

**Report 20-2
February 2020**

Wisconsin Retirement System Actuarial Audit

STATE OF WISCONSIN



Legislative Audit Bureau ■

Wisconsin Retirement System Actuarial Audit

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STATE OF WISCONSIN | Legislative Audit Bureau

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Joe Chrisman
State Auditor

February 21, 2020

Senator Robert Cowles and
Representative Samantha Kerkman, Co-Chairpersons
Joint Legislative Audit Committee
State Capitol
Madison, Wisconsin 53702

Dear Senator Cowles and Representative Kerkman:

The Legislative Audit Bureau is required by s. 13.94 (1) (dc), Wis. Stats., to contract for the performance of an actuarial audit of the Wisconsin Retirement System (WRS) at least once every five years. An actuarial audit involves engaging the services of an outside actuary to review the work of the plan's consulting actuary. Actuarial audits enhance the credibility of the actuarial valuation process by providing independent assurance that the valuation was performed in accordance with the actuarial standards of practice, which are prescribed by the Actuarial Standards Board. Actuarial audits may also provide recommendations to improve the actuarial valuation process, including how information is presented in the actuarial valuation report.

After a formal request-for-proposal process, the Bureau awarded a contract to Segal Consulting Midwest (Segal) for an independent audit of the December 31, 2018 actuarial valuation for non-retired and retired participants, and the three-year experience study covering the period from January 1, 2015, through December 31, 2017. An actuarial valuation is used to assess the long-term viability of the WRS and to establish the contribution rates that are needed to meet current and future obligations of the WRS. An experience study assesses whether actual experience of the WRS, such as the rate at which participants leave WRS-covered employment, indicates that the actuarial assumptions used in the actuarial valuation should be updated.

Under the contract, Segal verified and analyzed the completeness and validity of the data used in the actuarial valuation and performed a "full-scope" actuarial audit of the December 31, 2018 actuarial valuation. As part of the full-scope actuarial audit, the original actuarial valuation was replicated based on the same participant data, assumptions, and actuarial valuation methods that were used by the Department of Employee Trust Funds (ETF) and its consulting actuary, Gabriel, Roeder, Smith & Company (GRS). Segal also assessed the reasonableness of the actuarial assumptions that were validated and updated through the three-year experience study. The actuarial audit was conducted in accordance with the actuarial standards of practice.

This report includes the results of the actuarial audit performed by Segal, a response from ETF, and a response from GRS. Bureau staff managed the audit contract but were not involved in the fieldwork, analysis, or writing of the actuarial audit report.

Segal concluded that GRS had a "sound valuation process" for the December 31, 2018 actuarial valuation (page 21). In addition, Segal generally agreed with the results of the three-year experience study and concluded that the actuarial cost method, the asset valuation method, and the mechanism used to smooth investment earnings over a five-year period were reasonable

and conformed to the actuarial standards of practice (pages 2 and 29). Further, Segal reported that the long-term expected rate of return assumption of 7.0 percent was within national benchmarks, that the range of 6.8 percent to 7.0 percent recommended by GRS was reasonable, and that the selection of 7.0 percent by the ETF Board was appropriate (page 12).

To improve the actuarial valuation, the overall evaluation of the WRS experience, and the assumptions used, Segal provided comments and recommendations to be considered by ETF and GRS. First, Segal recommended that GRS work with ETF to determine if additional information was available about 3,300 participants who were reported as receiving a retirement benefit but who were not included in data files of retired participants. Additional information may allow for inclusion of these participants in the actuarial valuation (page 6).

Second, Segal recommended that GRS include its basis for deviating from the mortality improvement scale published by the Society of Actuaries (page 15). The mortality rate assumption plays a key role in determining a pension plan's liability and the benefits that will be paid to participants. Segal reported that if GRS had used the published mortality improvement scale, the actuarial liability would have increased by approximately 1.25 percent.

Third, Segal commented that it expected the long-term rate of return assumption used during calendar year 2018 (7.2 percent) would have been used in determining the expected investment earnings amount in the Market Recognition Account (MRA) (page 26). The MRA is used to smooth investment income or loss over a five-year period and results in the investment earnings distributed into the plan being affected by amounts from each of the previous four years. The expected investment earnings amount is used, along with actual investment earnings and amounts from the previous four years, in determining the investment earnings distributed into the plan. As we noted in report 19-17, in December 2018 the ETF Board approved a decrease in the long-term expected rate of return assumption from 7.2 percent to 7.0 percent for the December 31, 2018 actuarial valuation. Because 7.0 percent was used in determining the expected investment income for calendar year 2018, the investment earnings distributed into the plan for calendar year 2018 were lower than if 7.2 percent had been used. This difference will be distributed into the plan over the next four years. ETF chose to use 7.0 percent based upon past administrative practice.

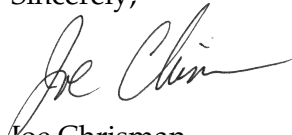
Fourth, Segal recommended modifications to the current discussion of risk and maturity measures included in the actuarial valuation report to improve the reader's understanding of the concepts and risks inherent in the WRS (page 27). In report 18-10, we reported that the Actuarial Standards Board adopted a new standard of practice, effective in November 2018, for pension plan actuaries and administrators to disclose in their annual valuations the amount of risk to which the public pension plan is exposed. Segal noted that although the current discussion addresses risks that affect a pension system, it is generic and could be improved by adding more specifics related to the WRS.

Segal made other recommendations, including that investment return information be presented across a longer time period, a review of mortality experience be conducted separately for each job classification, and additional information be provided to support other assumptions used in the calculation of the actuarial liability (pages 29 and 30).

Senator Robert Cowles and
Representative Samantha Kerkman, Co-Chairpersons
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February 21, 2020

We appreciate the courtesy and cooperation extended to us by Segal, ETF, and GRS in the performance of this independent actuarial audit.

Sincerely,

A handwritten signature in black ink, appearing to read "Joe Chrisman". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Joe Chrisman
State Auditor

JC/LK/ss



**State of Wisconsin
Legislative Audit Bureau**

**ACTUARIAL AUDIT OF THE WISCONSIN RETIREMENT
SYSTEM**

DECEMBER 31, 2018 ACTUARIAL VALUATION

**THREE-YEAR EXPERIENCE STUDY (JANUARY 1, 2015 –
DECEMBER 31, 2017)**

February 18, 2020

Ms. Lisa Kasel
Assistant Audit Director
Wisconsin Legislative Audit Bureau
22 E. Mifflin Street, Suite 500
Madison, WI 53703

Re: **Actuarial Audit of the December 31, 2018 Actuarial Valuation
and the Three Year Experience Study (January 1, 2015 – December 31, 2017)**

Dear Ms. Kasel:

Segal Consulting Midwest (Segal) is pleased to present the results of the actuarial audit of the December 31, 2018 actuarial valuation and review of the Three-Year Experience Study Report. The purpose of this audit is to conduct an independent analysis of the actuarial methods, assumptions, and procedures used by the Wisconsin Retirement System's ("WRS") actuary Gabriel, Roeder, Smith & Company (GRS) for the active and retired lives valuation as of December 31, 2018. This audit includes the following:

1. ***Verification of Data Collection and Validity*** – an assessment of the validity, completeness, and appropriateness of the participant data, including the degree to which data is sufficient to support the conclusions of the actuarial valuation and the use and appropriateness of any assumptions made regarding the data.
2. ***Methods and assumptions review*** – an analysis and benchmarking of the actuarial assumptions and a review of the actuarial methods utilized in determining the normal cost, actuarial accrued liability, and funded status as of December 31, 2018, including a review of the Three-Year Experience Study covering the period January 1, 2015 to December 31, 2017.
3. ***Replication of the December 31, 2018 actuarial valuation*** – an evaluation of the valuation results, with a detailed review of the findings, including a replication of the December 31, 2018 valuation results.
4. ***Report review*** – a review of the reports for the retired members and non-retired members of the Wisconsin Retirement System, including a review of the valuation conclusions and the required contribution rates. In addition, the results were reviewed to determine if they comply with actuarial standards and whether such valuation reports reflect appropriate disclosure information under any required reporting.

This review was conducted under the supervision of Kim Nicholl, a Fellow of the Society of Actuaries, a member of the American Academy of Actuaries, and an Enrolled Actuary under ERISA, and Matthew Strom, 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 Legislative Audit Bureau, the Department of Employee Trust Funds (“ETF”) staff, and GRS is gratefully acknowledged.

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

Sincerely,



Kim Nicholl, FSA, MAAA, EA
Senior Vice President and Actuary



Matthew A. Strom, FSA, MAAA, EA
Senior Vice President and Actuary

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Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Executive Summary

The State of Wisconsin Legislative Audit Bureau (LAB) retained Segal to conduct an independent actuarial audit of the Wisconsin Retirement System's (WRS) December 31, 2018 actuarial valuation and the Three-Year Experience Study covering the period January 1, 2015 to December 31, 2017, as performed by the WRS consulting actuary, Gabriel, Roeder, Smith & Company (GRS).

The main objectives for this engagement included:

1. A review of the demographic and financial information;
2. A review of the reasonableness and consistency of actuarial assumptions, methods and procedures;
3. An evaluation of whether the valuation reflects State statutes;
4. Replication of the valuation results to confirm reasonableness and accuracy of contribution rates and actuarial accrued liabilities;
5. An evaluation of whether the valuation was performed in accordance with Actuarial Standards of Practice (ASOPs);
6. An assessment of the quality of the valuation report; and
7. An evaluation of the results and the actuarial assumptions generated from the Three-Year Experience Study.

The objective of an actuarial audit of any valuation is to provide validation that the liabilities and contribution rates of WRS are reasonable and being calculated as intended. This review includes a full replication of the December 31, 2018 actuarial valuation results, plus a review of the key components in the valuation process that encompass the derivation of the liabilities and contribution rates for WRS. These key components include the data employed, the benefits valued, the actuarial assumptions and funding method used, and the asset valuation method employed.

We reviewed all information supplied to us, including participant data files and reports. We also requested and reviewed additional information from GRS, including test lives and documentation of procedures beyond those disclosed in the valuation reports.

Summary of Findings

This audit validates the findings of the December 31, 2018 actuarial valuation and the Three-Year Experience Study covering the period January 1, 2015 to December 31, 2017. Segal was able to match the valuation results and the test life output within an acceptable range. The data appears complete and we were able to closely match the participant counts reported by GRS. We concluded the valuation was performed in accordance with the actuarial standards of practice promulgated by the Actuarial Standards Board (ASB).

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Executive Summary

Our replication of the valuation produced results that are within 0.02% of the total present value of future benefits and within 0.04% of the total actuarial accrued liability. Differences less than 3% are generally considered a reasonable match; the results are well within that tolerance. Additional detail on the replication of the December 31, 2018 actuarial valuation can be found in Section IV.

Our key comments and recommendations relative to the December 31, 2018 actuarial valuation and Three-Year Experience Study are as follows:

- GRS is processing the data files in a reasonable and accurate manner and participants are being removed from the active lives valuation and added to the retired lives valuation at the appropriate time;
 - There are 3,300 records reported in the active lives data file as receiving a retirement benefit, but were not included in the retired lives data. At our request, GRS reviewed these records and determined that a subgroup of these records were retired but were not in the retiree data file, due to a lag in reporting. GRS indicated that the data lag issue was identified in prior studies and is one reason that GRS uses a contingency load in the active valuation.
- The economic assumptions are within norms for the peer group;
 - We recommend that GRS consider showing results based on capital market assumptions over a time horizon longer than 10 years.
- With respect to the 60% factor applied to the mortality improvement factors from Scale MP-2018, we recommend that GRS include a basis for deviating from the published improvement scale;
- The asset valuation method is being applied correctly and in our opinion, the five-year smoothing method is reasonable and meets actuarial standards;
- With the exception of a few test lives shown in Section IV, the test life detail was matched to within 1%;
- The Market Recognition Account uses an assumed asset return for the year ending December 31, 2018 of 7.0% while during calendar 2018, the assumption was 7.2%; and
- Consider modifying the current Discussion of Risk/Maturity Measures section to improve the intended user's ability to grasp the concepts and understand the risks inherent in WRS.

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

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section I: Purpose, Scope and Methodology of the Audit

Purpose of the Audit

The Legislative Audit Bureau retained Segal to conduct a replication of the December 31, 2018 actuarial valuation and a review of the Three-Year Experience Study covering the period January 1, 2015 to December 31, 2017. The actuarial audit includes:

- An assessment of the validity of the data used in the valuation;
- A review of the appropriateness of the current funding method and procedures;
- An evaluation of economic and non-economic assumptions;
- Confirmation of the valuation results; and
- A review of the actuarial reports to determine if there is consistency in the presentation of the actuarial valuation results and whether the reports are consistent with professional standards.

Scope of the Audit

Performing a full replication of the December 31, 2018 actuarial valuation provides:

1. Assurance that appropriate benefits are being valued;
2. Confirmation that the valuation system is accurately applying decrements to all members by examining the test lives and replicating the December 31, 2018 actuarial valuation;
3. Confirmation that the program is valuing benefits as described in the valuation reports and consistent with applicable statutes;
4. A review of economic and demographic assumptions and an assessment of their reasonableness;
5. A review of the reasonableness of actuarial funding and asset valuation methods;
6. An indication as to whether the liabilities and contribution rates shown are not reasonable or are incorrectly calculated;
7. A review that the current actuary's valuation system is accurately applying each assumption; and
8. Confirmation the valuation system is adding together liabilities appropriately for each decrement, for each member, and over the entire population (meaning no participant group is excluded and no liabilities are being omitted).

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section I: Purpose, Scope and Methodology of the Audit

Methodology of the Audit

The purpose of this audit is to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, methods, and contribution rates, and confirm the actuarial valuation results.

The measurement of the reasonableness of the funding levels encompasses three key analyses:

1. A verification of the benefits being projected for future payment;
2. A verification of the appropriateness of the actuarial assumptions that are used in calculating the liabilities; and
3. A verification of the appropriateness of the funding and asset valuation methods.

Benefits Analysis

Critical to projecting future benefits is receiving complete and accurate data. We reviewed the process by which data is prepared for the actuarial valuation, including:

1. An assessment of the completeness of the data;
2. A review of the data screening process employed; and
3. A comparison of the valuation data to the data supplied by ETF to GRS.

We developed computer models that generated test life output, which enabled us to compare our test life results with GRS's results. These models also allowed us to confirm that the GRS valuations project benefits in a manner consistent with the Summary of Plan Provisions in the valuation reports. For purposes of this study, we regard differences of less than 3% to be acceptable for the total present value of benefits and actuarial accrued liability and 5% to be acceptable for the review of census data and test life output.

Assumptions Analysis

The second critical component in assessing the reasonableness of the funding levels is in the selection and the application of the actuarial assumptions. With respect to the assumptions, we:

1. Reviewed the Three-Year Experience Study report;
2. Independently determined the reasonability of the investment return assumption by using capital market assumptions from Segal Marco Advisors; and
3. Benchmarked the economic assumptions against a survey of state and local employee retirement systems.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section I: Purpose, Scope and Methodology of the Audit

Methods and Procedures Analysis

The third component in assessing funding levels is the selection and application of the actuarial cost method (including the method for amortizing the unfunded actuarial accrued liability) and the asset valuation method (including smoothing techniques).

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section II: Data Validity

Actuarial Standards of Practice Related to Data

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

The actuary should also comply with the requirements of ASOP No. 41, *Actuarial Communications*, to indicate the source of the data, to describe (at a high level) the process used to evaluate the data, and to disclose any adjustments or modifications made to it. In compliance with the applicable ASOPs, GRS provides the source of the data used in the valuation in the cover letter and discloses that reasonableness checks were completed as part of the valuation process. Section E of each valuation report summarizes the data received.

Overall, we have found no reason to doubt the substantial accuracy of the information on which the valuation was based. The data was comprehensive and largely complete as provided.

Data Used in the Valuation

We obtained data files directly from GRS. With minimal adjustment to modify into a format recognized by our computer software, we found that the counts for the active and retired files were relatively close to the results shown in the valuation report, and well within the 5% threshold we established for determining materiality of differences. All data for actives, inactive not retired, annuitants and beneficiaries was provided as of the actuarial valuation date (December 31, 2018).

An additional part of our data validity review was addressing the transition of participants from active to annuitant status and whether participants are being removed from the active lives valuation and added to the retired lives valuation at the appropriate time. The active lives data file included approximately 19,700 records that were reported with an end of year status of “closed.” Of these 19,700 records, nearly 10,700 were included as new records in the retired lives data. Of the remaining 9,000 records, 5,700 were coded as having withdrawn their employee contribution balance or having received a death benefit. The final 3,300 records were reported as receiving a retirement benefit but were not included in the retired lives data. At our request, GRS reviewed these records and determined that a subgroup were retired but were not in the retiree data file, due to a lag in reporting. GRS indicated that the data lag issue was identified in prior studies and is one reason that GRS uses a contingency load in the active valuation.

We recommend that GRS work with ETF to determine if additional information about these members is available in order to include the liability in the actuarial valuation.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section II: Data Validity

In addition, we having the following comments and suggestions regarding the participant data:

1. Four years' worth of historical salary information is provided in the valuation data for each active member, but GRS indicates only the previous year's earnings are used in the valuation. **GRS should consider using all provided historical earnings information in the valuation to better calculate each member's salary history.**
2. In the active data file, there is a data field titled "Deceased Code" that is not used by GRS. This field identifies if a member is deceased as of year-end. **GRS should consider using this data field in the valuation to make sure active liabilities are not being included for members that are already deceased as of the valuation date.**

The tables that follow include a summary of key data elements compiled by Segal compared to those shown in the valuation reports.

December 31, 2018 Analysis of Participant Data						
	Active			Inactive		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
General Members:						
Number	233,462	233,446	1.00	160,074	160,074	1.00
Total Payroll	\$12,445 M	\$12,160 M	0.98	N/A	N/A	N/A
Average Salary	53,307	52,089	0.98	N/A	N/A	N/A
Average Age	45.4	45.4	1.00	47.5	47.5	1.00
Average Service	11.3	11.3	1.00	3.3	3.3	1.00
Executive & Elected:						
Number	1,302	1,309	1.01	595	595	1.00
Total Payroll	\$108.0 M	\$107.5 M	1.00	N/A	N/A	N/A
Average Salary	82,986	82,133	0.99	N/A	N/A	N/A
Average Age	55.4	55.5	1.00	54.7	54.6	1.00
Average Service	13.9	13.9	1.00	12.9*	4.4	0.34
Protective With SS:						
Number	19,399	19,399	1.00	6,871	6,871	1.00
Total Payroll	\$1,263.1 M	\$1,243.4 M	0.99	N/A	N/A	N/A
Average Salary	65,113	64,094	0.98	N/A	N/A	N/A
Average Age	40.1	40.1	1.00	41.6	41.6	1.00
Average Service	12.3	12.3	1.00	4.2	4.2	1.00
Protective Without SS:						
Number	2,770	2,770	1.00	238	238	1.00
Total Payroll	\$224.9 M	\$224.0 M	1.00	N/A	N/A	N/A
Average Salary	81,206	80,866	1.00	N/A	N/A	N/A
Average Age	40.9	40.9	1.00	43.3	43.3	1.00
Average Service	14.0	14.0	1.00	6.4	6.4	1.00

* In the December 31, 2017 Annual Actuarial Valuation and Gain/Loss Analysis Report, the average service for the Executive & Elected group was 4.4. Therefore, it is likely that the 12.9 was a typo since that great of a change in one year is not reasonable.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section II: Data Validity

December 31, 2018 Analysis of Retired Members Data						
	Core			Variable		
	GRS	Segal	Ratio of Segal/GRS	GRS	Segal	Ratio of Segal/GRS
Regular:						
Number	201,466	203,118	1.01	39,574	39,870	1.01
Total Benefits	\$4,841.9 M	\$4,847.1 M	1.00	\$416.1 M	\$416.5 M	1.00
Average Age	70.9	70.9	1.00	70.8	70.8	1.00
Disability:						
Number	8,281	8,554	1.03	1,256	1,252	1.00
Total Benefits	\$178.0 M	\$178.5 M	1.00	\$7.4 M	\$7.4 M	1.00
Average Age	64	64.0	1.00	66.6	66.5	1.00
Death-in-Service:						
Number	1,379	1,468	1.06	357	362	1.01
Total Benefits	\$21.0 M	\$21.0 M	1.00	\$2.3 M	\$2.3 M	1.00
Average Age	67.4	67.5	1.00	68.1	67.4	0.99

As previously mentioned, we were able to match most information reported by GRS to within 1% with minimal adjustment to the data to modify into a format recognized by our computer software.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section III: Actuarial Assumptions and Methods

As part of our analysis, we have reviewed the principal assumptions used in the December 31, 2018 actuarial valuation reports for consistency, reasonableness and compatibility. In addition, we have reviewed the Three-Year Experience Study report (that covered experience for the three-year period ending December 31, 2017).

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 its Three-Year Experience Study report, and appears to have taken the guidance into account when making its recommendations for the economic assumptions.

As part of our review, we also compared the recommended set of economic assumptions to those used by a peer group of 188 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 Comprehensive Annual Financial Reports through the 2018 fiscal year (or fiscal 2019, if available).

Economic assumptions have a significant effect on the development of WRS 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 economic assumptions studied by GRS that affect the WRS funding requirements include:

- Price inflation
- Wage inflation
- Investment rate of return
- Administrative expenses
- Merit and longevity pay increases

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section III: Actuarial Assumptions and Methods

Price Inflation

GRS recommended reducing the price inflation assumption from 2.7%, citing a “comfortable” range of 2.0% to 2.5%. GRS initially recommended a price inflation assumption at the upper end of that range (“2.3% to 2.5%”) and the ETF Board adopted a price inflation assumption of 2.5%.

The data cited for making this recommendation is based on published forward-looking price inflation forecasts and is consistent with sources Segal relies on when making similar recommendations. The long-term data cited (e.g., 30-year expectations or longer) generally point towards a range of 2.2% to 2.3%, with the exception of the long-term assumption used in the 2018 Social Security Trustees report, which uses 2.6%.

The average inflation assumption from the PPD based on the latest information available is around 2.7%. However, this average has been declining in recent years (3.2% in 2013, 3.1% in 2014, 3.0% in 2015, 2.9% in 2016, and 2.8% in 2017).

We believe the assumption of 2.5% for price inflation selected by the ETF Board is reasonable.

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 3.2% to 3.0%, which would be consistent with an underlying price inflation assumption of 2.5%. GRS indicated that the data analyzed could support a wage inflation assumption 30 basis points lower, or as low as 2.7%.

Reviewing the data supplied by GRS in the Three-Year Experience Study report, while the long-term (30-year) spread between CPI-U and National Average Earnings is 0.9%, the spread between CPI-U and average increases in WRS wages is only 0.2%.

Based on this analysis, we agree that the recommended wage inflation range of 2.7% to 3.0% is reasonable and the resulting wage inflation assumption of 3.0% selected by the ETF Board is reasonable.

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 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.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section III: Actuarial Assumptions and Methods

Excerpt from ASOP 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, WRS-specific data and expectations concerning the future economic environment.

Building the Assumption

GRS recommended lowering the assumed rate of investment return from 7.2% to a range of 6.8% to 7.0% (citing a "reasonable range" of 6.5% to 7.3%).

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GRS studied the capital market assumptions and expected portfolio returns (adjusted for the recommended 2.5% price inflation assumption) for a dozen national investment consulting firms. The average nominal arithmetic (i.e., one-year) return, net of investment and administrative expenses, was 7.27% with a standard deviation of 13.14%. The average expected 50th percentile return over a 20-year time horizon was estimated at 6.46%. While not explicitly stated, the implied time horizon of the investment consultants' capital market assumptions that were used by GRS in the Three-Year Experience Study is 10 years.

We tested the average 6.46% average expected 50th percentile return calculated by GRS for reasonableness, using Segal Marco Advisor's capital market assumptions and the WRS target asset allocations as outlined in the Three-Year Experience Study report. Based on Segal Marco Advisor's 2018 capital market assumptions for a 20-year investment horizon, the median real rate of return was 5.16%. Adding Segal Marco Advisor's 2018 price inflation assumption of 2.00% yields the median net investment return of 7.16%. If Segal Marco Advisor's median real rate of return were combined with the 2.50% price inflation assumption used by GRS, the median net investment return would be 7.66%. The difference in the time horizons for the assumptions included in the GRS report and those used by Segal likely accounts for some of the difference in the expected returns. Based on these results, we believe the 6.46% average expected 50th percentile return calculated by GRS is reasonable.

Benchmarks

The trend among public retirement systems is to lower the investment return assumption, particularly given the outlook for a low inflation environment. A February 2019 NASRA 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 PPD data was 7.19%.

The 7.0% assumption, adopted by the ETF Board, is in line with national benchmarks.

We believe the recommended range of 6.8% to 7.0% for the investment rate of return assumption was reasonable at the time the Three-Year Experience Study was prepared and that the ETF Board's selection of the 7.0% assumption was appropriate.

The Three-Year Experience Study report uses 10-year capital market assumptions to support the WRS long-term investment return assumption recommendation and to develop the "reasonable range" of 6.5% to 7.3%. These 10-year assumptions appear to be used to calculate the lower bound of the reasonable range, which is the average geometric nominal return over 20 years. **Because expected returns vary over different time horizons, we recommend that the time horizon for each manager in the investment survey be shown. In addition, we recommend that GRS consider showing results based on capital market assumptions over longer time horizons, such as a period of 20 years or longer.**

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Administrative Expenses

The investment return assumption is net of administrative expenses. The investment return analysis includes an underlying assumption of 0.05% related to plan-incurred administrative expenses. While this assumption was not explicitly studied as part of the Three-Year Experience Study, a review of the asset section of recent actuarial valuation reports shows that the line item for “ETF Administrative Expenses” have been approximately 0.02% to 0.03% of average assets. The 0.05% assumption used in the analysis seems reasonable.

Merit and Longevity Pay Increases

The salary increase assumption was studied by examining merit and longevity increases separately from inflation. GRS recommended no changes to the merit and longevity pay increases for any of the groups. The information supplied in Section C of the Three-Year Experience Study report does not contain enough detail to assess whether the recommendation for no changes across the board is reasonable or not. In reviewing the information that is contained in Section C, there are clearly places where no change would be necessary and we agree with their analysis and recommendation. There are also instances where, based on the information provided, it appears that a minor adjustment would be warranted.

As an example, for the General group, the actual merit and seniority increases for service through 20 years is generally consistent with the current assumption. However, actual experience appears to be about half of expected for service group 21-25 and a third of expected for service group 26-30. The actual salary increases for those with 31 or more years was substantially inflation only (i.e., no merit/longevity increase). A review of gain/loss detail from the 2015, 2016, and 2017 active lives valuation reports shows liability gains due to salary increases less than expected for the General group of \$75 million, \$268 million, and \$114 million, respectively. Presumably, a portion of these gains is driven by inflation that was lower than expected. However, even with a decrease in assumed price inflation from 2.7% to 2.5%, there were still salary gains of \$322 million during calendar 2018.

DEMOGRAPHIC ASSUMPTIONS

The demographic assumptions used to value WRS 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);

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- Disability retirement;
- Service and early retirement; and
- Others, including forfeitures and marriage assumptions.

Actuarial Standard of Practice No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations* 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 general 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 WRS 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 Three-Year Experience Study trends as part of the consideration for recognition of the most recent three-year trends is appropriate, particularly since the interval between studies is a relatively short period.

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. It had long been theorized – and a recent Society of Actuaries (SOA) Public Sector mortality study confirmed – that retired teachers tend to live longer than non-teachers. In fact, the SOA study (which was officially released subsequent to completion of the Three-Year Experience Study report) concluded that there are three broad

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categories of public sector employment that demonstrate different post-retirement mortality behavior: general employees, teachers, and public safety. **Since the WRS retiree populations consists of a mix of all three broad categories, consideration should be given in future studies on analyzing the mortality experience separately for each broad group.** Taken together, WRS is large enough to have credible mortality experience among non-disabled annuitants. However, the experience may not be fully credible when broken into each employment classification, so this should be taken into consideration as well when evaluating the best approach to develop future recommendations.

GRS recommended mortality assumptions for non-disabled annuitants (separately for males and females) that were developed using the experience of the underlying population. The experience for the recent three-year study period was blended with rates developed in prior experience studies. Since mortality experience for disabled annuitants and active members was far more limited (and less credible), GRS indicates that recommended adjustments were determined based on adjustments recommended from reviewing the non-disabled annuitant population.

To reflect anticipated improvements in future mortality, GRS recommended using 60% of the MP-2018 Projection Scale on a fully generational basis. GRS rationalizes using a portion of the projection scale due to each subsequent update to the original MP-2014 improvement scale containing less mortality improvement than the prior year. “Until the projection scale begins to stabilize” GRS recommends applying the 60% factor to the current scale.

We agree that the MP tables have continued to show less mortality improvement than the prior table. However, based on the change in sample annuity factors included in the accompanying documentation for each improvement scale publication, the 2018 improvement scale had already begun to stabilize.

	% Change in Monthly Annuity Value	
	75-year old male	75-year old female
MP-2014 to MP-2015	-2.7%	-3.0%
MP-2015 to MP-2016	-1.7%	-1.8%
MP-2016 to MP-2017	-1.0%	-1.0%
MP-2017 to MP-2018	-0.3%	-0.3%

In addition, the ultimate rate of improvement (in 16 years) has not changed since MP-2014.

GRS did not provide any support or basis for the 60% factor. Segal asked GRS to provide support for this factor. The GRS response is as follows:

“Due to the cost sharing nature of the WRS, large changes in the mortality assumption directly impact the benefits being paid to current retirees each year. Therefore, caution must be taken before making large changes in this assumption. There is not a mathematical calculation for this adjustment. Rather, due to the rationale above, the recommendation was to create a glidepath from 50% of the projection scale to 100% of the projection scale when the projection scale

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appears to stabilize. While consideration was given to moving to 75% of the projection scale (halfway to the full table), we assigned a lower credibility factor to the latest MP table due to the consistent pattern of decreases in mortality improvement.”

As stated above, Segal believes that the projection scale has stabilized. **If GRS had used 100% of the projection scale, the calculated WRS accrued liability would have been approximately 1.25% greater. We recommend that GRS include a basis for deviating from the published improvement scale in the Three-Year Experience Study report.**

Withdrawal

The withdrawal assumption is comprised of service-based rates covering the first ten years of employment and age-based rates thereafter. Withdrawal rates developed in the Three-Year Experience Study were set such that the proposed rates were halfway between actual experience and assumed experience on a liability-weighted basis. In general, this produces 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.

We observed that for male Public School service-based rates, the aggregate proposed rate is not between the crude observed rates and previous rates. This appears to be due to the proposed rate at eight years of service, which is 122% of actual.

Age-based tables are clearly defined to include service of ten or more years. The service-based tables include ten “Service Index” categories that range from one to ten. **GRS should consider clarifying what “Service Index” refers to and that “Service Index 10” does not include members with ten years of service.**

The same ten-year select period is used across all membership groups. **While the ten-year period may be appropriate and the best fit for each group, we recommend that GRS consider studying the employee groups independently to see if alternative withdrawal assumption formats would yield a better fit for a particular group.**

Disability Retirement

The WRS disability rates are low 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 three-year period is small. We agree with GRS that this assumption is not as critical as other assumptions and believe the proposed assumptions are reasonable. **However, we recommend that the experience for Public School, University, and Executive and Elected members be analyzed together in order to increase the credibility of the experience.** These job classifications should not have considerably different exposure to becoming disabled.

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Normal and Reduced Retirement

Retirement liability is 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.

Some refinements were made to retirement rates, similar to the method applied to active turnover. Rates were generally modified such that proposed experience would be halfway between expected and actual experience, on a liability-weighted basis. In some cases, GRS proposed no changes to rate and upon reviewing these particular situations, we agree that no adjustments were necessary.

For General, Public School, and University members, the male and female experience was analyzed separately. For Protective and Executive and Elected members, the male and female experience was analyzed together. **It may be worth reviewing male and female experience separately for these groups as well, despite the limited exposures.**

Other Assumptions

There are a number of assumptions and methods that do not necessarily fall into the economic or demographic decrement categories. These include the marriage assumption, assumed retirement for deferred members, percentage of terminating members taking a separation benefit, and liability adjustments to account for additional contingencies in actual benefit amount calculated at the time of retirement. GRS did not include any analysis for these assumptions in the Three-Year Experience Study report. While none of these assumptions is a large driver of actuarial liability, **we recommend that the Three-Year Experience Study reports include some acknowledgement of these assumptions and that GRS believes they continue to be reasonable. We recommend that every other or every third study these assumptions be studied in more detail and supporting information be included in the report.**

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 (PTF) 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

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- 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 WRS are in line with the CCA PPC White Paper and PTF suggestions.

Funding Method for Liabilities

The funding method prescribed by statute for WRS and used for establishing contribution rates for the 2020 calendar year is the frozen initial liability (FIL) actuarial cost method. In addition, the Experience Amortization Reserve (described below) was established for minimizing short-term rate fluctuations that occur as a result of experience subsequent to the Frozen Initial Liability. The description of the method stated in the actuarial valuation report is sufficient.

We find the current method for determining contribution rates to be reasonable.

Experience Amortization Reserve

The Experience Amortization Reserve (EAR) is established under Section 40.04(1) of the Wisconsin Statutes in an attempt to stabilize contribution rates by amortizing certain actuarial gains and losses over time. Typical experience gain/loss recognition under the FIL actuarial cost method would result in amortization over the expected future working lifetime of the active member population. The EAR methodology allows for increased flexibility for setting the period that experience gains and losses (as well as increases/decreases in actuarial liability due to changes in actuarial assumptions) will be amortized. While under a traditional approach to FIL, experience gains and losses would be amortized over the average future working lifetime of the active group (approximately 12 years in the case of WRS), the EAR has a standard amortization period of 20 years.

In this manner, experience gains and losses are recognized over a longer period of time than they otherwise would be under the standard FIL approach. However, for a public pension system such as WRS, 20 years is not an unreasonably long period for gain/loss amortization.

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Asset Valuation Method

In compliance with Section 40.04(3) of the Wisconsin Statutes, assets in the Core Investment Trust are valued using the Market Recognition Account (MRA). This method smoothes investment gains and losses for each fiscal year by recognizing these gains and losses evenly over a five-year period. The MRA method does not impose a corridor that places limits on the spread between actuarial value of assets (AVA) and market value of assets (MVA).

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. Segal recognizes the importance of this requirement and assists clients in establishing reasonable methodologies for recognizing investment gains and losses and limiting 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 Actuarial Standard of Practice No. 44. The following is an excerpt from this ASOP that establishes the qualities a reasonable asset smoothing method must exhibit.

From the Actuarial Standard of Practice 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.*

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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 44. These are that acceptable asset smoothing must create asset values that fall within a reasonable range around market value and 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 the market value. Segal has established an internal policy, which is consistent with others in the actuarial community, that five years is a sufficiently short period to constitute a reasonable asset smoothing method. Therefore, it is our opinion that the method utilized by WRS is reasonable.

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Section IV: Replication of December 31, 2018 Actuarial Valuation

Replication of December 31, 2018 Actuarial Valuation

In replicating the results of the WRS valuation as of December 31, 2018, we found that, overall, GRS has a sound valuation process. We matched the valuation results and the test life output within an acceptable range. A comparison of the valuation results is displayed below. Differences less than 3% are generally considered a reasonable match. The results are generally well within that tolerance.

Total Plan

	\$ Millions		Ratio of Segal/GRS
	GRS	Segal	
1. Present Value of Future Benefits For:			
a. Active	\$52,457.9	\$52,066.9	99.25%
b. Inactive, Not Retired	\$6,981.6	\$6,672.1	95.57%
c. Variable Adjustment	\$365.3	\$365.7	100.11%
d. Additional Contributions	\$201.1	\$201.1	100.00%
e. Retirees and Beneficiaries	\$60,836.9*	\$61,510.1	101.11%
f. Total	\$120,842.8	\$120,815.9	99.98%
2. PV Future Entry Age Normal Costs	\$17,425.5	\$17,354.9	99.59%
3. PV Future Earnings	\$130,163.2	\$129,099.0	99.18%
4. Entry Age Accrued Liability (1f - 2)	\$103,417.3	\$103,461.0	100.04%

* See page 26 of the December 31, 2018 Annual Actuarial Valuation of Retired Lives Report.

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

Differences in the determination of the normal cost and the present value of future normal cost are very common. However, as can be seen in the chart above, the replication of the total actuarial present value of future benefits was within 0.02% and the actuarial accrued liability was within 0.04%. As shown above, the replication of the Present Value of Future Benefits for inactive, not retired members was 4.4% lower. Given the very close match of the total Actuarial Present Value of Projected Benefits and Accrued Liability, we consider the overall match results to be reasonable.

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Section IV: Replication of December 31, 2018 Actuarial Valuation

The results for active and inactive participant subgroups are shown below.

General, Executives & Elected Officials

	\$ Millions		Ratio of Segal/GRS
	GRS	Segal	
1. Present Values of Future Benefits For:			
a. Active	\$45,018.5	\$44,654.5	99.19%
b. Inactive, Not Retired	\$6,346.8	\$6,123.7	96.48%
c. Variable Adjustment	\$323.5	\$324.8	100.40%
d. Total	\$51,688.8	\$51,103.0	98.87%
2. PV Future Entry Age Normal Costs	\$14,929.0	\$14,913.9	99.90%
3. PV Future Earnings	\$115,478.8	\$114,519.7	99.17%
4. Entry Age Accrued Liability (1d - 2)	\$36,759.8	\$36,189.0	98.45%

Protective with Social Security

	\$ Millions		Ratio of Segal/GRS
	GRS	Segal	
1. Present Values of Future Benefits For:			
a. Active	\$5,975.7	\$5,952.8	99.62%
b. Inactive, Not Retired	\$578.9	\$492.6	85.09%
c. Variable Adjustment	\$34.9	\$34.1	97.71%
d. Total	\$6,589.5	\$6,479.5	98.33%
2. PV Future Entry Age Normal Costs	\$2,014.0	\$1,965.8	97.61%
3. PV Future Earnings	\$12,395.0	\$12,292.0	99.17%
4. Entry Age Accrued Liability (1d - 2)	\$4,575.5	\$4,513.7	98.65%

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Section IV: Replication of December 31, 2018 Actuarial Valuation

Protective without Social Security

	\$ Millions		Ratio of Segal/GRS
	GRS	Segal	
1. Present Values of Future Benefits For:			
a. Active	\$1,463.7	\$1,459.5	99.71%
b. Inactive, Not Retired	\$55.9	\$55.9	100.00%
c. Variable Adjustment	\$6.9	\$6.8	98.55%
d. Total	\$1,526.5	\$1,522.2	99.72%
2. PV Future Entry Age Normal Costs	\$482.5	\$475.2	98.49%
3. PV Future Earnings	\$2,289.4	\$2,287.3	99.91%
4. Entry Age Accrued Liability (1d - 2)	\$1,044.0	\$1,047.0	100.29%

Test Life Output

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

We were provided with results for 36 test lives, including 12 active members, six terminated vested members, and 18 retirees and beneficiaries. The key characteristics of these test lives, as well as a comparison of the Actuarial Present Value of Projected Benefits between GRS and Segal are outlined below. In addition, the active test lives Present Value of Future Salary and Entry Age Accrued Liability results were compared between GRS and Segal.

As shown in the following tables, we have generally matched the GRS calculations to within our 5% threshold. In the handful of instances where the ratio of Segal to GRS is outside of the tolerance, we have reviewed these test lives in further detail. Primarily, these discrepancies are due to different rounding of ages during interim steps in the valuation process that, in aggregate across all members, net out to an immaterial amount.

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Section IV: Replication of December 31, 2018 Actuarial Valuation

December 31, 2018 Valuation of the Wisconsin Retirement System Retired Lives Test Life Comparison

Present Value of Benefits					Present Value of Benefits				
No.	Test Life Description	GRS	Segal	Ratio of Segal/GRS	No.	Test Life Description	GRS	Segal	Ratio of Segal/GRS
1	Retired – General, Variable	182,443	185,312	1.02	10	Disabled – Protective w/o SS, Core	1,014,649	1,014,265	1.00
2	Retired – General, Core	230,935	234,566	1.02	11	Disabled – Protective w/o SS, Variable	86,370	86,338	1.00
3	Retired – Protective w/o SS, Core	675,949	670,639	0.99	12	Disabled – Executive/Elected, Core	788,336	801,275	1.02
4	Retired – Protective w/o SS, Variable	45,303	44,947	0.99	13	Beneficiary – General, Core	92,253	93,161	1.01
5	Retired – Protective w/ SS, Core	433,849	432,347	1.00	14	Beneficiary – General, Core	130,952	129,152	0.99
6	Retired – Executive/Elected, Core	119,948	120,561	1.01	15	Beneficiary – Protective w/ SS, Core	248,039	248,890	1.00
7	Retired – Executive/Elected, Variable	17,615	17,705	1.01	16	Beneficiary – Protective w/o SS, Core	190,401	193,107	1.01
8	Disabled – General, Core	588,860	577,569	0.98	17	Beneficiary – Executive/Elected, Core	159,335	160,930	1.01
9	Disabled – Protective w/SS, Core	525,233	528,452	1.01	18	Beneficiary – Executive/Elected, Variable	206,859	208,930	1.01

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Section IV: Replication of December 31, 2018 Actuarial Valuation

December 31, 2018 Valuation of the Wisconsin Retirement System Non-Retired Lives Test Life Comparison

Test Life Description	Present Value of Future Salary			Present Value of Benefits			Entry Age Accrued Liability		
	GRS	Segal	Ratio of Segal/ GRS	GRS	Segal	Ratio of Segal/ GRS	GRS	Segal	Ratio of Segal/ GRS
1 – Deferred Executive/Elected				16,360	16,360	1.00			
2 – Deferred Protective w/ SS				27,632	29,128	1.05			
3 – Deferred Protective w/o SS				23,492	23,908	1.02			
4 – Deferred University				144,697	144,697	1.00			
5 – Deferred Teacher				10,730	10,730	1.00			
6 – Deferred General				21,853	23,313	1.07			
Active Hired Before 01/01/2011									
1 – Active Executive/Elected	1,368,492	1,271,110	0.93	428,393	385,817	0.90	274,260	275,182	1.00
2 – Active Protective w/ SS	535,536	568,891	1.06	371,445	378,253	1.02	275,714	273,068	0.99
3 – Active Protective w/o SS	1,284,134	1,284,286	1.00	457,251	455,593	1.00	215,186	220,161	1.02
4 – Active University	1,033,166	1,032,019	1.00	240,915	235,678	0.98	119,494	132,949	1.11
5 – Active Teacher	768,757	782,066	1.02	275,869	270,140	0.98	170,964	170,874	1.00
6 – Active General	351,077	352,107	1.00	147,060	142,739	0.97	102,148	97,370	0.95
Active Hired After 01/01/2011									
1 – Active Executive/Elected	1,381,602	1,294,990	0.94	280,544	303,469	1.08	119,717	137,075	1.14
2 – Active Protective w/ SS	932,076	929,699	1.00	165,374	164,031	0.99	29,617	29,170	0.98
3 – Active Protective w/o SS	1,233,215	1,231,632	1.00	354,943	356,279	1.00	90,287	90,345	1.00
4 – Active University	521,855	523,924	1.00	82,823	82,913	1.00	17,881	19,344	1.08
5 – Active Teacher	592,941	599,571	1.01	125,784	122,409	0.97	35,749	37,419	1.05
6 – Active General	650,173	647,449	1.00	186,554	182,992	0.98	95,516	88,480	0.93

Note: Items above that are blank are not applicable to that test life.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section V: Review of Actuarial Valuation Reports

Valuation Reports

While the accuracy of the actuarial valuations is the primary focus of an actuarial review, the content and presentation of the actuarial valuation results to a layperson and professional are also important. Our recommendations are to provide clarity to the existing reports. **Based on our review of the December 31, 2018 Actuarial Valuation Reports (i.e., Annual Actuarial Valuation and Gain/Loss Analysis and Annual Actuarial Valuation of Retired Lives), we offer the following comments:**

1. It would be helpful to include commentary in the Annual Actuarial Valuation of Retired Lives on how the Core and Variable annuities function within WRS. The assets are allocated between these two annuities, but there is no description on how this allocation occurs or how participants receive either annuity.
2. Assumption changes from the prior valuation should be highlighted in the Executive Summary of both Actuarial Valuation Reports. For example, the investment return assumption for active participants was lowered from 7.2% in the December 31, 2017 valuation to 7.0% in the December 31, 2018 valuation, but this was not mentioned.
3. For the Market Recognition Account, the assumed asset return for the year ending December 31, 2018 was changed to 7.0%. However, during calendar 2018, the assumption was 7.2%. We would have expected the amount for immediate recognition be based on the 7.2% assumption rather than 7.0%. In response to our question on this, GRS stated that ETF elected to use 7.0% based upon past administrative practice. However, we believe that 7.2% should have been used, as this was the assumption during the period. In any event, since all investment gains and losses are fully recognized in the Market Recognition Account after five years, the impact on overall results would be negligible.
4. In the Annual Actuarial Valuation of Retired Lives Report, the total new awards in 2018 shown on pages 8 (10,035 new Core awards) and 17 (1,772 new Variable awards) do not match the new annuities being paid in 2018, shown on pages 25 and 26 (9,620 and 1,712), respectively. This may be due to some awards not commencing until 2019. Some explanation in the report noting why these amounts do not match would provide additional clarity.
5. Page D-9 of the Annual Actuarial Valuation and Gain/Loss Analysis Report shows a 5-year history of gains and losses by participant group and decrement. There are a few assumptions that have consistent losses during the 5-year period (General Retirement, Protective Retirement with and without Social Security, and Protective Separations without Social Security). Given the consistent losses, commentary relative to how the experience review process works to reduce the potential for future losses could be beneficial.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section VI: Review of Risk Assessment Disclosure

As part of our audit process, we reviewed the December 31, 2018 Actuarial Valuation Reports to assess if the risks associated with WRS were being properly described. Communicating inherent risks in a retirement system is an important element of all actuarial communications and is required under the Actuarial Standards of Practice.

Section B-9 of the Annual Actuarial Valuation and Gain/Loss Analysis Report contains information related to discussion of risks, which is required information for funding valuations and pricing valuations pursuant to Actuarial Standards of Practice Statement No. 51 (ASOP 51). The discussion of risk includes two pages of relatively generic language that outlines the general risks that affect a pension system. This section also includes an additional two pages with ratios and other calculations specific to WRS. In general, we believe this section complies with the spirit of ASOP 51 and the risk discussion. However, these disclosures may not help the intended users of the actuarial valuation reports gain a better understanding of risks inherent in the measurements of liabilities and actuarially determined contributions.

Some observations and suggestions for improvement in the December 31, 2018 Actuarial Valuation Reports are as follows:

1. Section 3.6 of ASOP 51 states, *“If, in the actuary’s professional judgment, a more detailed assessment would be significantly beneficial for the intended user to understand the risks identified by the actuary, the actuary should recommend to the intended user that such an assessment be performed.”* Section B-9 of the Annual Actuarial Valuation and Gain/Loss Analysis Report does not contain such a recommendation. This implies that the actuary does not believe a more detailed risk assessment is necessary or that one would not be useful to the intended user. However, we believe there is enough risk inherent in WRS that a more detailed risk assessment would be useful.
2. The generic language in the first part of Section B-9 of the Annual Actuarial Valuation and Gain/Loss Analysis Report does not contain items unique to WRS. For example, there is no mention of the risk-sharing features that are triggered from poor investment returns. It would be more informative if this section were revised to include elements that were tailored specifically to the features and risks of WRS.
3. One suggestion to improve the usefulness of this section would be to keep (and expand) the existing language and add commentary specific to WRS when discussing each risk element. For example, pages B-11 and B-12 of the Annual Actuarial Valuation and Gain/Loss Analysis Report could be reformatted to explain each risk, show the particular WRS metric related to that risk, and provide commentary. The current format makes it challenging for the intended user to grasp the concepts and understand the risks inherent in WRS.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section VI: Review of Risk Assessment Disclosure

4. The Annual Actuarial Valuation of Retired Lives Report attempts to satisfy the requirements of ASOP 51 by pointing the reader back to the Annual Actuarial Valuation and Gain/Loss Analysis Report. However, given that the Annual Actuarial Valuation of Retired Lives Report is a separate document and the fact that there are elements of the Annual Actuarial Valuation of Retired Lives Valuation that contain additional risks that could be separately identified, we believe the Annual Actuarial Valuation of Retired Lives Report should include a separate discussion of risk as well.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section VII: Conclusions and Recommendations

This full scope audit reviewed the data used, the benefits valued, the valuation results, and the actuarial methods and assumptions employed in the December 31, 2018 actuarial valuations. We generally agree with the results of the valuation reports and the Three-Year Experience Study report, with a few recommendations for improvement. We found the actuarial cost method and asset valuation method conform with the Actuarial Standards of Practice. The data appears complete and with a cursory analysis of the information supplied, we were able to closely match the participant counts reported by GRS.

Below we summarize our comments and recommendations for your consideration:

A. Section II: Data Validity

1. There are 3,300 records reported on the active data file as receiving a retirement benefit but these records were not included in the retired lives data. We recommend that GRS work with ETF to determine if additional information about these members is available in order to include the liability in the actuarial valuation.
2. Consider using all provided historical earnings information in the valuation to better calculate each member's salary history.
3. Consider using the field "Deceased Code" in the valuation to make sure active liabilities are not being included for members that are already deceased as of the valuation date.

B. Section III: Actuarial Assumptions and Methods

1. Because expected returns vary over different time horizons, we recommend that the time horizon for each manager in the investment survey be shown. In addition, we recommend that GRS consider showing results based on capital market assumptions over longer time horizons, such as a period of 20 years or longer.
2. Since the retiree populations consists of a mix of general employees, teachers, and public safety, consideration should be given in future experience studies on analyzing the mortality experience separately for each broad group.
3. With respect to the 60% factor applied to the mortality improvement factors from Scale MP-2018, we recommend that GRS include a basis for deviating from the published improvement scale in the Three-Year Experience Study report.
4. Consider clarifying what "Service Index" refers to and that "Service Index 10" does not include members with ten years of service.
5. While the ten-year select period may be appropriate and the best fit for each group, we recommend that GRS consider studying the employee groups independently to see if alternative withdrawal assumption formats would yield a better fit for a particular group.

Wisconsin Legislative Audit Bureau – Actuarial Audit of WRS

Section VII: Conclusions and Recommendations

6. When analyzing the disability incidence assumption, we recommend that the experience for Public School, University, and Executive and Elected members be analyzed together in order to increase the credibility of the experience.
7. When analyzing the retirement assumptions, consider reviewing male and female experience separately for Protective and Executive and Elected, despite the limited exposures.
8. We recommend that the Three-Year Experience Study reports include some acknowledgement of “other” assumptions and that GRS believes they continue to be reasonable. We recommend that these assumptions be studied every other or every third study and supporting information should be included in the report.

C. Section V + VI: Review of Actuarial Valuation Reports and Risk Assessment Disclosures

1. In the Annual Actuarial Valuation of Retired Lives Report, include commentary on how the Core and Variable annuities function within the plan.
2. Assumption changes from the prior valuation should be highlighted in the Executive Summary of both reports.
3. We believe the investment return assumption for calendar 2018 was 7.2%, not 7.0%, and 7.0% should have been reflected in the Market Recognition Account calculations.
4. In both reports, consider modifying the current Discussion of Risk/Maturity Measures section to improve the intended user’s ability to grasp the concepts and understand the risks inherent in WRS.
5. In the Annual Actuarial Valuation of Retired Lives Report, provide an explanation or footnote why there is a discrepancy between the number of new 2018 awards shown on pages 8 and 17 and the counts for new annuities being paid on pages 25 and 26.
6. Given the consistent losses among some participant groups for certain assumptions, commentary relative to how the experience review process works to reduce the potential for future losses could be beneficial in the Annual Actuarial Valuation and Gain/Loss Analysis Report.

In this report, we have noted areas that we believe will improve the usefulness and clarity of the December 31, 2018 Actuarial Valuation and Three-Year Experience Study, and improve the valuation results. We are available to discuss any aspect of our review with the Legislative Audit Bureau, the ETF Board of Trustees, ETF staff, or the WRS actuary. Segal is independent of Gabriel, Roeder, Smith & Company, and we are not aware of any conflict of interest that would impair the objectivity of our actuarial audit of their work.

Responses ■



STATE OF WISCONSIN
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SECRETARY

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February 19, 2020

Joe Chrisman, State Auditor
Legislative Audit Bureau
22 E Mifflin St, Suite 500
Madison, WI 53703

Dear Mr. Chrisman,

Thank you for the opportunity to address the conclusions and recommendations provided by Segal Consulting (Segal) in their review of Wisconsin Retirement System (WRS) actuarial reports and experience study completed by Gabriel Roeder Smith and Company (GRS). The objective of this type of audit is to validate that the liabilities and contribution rates of the WRS are reasonable and calculated as intended. We are pleased this independent review confirms the work of GRS.

Segal concluded GRS' valuation practices, methods and assumptions are sound and in accordance with the actuarial standards of practice promulgated by the Actuarial Standards Board. This review was more comprehensive than past actuarial audits because the methodology included a full replication of the December 31, 2018 valuation results. Segal's calculation of the total present value of future benefits and actuarial accrued liability was well within an acceptable range. These findings enhance the credibility of the actuarial valuation process used by the WRS.

Segal made many helpful observations and recommendations intended to improve the clarity of the valuation reports they reviewed. While the GRS response addresses each of Segal's recommendations, I would also like to briefly comment on a few of them. Segal recommended GRS include in their report the rationale for using a percentage less than 100% of the published national mortality improvement projection scale. We agree and GRS plans on providing a more empirical description of their reasoning in future experience studies. Considering GRS' past ability to correctly determine how the national mortality tables compare to the actual experience in the WRS, including more information on the rationale used in the analysis will help the reader better understand the assumption recommendation.

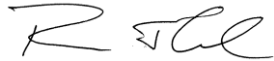
Segal also commented on the implementation of the recent change in the investment return assumption from 7.2% to 7.0%. ETF used 7.0% in calculating the Market Recognition Account (MRA) for 2018 based on the Employee Trust Funds Board (Board) approval, which aligns to past practice. In light of Segal's review, we will revisit this practice with GRS and the Board. It is important to note using 7.0% instead of 7.2% had a negligible impact on the dividend adjustment calculation and all MRA gains and losses are still fully recognized within five years.

Lastly, Segal commented that a more detailed risk assessment, specific to the WRS, would be useful. As the Legislative Audit Bureau is aware, every two years GRS and the State of Wisconsin Investment Board (SWIB) review and analyze specific risks of the WRS. The most recent risk assessment study was conducted in the fall of 2019. Segal confirmed this was not

within the scope of their review. We will work with GRS to reference or incorporate some of this analysis in the WRS actuarial valuation reports in the future.

We appreciate the work of Segal and the assistance of the LAB in facilitating this audit. We are pleased with the results and will be working with GRS to further improve how information is presented in future actuarial valuations to make them more useful and understandable to readers.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Conlin". The signature is fluid and cursive, with the first letter of the first name being a large, stylized "R".

Robert J. Conlin
Secretary



February 18, 2020

Mr. Joe Chrisman
Wisconsin Legislative Audit Bureau
22 E. Mifflin Street, Suite 500
Madison, Wisconsin 53703

Re: Actuarial Review of GRS Work for WRS

Dear Mr. Chrisman:

Earlier this year, the audit bureau retained the Segal Group, Inc. to review our December 31, 2018 Actuarial Valuations and the 2015-2017 Experience Study. GRS is very supportive of the actuarial review process. We have reviewed the work of other firms, and similarly, our work has been reviewed many times. A common purpose of an actuarial review is to double check the retained actuary's technical work, and to ensure that mathematical processes are being carried out correctly and appropriately. The actuarial review process also provides a means for Boards to receive a different perspective on their particular situation from another experienced consulting firm. In virtually every actuarial review that GRS has been involved in, the end result is an improved product for the client.

Ms. Nicholl and Mr. Strom, the Segal actuaries assigned to the audit, have now completed the review and have provided their report. The main conclusions reached in their audit regarding the December 31, 2018 valuations were stated on page 1 of their report as follows:

- "This audit validates the findings of the December 31, 2018 actuarial valuation and the Three-Year Experience Study covering the period January 1, 2015 to December 31, 2017."
- "Segal was able to match the valuation results and the test life output within an acceptable range."
- "The data appears complete and we were able to closely match the participant counts reported by GRS."
- "We concluded the valuation was performed in accordance with the actuarial standards of practice promulgated by the Actuarial Standards Board (ASB)."

We direct your attention in particular to the first bullet point above. We are certainly pleased that the auditor was able to validate our work. The auditor has in addition made a number of helpful suggestions and recommendations, which is customary and expected as part of the audit process. The recommendations are, for the most part, designed to help improve a process that has already been validated. They are not indicative of any type of substantive error or omission in the work product. We will consider those suggestions very carefully during the coming actuarial work cycle. There follows below a brief commentary on the summary recommendations that the reviewers made on pages 29 and 30 of their report.

A. Data Validity

1. **There are 3,300 records reported on the active data file as receiving a retirement benefit but these records are not included in the retired lives data. Work with ETF to determine whether additional information is available in order to include the liability in the actuarial valuation.**

By way of background, the active and retiree data files are not received at the same time. The retiree data file is received at the end of December or first week of January and the active data is typically available in April of each year, after the retiree data is validated and the retiree valuation is completed. Therefore, there will always be a lag in the reporting for retirees between the active and retiree data files. For example, members who retire during the last few weeks of December will typically not show up in the retiree valuation until the following year, but will show up in active lives data as retired. In the active lives valuation, this is accounted for with a contingency load. For the retired lives valuation, they are accounted for when they actually appear in the retiree valuation. For example, in the December 31, 2018 valuation there was a small cohort of new retirees who actually retired in December of 2017. A similar cohort of members who retired in December of 2018 will show up in the December 31, 2019 valuation.

We note that of the 3,300 records noted above, about 90% of these records are reported as closed with no further benefits available. Additionally, the Benefit Type paid according to the data layout is Retired under 40.23 or 40.25(1). Since section 40.25(1) refers to lump sum payouts, it was presumed these members were paid out and therefore not pertinent to the active or retired lives valuations. The remaining 10% will typically show up in the retiree valuation the following year (due to the reporting lag discussed above) unless their account is subsequently closed.

This process is necessary in order to complete the dividend adjustment calculation by March in accordance with WRS statutes. We can discuss with ETF the pros and cons of alternative approaches. We can also document this procedure in future valuations to help clarify for the reader of the valuation report.

2. **Consider using all provided historical earnings information in the valuation to better calculate each member's salary history.** We are using the average earnings data field in the valuation – this is likely more accurate than using historical pay information that may not accurately reflect current final average earnings. However, we will disclose that this field is being used in the report.
3. **Consider using the field "Deceased Code" in the valuation to make sure active liabilities are not being included for members that are already deceased as of the valuation date.** We reviewed the 2018 data and found 6 cases reported as active with "Deceased Code." These six people are essentially reported as both actively working plan participants and deceased at the same time, in other words, the data is slightly internally inconsistent. In such cases, we prefer the conservative approach of treating them as active, but due to the small number, we believe this to be immaterial.

B. Actuarial Assumptions and Methods

1. **Investment return: show time horizon for each manager and incorporate longer time horizons, such as a period of 20 years or longer.** Our Capital Markets Assumptions Modeler (CMAM) is reviewed each year in order to provide an appropriate analysis which is consistent with the Actuarial Standards of Practice. Most of the investment consultants in our pool provide capital market assumptions based on 10-year horizons; a handful provide 20+ year capital market



assumptions in addition to the 10-year assumptions. We could certainly show results based on the longer-term horizons in addition to the 10-year results, but we do not want to give the impression that the longer-term figures are more correct than the 10-year figures. The structure of liabilities is also important.

2. **Review retiree mortality experience separately for general employees, teachers and public safety in future experience studies.** The Society of Actuaries (SOA) developed mortality tables for distinct public sector occupations with notable differences between groups that will be investigated for WRS valuations. GRS will look at experience by group in the next experience study. However, there may not be sufficient credible data to develop meaningful mortality rates for certain job classifications, in particular, for public safety employees. We are also concerned that the use of different mortality assumptions for different occupations could have an unintended effect on the dividend process, reserve transfers and optional forms calculations.
3. **Provide a basis for use of 60% factor applied to the mortality improvement factors from Scale MP-2018 in the Experience Study Report.** We review the mortality assumption with due care in every 3-year experience study, working diligently to compare published mortality tables to the actual experience in Wisconsin. Please note that for most retirement systems, providing additional margin for adverse deviation is common practice and relatively benign. However, for WRS, overstated liabilities have the iterative effect of increasing the employee contribution rate, which increases the benefits, which increase the liabilities more, which increases contribution rates, etc... We will continue to review this matter with each experience study with the goal of treating all retirees in a fair and uniform manner and to minimize the likelihood of significant mortality gains or losses.

Some history that was not part of this audit: GRS began using “generational mortality” with improvement scales in connection with the previous experience study, wherein we used a 50% factor applied to the MP-2015 scale. We used a 50% factor because we thought it likely that the mortality improvement scale was overstating future mortality improvement, especially in Wisconsin, where mortality rates are already well below national averages. With hindsight, use of a 100% factor at that time would have introduced a distortion into the dividend process by increasing liabilities for a System where no significant mortality losses had occurred for the prior period. The 2015-2017 Experience Study increased the factor to 60% because we think the improvement scales are becoming more reliable than the original scales in relation to WRS experience. Lastly and importantly, GRS will include a more empirical description of our reasoning/review conclusions in future experience studies.

4. **For the withdrawal decrement, clarify terms “Service Index” and “Service Index 10.”** We will clarify these terms going forward. “Service Index 10” means the tenth year of service, which is the year when the person’s actual service credit was 9 years and some months.
5. **Consider alternative withdrawal assumptions to fit particular groups.** We will consider this in the next experience study.
6. **Analyzes disability experience for combined group of Public School, University and Executive & Elected members to increase credibility in next experience study.** We will consider this in the next experience study.



7. **Consider review of male and female retirement experience separately for Protective and Executive & Elected groups, despite limited exposures.** We do not think there are enough females in Protective to allow for statistically significant inference. We can look at this for the Executive and Elected group.
8. **Investigate “other” assumptions periodically -- every other or every 3rd experience study.** We think this is a good recommendation and will begin with the next experience study and will do so to the extent that we can get data.

C. Actuarial Valuation Reports and Risk Assessment Disclosures

1. **Include commentary of Core and Variable annuity functioning in the Retired Lives Valuation.** Future Retired Lives reports will provide additional commentary on how these annuities function within the plan.
2. **Highlight assumption changes from the prior valuation in the Executive Summary of both reports.** We will make a note to clarify this in future reports.
3. **Segal believes the investment return assumption for calendar 2018 was 7.2%, not 7.0%, and 7.0% should have been reflected in the MRA calculations.** We believe that Segal’s intended recommendation (**emphasis added**) is “...and 7.2% should have been reflected in the MRA calculations.” The MRA calculations reflected 7.0%, consistent with ETF historical treatment. GRS and ETF will review and codify this process going forward. We also note that this has no material effect on the valuations, as all gains and losses in the MRA account are fully recognized within 5 years.
4. **Consider modifying discussion of risk measures in both reports.** Since the previous audit we continually make updates to the valuation reports to reflect updated ASOPs and to improve readability for the intended user – and will continue to work to make risk measures clearer for the reader.
5. **Retired Lives Report: explain discrepancy between number of new 2018 awards (Pages 8 and 17) and counts for new annuities (pages 25 and 26).** This is due to reporting lag -- many new retirees have a 2017 retirement date and there will be a cohort of 2018 retirements which will not show up until next year. We will add documentation to the report to make this distinction clear.
6. **Provide commentary in Annual Actuarial Valuation and Gain/Loss Analysis Report about how the experience study review process works to reduce potential for future losses.** We will add commentary in the 2019 valuation.

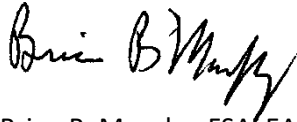


Auditor Report Section VI: Review of Risk Assessment Disclosures

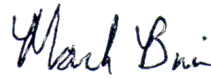
Lastly, the auditing actuary report includes a statement that “we believe this section complies with the spirit of ASOP51”, but later suggests that “...the actuary does not believe that a more detailed risk assessment is necessary...”. We note that the auditor’s scope was limited to the valuation and experience study, and that they likely are unaware that every 2 years GRS and the State of Wisconsin Investment Board undertakes a significant project related to the specific risks of the WRS. The most recent risk assessment study was presented in the fall of 2019. We will add references to this study in both the Active and Retired Lives valuation reports’ discussion of Risk.

We are very pleased with the results of the audit, and, in particular, we are pleased that the auditor has successfully validated both our 2018 valuation and the 2015-2017 experience study. We certainly appreciate the thorough work, professional demeanor, and helpful suggestions and recommendations that the auditors have made. We will continue to review them throughout the next work cycle and will implement those that seem to be in the best interest of the WRS.

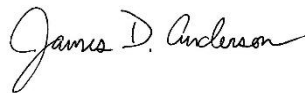
Sincerely



Brian B. Murphy, FSA, EA, FCA, MAAA, PhD



Mark Buis, FSA, EA, FCA, MAAA



James D. Anderson, FSA, EA, FCA, MAAA

BBM/MB/JDA:sc

cc: Robert Conlin (ETF)
Cindy Klimke (ETF)
Kim Nicholl (Segal)
Matthew Strom (Segal)

