|
| Total Present Value of Benefits | 2% |
| Total Accrued Liability | 5% |
| Normal Cost | 5% |
| Present Value of Future Pay | 2% |

When looking at individual test life cases, difference may be much larger due to differences in rounding between actuarial software. For this reason, it is also important to consider the variance between the sums of the test cases, which will generally dampen the effect of differences due to rounding. However, the smaller the group of test cases, the larger the acceptable tolerances should be. We have found that the sums of the test cases (actives, retirees and terminated vested) for each of the plans we have reviewed are all within or acceptably close to the tolerance we would have applied to the plan totals when performing a full replication. We therefore believe the plan total results for TSERS, LGERS, RODSPF, DIPNC and RHB are reasonable.

This is our third year performing this analysis. As such, we attempted to request some of the same test life cases this year as we did in previous years, so we could review how the results changed from year-to-year. We have had similar results in our test life comparisons in each of the three years we have performed the analysis. One thing that was noticed in the 2018 and 2019 comparisons was that the normal cost as a percent of pay for LGERS active changed from year to year by between 0.25% of pay and 1.50% of pay. Last year CavMac indicated that this was related to a change in the method of round ages that was newly implemented in the December 2018 valuation (in order to be consistent with the method of rounding used in the TSERS valuation). However, we see this phenomenon again this year, although to a lesser degree, as shown in the LGERS active test life display on page 17. When using the individual entry age actuarial cost method, the normal cost expressed as a percent of pay, would not be expected to materially change from year to year, unless that member's underlying data or plan provisions changed (note the GRS year-to-year calculations are more stable than the CavMac calculations). We recommend this result be reviewed by CavMac. On a technical note, if we were expressing the normal cost as a percent of the member's pay projected to be paid in the next year, we would not expect any change in the normal cost percent from year-to-year. However, since we do not have (and did not request) the projected pays for the year following the valuation, we used reported pay instead which introduces some year-to-year fluctuation in the measurement. We have modified our TSERS and LGERS test life displays to show this comparison for each of the last three years. However, for TSERS, there were only two active lives that were included in both the 2017 and 2018 reviews and they had data changes. We are therefore only showing the comparison for 2018 and 2019 for TSERS.

Another year-to-year inconsistency that appeared this year was in the RHB terminated vested test cases. Test case 2 and 3 of that group are a year older than the cases requested last year. While most of the results tracked from year-to-year, those two did not. The Segal calculations are materially different this year, while our calculations are similar to our calculations from last year. We recommend that Segal review these two calculations and let us know if there is something different about them this year that resulted in their materially different liability calculations from last year.

We have the following comments regarding the valuation reports and the current actuaries' calculations:

- Since the CavMac reports were dated in October, we believe that ASOP 56 applies. However, we were unable to locate the ASOP 56 required disclosers in the CavMac reports. Note ASOP 56 is applicable to all actuarial work performed after October 1, 2020. Since the Segal report was issued before that date, ASOP 56 did not apply. We recommend that CavMac include the required ASOP 56 disclosures in all future reports.
- We recommend the North Carolina Retirement Systems (NCRS) provide their actuary with more complete information regarding terminated vested members. CavMac has previously indicated that they are working with NCRS on this point. CavMac also indicates that liabilities are estimated to be twice the members' accumulated contributions. Test life information indicates that this was also the case for non-vested members. We recommend that liabilities be set equal to members' accumulated contributions for non-vested members, as a measure of the outstanding refund. Alternately, if CavMac has rationale for estimating liabilities for terminated vested members to be twice the members' accumulated contributions, disclose the rationale for the assumption.
- The test life information indicates that in certain circumstances, data was modified before being used (as allowed for under ASOP 23). However, ASOP 23, section 4.1 requires disclosure of such modifications, the general data review process, any and any "significant judgmental adjustments or assumptions." We recommend that CavMac increase the documentation regarding their data processing. Specifically, we suggest that documentation/commentary include:
    - How members receiving DIPNC benefits are valued in TSERS (specifically, how is the pay data determined);
    - How valuation pay and reported pay differ (there is a vague comment in the report that we suggest expanding);
    - What pay limitations are valued and how that might differ from other assumptions (TSERS test case 2 implies that the reported pays are capped at the 401(a)(17) limit in the valuation and that limit is increased at 3.5% per year); and
    - How members with reported sex of U are valued (male or female).
- Review whether or not it would be appropriate to set the member's accrued contributions as a floor on the liabilities (for TSERS test case 4 from our 2017 review, CavMac's total and accrued liability calculation are lower than the member's current accumulated contributions shown on the data file).
- Disclose that the timing of retirement changes from mid-year to beginning of year at and after the end of the retirement pattern (this is illustrated in the results for LGERS test case 2). Note page 77 of the LGERS report contains a statement on timing that timing for all assumptions is mid-year (July 1) when this is actually not the case for the last age and beyond of the retirement pattern
- Identify how RODSPF service is determined/maintained (see comment below).
- Segal should review the two terminated test live cases (case 2 and case 3) that materially changed this year.

We have the following comments regarding future audits:

- In reviewing the RODSPF actives, it became clear that the reported service on the file was not RODSPF service in all cases (it was most likely total LGERS service). We were able to find RODSPF start dates based on internet searches of public data to better match calculations. We suspect that CavMac must have had additional data regarding RODSPF service for active members (as searching public databases would not be practical for the entire RODSPF active population). We recommend that such additional information be included in data provided to the auditor.

# SECTION 4

## A REVIEW OF THE RESPECTIVE GASB REPORTS

# Content Review

The GASB 67/74 letters combined with the schedules in the funding valuation appear to have all of the actuarial schedules required by Statement Nos. 67/74.

For the reports prepared by CavMac, there are separate GASB letters issued with the main results. However, the information in these letters appears to be replicated in the funding valuation with additional GASB schedules. We believe that all of the actuarial schedules and actuarial disclosures required by GASB 67/74 are detailed in the funding valuation report.

For the report prepared by Segal, there is no funding valuation (in accordance with the plan sponsor's decisions). The report that Segal provided for the GASB 74 results contained the underlying valuation results as of December 31, 2019. We believe that the Segal GASB 74 report contains all the actuarial schedules and disclosures required by GASB 74.

# Calculations Review

While our review affirmed the December 31, 2019 calculations of liabilities, the following chart shows our attempt at replicating the roll forward to June 30, 2020. Since the exact calculations were not provided and certain elements had to be estimated, we did not expect to exactly reproduce the June 30, 2020 numbers. As the schedules show, our estimates were extremely close. We note that the RHB results would be even closer if we used last year's discount rate in line 12. While this is most likely a coincidence, we recommend that Segal quickly review their calculations to ensure that the discount rate was changed everywhere appropriate.

| | | TSERS | LGERS | RODSPF | DIPNC | RHB |
|---|---|---|---|---|---|---|
| | Data | | | | | |
| 1 | December 31, 2019 AAL | 84,873,315,000 | 30,700,921,303 | 30,907,611 | 326,431,066 | 28,889,369,897 |
| 2 | Employee Contribs during 12 months, ending 6/30/20 | 964,544,000 | 436,754,000 | - | - | - |
| 3 | Employer Normal Cost Rate (Excl Admin Exp) as of 1/1/20 | 5.06% | 5.74% | 15.32% | 22,708,000 | 1,974,212,317 |
| 4 | Payroll as of 12/31/19 | 14,886,467,797 | 6,488,881,575 | 6,976,884 | 1 | 1 |
| 5 | Benefits Paid during 12 months ending 6/30/20 | 4,934,999,000 | 1,551,217,000 | 1,788,000 | 55,210,000 | 1,084,668,452 |
| | GRS' approximation of numbers needed for roll forward | | | | | |
| 6 | Change in Benefit Terms (not already included in 12/31/2019 AAL) | - | - | - | - | - |
| 7 | Service Cost from 12/31/19 to 6/30/20: (3)*(4)/2 | 376,627,635 | 186,339,009 | 534,416 | 11,354,000 | 987,106,159 |
| 8 | Benefit Payments from 12/31/19 to 6/30/20: (5)/2 | 2,467,499,500 | 775,608,500 | 894,000 | 27,605,000 | 542,334,226 |
| | GRS' approximation of 6/30/20 TPL/OBEP Liab (roll forward) | | | | | |
| 9 | 12/31/19 TPL: (1)+(6) | 84,873,315,000 | 30,700,921,303 | 30,907,611 | 326,431,066 | 28,889,369,897 |
| 10 | Service Cost: (2)/2 + (7) | 858,899,635.26 | 404,716,009.07 | 534,415.84 | 11,354,000.00 | 987,106,158.50 |
| 11 | Benefit Payments | 2,467,499,500 | 775,608,500 | 894,000 | 27,605,000 | 542,334,226 |
| 12 | Interest: (1)*7%/2 + [(10)-(11)]*7%/4[#] | 2,942,415,527 | 1,068,041,627 | 576,147 | 5,968,229 | 321,684,902 |
| 13 | TPL/OPEB Liab 6/30/20: (9) + (10) - (11) + (12) | 86,207,130,663 | 31,398,070,439 | 31,124,173 | 316,148,295 | 29,655,826,732 |
| 14 | TPL/OPEB Liab 6/30/20 developed by CavMac/Segal | 86,164,011,000 | 31,372,060,000 | 31,129,000 | 316,039,000 | 29,802,158,533 |
| 15 | Ratio of GRS approximation to CavMac/Segal Calculation | 100.1% | 100.1% | 100.0% | 100.0% | 99.5% |

[#] *For RODSPF and DIPNC, 7% is replaced with 3.75%; 2.21% for RHB.*

# SECTION 5

## COMMENTS AND CONCLUSIONS

# Comments

We would like to thank Segal and CavMac for their cooperation in the completion of this review. However, we would like to specifically recognize Segal for going above and beyond expectations in their efforts to ensure that we had the information necessary to complete our assignment.

While we have indicated we believe the assumed rate of return of 7.00% was reasonable for TSERS and LGERS (based on the information provided for this review). However, capital market expectations have continued to decrease. If this trend continues, we recommend this assumption be lowered for future valuations (assuming no change in the asset allocation).

# Prior Year's Recommendations

We have reviewed the reports with regard to our recommendations from last year (and the prior year) and have not found implementation of any of our recommendations.

While most of our recommendations can be considered our opinion of best practices, one recommendation (from last year) was/is related to the documentation of data processing required by Actuarial Standard of Practice (ASOP 23). It is not clear to GRS that the CavMac valuation reports meet this ASOP as it relates to disclosure requirements. In addition, since the CavMac reports were issued after October and do not appear to contain the required modeling disclosers, we believe they now fail to meet a second ASOP (statement 56).

# Conclusions

We believe the actuarial assumptions, actuarial cost methods, procedures, and valuation results are reasonable and based on our test life review, the valuation results are of reasonable accuracy.

We certify that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures (with the exception of the disclosure requirements discussed above).

# Recommendations for Future Years

We have the following recommendations for future valuations:

- Lower the price inflation assumption to within the range of 2.0% to 2.5%;
- Lower the long-term expected return for TSERS and LGERS in the future valuations;
- Add required ASOP 56 disclosures;
- Increase the documentation in the valuation regarding data processing/preparations;
- We recommend the North Carolina Retirement Systems (NCRS) provide their actuary with more complete information regarding terminated vested members, and that either liabilities be set equal to members' accumulated contributions for non-vested members or the rationale for setting equal to twice the non-vested members' accumulated contributions be disclosed;
- We recommend that CavMac increase the documentation regarding their data processing to comply with ASOP 23. Specifically, we suggest that documentation/commentary include:
    - How members receiving DIPNC benefits are valued in TSERS;
    - How valuation pay and reported pay differ (there is a vague comment in the report that we suggest expanding);
    - What pay limitations are valued and how that might differ from other assumptions (such as the 401(a)(17) limit compensation limit);
    - How members with reported sex of U are valued (male or female);
    - Ensure compliance with ASOP 23; and
    - How RODSPF service is determined/maintained.
- Setting a floor on liabilities equal to members' accrued contributions;
- Disclose that the timing of retirements changes from mid year to beginning of year at the end of the retirement pattern; and
- Providing any additional data files used in the valuation to the actuarial auditor (such as RODSPF service for active members).