State Teachers Retirement System of Ohio

Proposal for Actuarial Audit Services
Due June 18, 2021, by 5 p.m. Eastern

Submitted by: Gabriel, Roeder, Smith & Company
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Southfield, Michigan 48076-3723
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June 16, 2021

Ms. Bethany Rhodes
Director
Ohio Retirement Study Council
30 East Broad Street, 2nd Floor
Columbus, Ohio 43215

Re: GRS' Response to the RFP for Actuarial Audit Services for the State Teachers Retirement System of Ohio

Dear Ms. Rhodes:

Gabriel, Roeder, Smith & Company (GRS) is pleased to have the opportunity to submit a proposal to provide actuarial audit services to the Ohio Retirement Study Council (ORSC). An actuarial audit reveals whether procedures are technically sound and if plan objectives are being met. Equally important, these types of reviews create a sense of security among those concerned with the viability of the retirement system.

Our proposal sets forth our understanding of the work and outlines our proposed process, timeline, and fees. It demonstrates the overall qualifications and capabilities of the GRS actuarial and consulting team. We believe that our proposed work plan will show that GRS is the provider of choice for this project.

There are three key areas that differentiate GRS from other consulting firms with regard to this project.

Dedication to the Public Sector: GRS serves more public sector retirement systems than any other firm. We provide actuarial and consulting services to 36 statewide retirement systems and have performed 24 actuarial audits for public pension systems in the last five years. Because we are the nation's largest provider of actuarial services to the public sector, we are often also the actuary being audited. As a result, ORSC will acquire a consulting team that is familiar with the auditing process and understands what is required to perform a thorough review.

Approach to the Work: We, like you, want to ensure that the actuarial condition of STRS is being measured as accurately as possible. Over the years, we have performed audits for retirement systems that confirmed their current processes were accurate and sound. In other situations, we identified issues of concern which required further investigation. We understand the importance of paying attention to the details and because we work with large and complex public sector retirement systems, our computer systems and processes are capable of handling large data sets and complex modeling.

Communication: From our experience with performing audits as well as having our own work audited, we recognize that communication throughout the project is essential for success. Also, the discussion generated by the audit process usually has value in the sharing of ideas and experiences. We also understand there are many stakeholders involved. Therefore, you may be confident that our work will include clear explanations and disclosures, in layperson terms. To the extent that terms common to the industry must be used, we provide concise explanations of these terms. To reinforce understanding of the results and the impact of policy options, our reports include graphic representations of the information, such as charts and tables. In presentations, we use the same approach, and endeavor to explain technical concepts and respond to questions in a clear and concise manner rather than presenting page after page of numbers.

GRS warrants that we have the staff and other required resources available to complete the required services within the required timeframe.

We are pleased to have this opportunity to serve ORSC and are confident that you will be pleased with the value our work provides to you and the STRS.

Once we are awarded this engagement, we will negotiate in good faith with ORSC to reach an agreement on contract terms as expeditiously as possible. As the nation's largest provider of actuarial services to public entities, we have negotiated mutually acceptable contract terms with our other clients in support of similar actuarial opportunities. We expect to also successfully reach agreement with ORSC on acceptable contract terms for this opportunity.

By submitting this proposal, GRS warrants and certifies that:

- It is eligible for award of a contract by the Attorney General's Office, pursuant to Ohio Revised Code Sections 9.24, 125.11, 125.25, and 3517.13.
- It has familiarized itself with the ethics statutes governing state employees and appointees, including those concerning employment of former government employees, gifts and lobbying.
- Applicant, any subcontractor, and any person acting on behalf of applicant or a subcontractor, shall not discriminate, by reason of race, color, religion, sex, age, genetic information, disability, military status, national origin, or ancestry against any citizen of this state in the employment of any person qualified and available to perform the work under any contract resulting from this RFP.
- It has read the RFP, understands it, and agrees to be bound by its requirements.
- If awarded a contract arising out of this RFP, it shall negotiate such contract in good faith, which contract shall be in a form provided by the Attorney General's Office.
- It has not included any legal terms or conditions for the contract in its proposal.

President Judith A. Kermans is authorized to contractually bind GRS. Her contact information is provided below:

Name:	Judith A. Kermans, EA, MAAA, FCA
Title:	President
Address:	One Towne Square, Suite 800 Southfield, Michigan 48076-3723
Telephone:	248.799.9000, Extension 1125
E-mail:	judy.kermans@grsconsulting.com

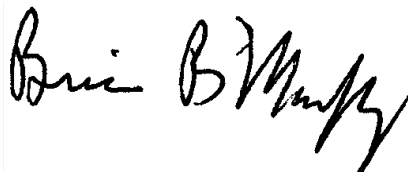
Senior Consultant and Actuary Brian B. Murphy will be your principal contact for staff use and for STRS use for purposes of this RFP and the resulting contract. His contact information follows:

Name:	Brian B. Murphy, FSA, EA, FCA, MAAA, PhD
Title:	Senior Consultant
Address:	One Towne Square, Suite 800 Southfield, Michigan 48076-3723
Telephone:	248.799.9000, Extension 1127
E-mail:	brian.murphy@grsconsulting.com

Ms. Rhodes, we would be delighted to perform this audit of the State Teachers Retirement System of Ohio on behalf of the ORSC and are confident that you will be pleased with our responsiveness and the quality of our work.

If you have any questions, or if we can be of further assistance to you throughout the remainder of the selection process, please do not hesitate to contact Brian Murphy at 248.799.9000, Extension 1127, or brian.murphy@grsconsulting.com.

Respectfully submitted,



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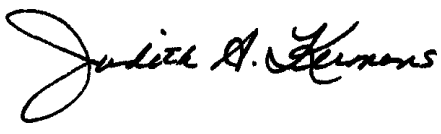
Brian B. Murphy, FSA, EA, FCA, MAAA, PhD
Senior Consultant and Actuary



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Judith A. Kermans, EA, MAAA, FCA
President

SECTION 4.1

PROPOSAL SUMMARY

Proposal Summary

4.1 PROPOSAL SUMMARY

Each proposal shall provide a narrative summary of the proposal being submitted. This summary should identify all of the services and work products that are being offered in the proposal and should demonstrate the firm's understanding of the project.

We understand the Ohio Retirement Study Council (ORSC) is seeking a qualified consulting firm to perform an independent actuarial audit of the State Teachers Retirement System retirement and health plan valuations and experience study. The purpose of the audit is to provide an independent verification and analysis of the assumptions, procedures, and methods used by the STRS' consulting actuary for the:

- STRS annual pension actuarial valuation as of June 30, 2020
- The five-year experience review for the period July 1, 2011 to June 30, 2016
- STRS annual retiree health care actuarial valuation as of June 30, 2020 including GASB Statement 74 disclosures.

GRS has been providing all of the requested services for over 80 years. We will provide the following services and deliverables, including but not limited to:

- Assessment of the validity, completeness, and appropriateness for STRS' structure and funding objectives of the demographic and financial information used by the consulting actuary in the valuation of STRS.
- Assessment of whether the consulting actuary's valuation method and procedures are reasonable and consistent with generally accepted actuarial standards and practices appropriate for STRS' structure and funding objectives, and are applied as stated by the actuary. If deviations from accepted standards are found during the audit, GRS will explain the rationale for the deviations and determine their effects, including their monetary impact.
- Assessment of whether the actuarial valuation assumptions are reasonable and consistent with generally accepted actuarial standards and practices; are reasonable based on STRS' experience; and are appropriate for STRS' structure and funding objectives. The assumptions evaluated will include both demographic and economic assumptions, such as mortality, retirement, separation rates, levels of pay adjustments, rates of investment return, and disability factors. As part of this assessment, GRS will consider and specifically address whether actual experience is appropriately evaluated in experience studies conducted by the consulting actuary at least every five years and whether recent changes in assumptions are appropriate, reasonable, and supported by the experience studies. Also, GRS will review the gain/loss analyses from the last four actuarial valuation reports.
- Perform parallel valuations of pension benefits as of June 30, 2020, and of retiree health care benefits as of June 30, 2020, using the validated member census data and the same actuarial assumptions.
- If GRS recommends assumption adjustments to more accurately reflect present and future assets, liabilities, and costs of STRS, then GRS will provide detailed rationale for its recommendations and will describe the general effect on STRS' condition resulting from the proposed changes in assumptions.
- Assessment of whether the system appropriately and consistently determines retiree contributions to health care and whether the implementation of the STRS' health care policies differs from those determinations.

Proposal Summary

- A written report in language clearly understood by lay readers summarizing the findings and results. Our report will include:
    - An executive summary;
    - An overall opinion as to the validity, completeness, and appropriateness of the demographic and financial information used by the consulting actuary to meet STRS' funding objectives;
    - An overall opinion as to the reasonableness of the consulting actuary's conclusions and the conformance of the consulting actuary's work with generally accepted actuarial standards and practices;
    - A detailed description of each audit exception and the estimated effects of each exception on STRS; and
    - Detailed recommendations for improvement. The recommendations should be easily identified within the report by use of bold, underlined, or italicized text, bullets, or other similar techniques.
- Presentation of the final report, in person, to the ORSC and the STRS Board.

GRS' motto when it comes to presentations and written communication is "education, not information." Our presentations will be concise, illustrative, and focused on "telling the story." We commonly find that our Boards continue to improve their understanding of the actuarial concepts with each presentation that we deliver, which indicates to us that we are fulfilling our role.

Our consultants strive to deliver reports that are easily understood by all stakeholders. Our clients have told us that this is one of our strengths. We understand that our reports are subject to public disclosure and review. Therefore, you can be confident that our work will always include clear explanations and disclosures, in layperson terms, of the methods and assumptions used in our calculations. In addition, our goal is to always minimize the use of technical jargon. To the extent that we must use terms common to the industry, we provide concise explanations of these terms, in either glossaries or within the body of the report.

Actuarial audits provide an independent peer review of valuations. Periodic reviews nearly always lead to improved procedures. Our audit services range from providing basic reviews to ascertain the reasonableness of results to comprehensive full-replication audits. Since our substantial actuarial audit experience derives from years of conducting this work and having our own work audited, we are able to deliver reviews that consistently provide useful information and improvements.

GRS approaches actuarial audits as several separate, but related assignments. These assignments can be loosely described as follows:

- Ensure all the mathematical calculations are correct and appropriate, including the modeling of current and future benefits, the application of assumptions, and the allocation of costs between current (normal cost) and past (accrued liability);
- Review the reasonableness of actuarial assumptions and funding policy;
- Provide a "second opinion" regarding funding, assumptions and methods; and
- Provide constructive suggestions for the incumbent and/or Board to consider regarding assumptions, policies, and report content/format.

Please see our proposed detailed workplan on pages 19-25.

Proposal Summary

In addition to the summary, please provide all of the following general information:

- The firm's primary contact for ORSC staff use and, if different, for STRS staff use during the audit, including the contact's address, telephone and e-mail address;

Brian B. Murphy is your primary contact for ORSC staff use and STRS staff use.

Name:	Brian B. Murphy, FSA, EA, FCA, MAAA, PhD
Title:	Senior Consultant and Actuary
Address:	One Towne Square, Suite 800 Southfield, Michigan 48076-3723
Telephone:	248.799.9000, Extension 1127; 248.506.4461 (Cell)
E-mail:	brian.murphy@grsconsulting.com

- General ownership structure of the organization, including subsidiary and affiliated companies, and joint venture relationships;

The corporate structure is shown in the graphic below. There are no joint venture relationships. We are an employee-owned corporation that is independent of banks, accounting firms, insurance companies and brokerage firms. This means GRS can provide totally independent and unbiased advice and service. Since the success of the company is determined by successful consulting relationships, our employees have a strong personal stake in the success of their relationships with our clients.

- Information regarding any material change in the firm's structure or ownership within the last eighteen months, or any material change in ownership, staff, or structure currently under review or being contemplated by the firm;

There have been no recent structural changes and none are contemplated.

- If available, a third-party assessment or report concerning client satisfaction and measures of the firm's strengths and weaknesses;

We survey our clients periodically regarding satisfaction, but do not have an independent third-party assessment. Below is a sampling of client testimonials.

- "We consider GRS to be an important business partner and we have a very good working relationship with GRS."
- 'GRS is a solid organization that delivers first-rate service via a professional and caring staff."
- "Hey! We are talking about actuarial stuff here. For the layman recipient, it all looks confusing but GRS does a good job at making it understandable to all."

- "I cannot overstate how much I value the relationship I have with our consultant. His responsiveness, patience and knowledge make it possible to manage the intense workload and deadlines involved at the City."
- "They respond quickly to emails and phone calls and are always personable, forthright, and experienced."
- "I have reviewed reports prepared by many of your competitors and always find the GRS ones to be superior."

- Any material litigation which has been threatened against the firm or to which the firm is currently a party;

There is no current material litigation against GRS and none is being threatened.

- A list and brief description of litigation brought against the firm by existing or former clients over the last five years; and

Gabriel, Roeder, Smith & Company (GRS) is not currently involved in any litigation. There has been no litigation brought against it within the last 5 years.

- A list of any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, together with a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review. In the event that the firm has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, the firm shall provide a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review, or, if necessary, an explanation of the actions that will be taken to ensure an independent review.

GRS is currently the retained actuary for the Ohio Public Employees Retirement System (PERS). Within the past five years, we have also served the Ohio State Highway Patrol Retirement System (SHPRS). Our Health Care group did project work for the Ohio Police and Fire System (OP&F) in 2017 and 2018. The relationship with OPERS does not constitute a conflict of interest because our role with respect to the actuarial audit is to assess the quality and accuracy of the work of the STRS retained actuary. The STRS retained actuary is not currently involved in any project for PERS and has no responsibility to assess our work there. There is no direct or indirect relationship between GRS and the STRS actuary. The former relationship with SHPRS does not constitute a conflict because we have no current responsibilities to SHPRS, and of course the SHPRS and STRS are served by different actuarial firms. The former relationship with OP&F does not constitute a conflict of interest. There is no current relationship with OP&F.

In the very unlikely event that a conflict is discovered during this assignment we will abide by the Academy of Actuaries' Code of Conduct. The Code requires us to notify the client or clients involved and discuss potential options. If given knowledge of the conflict, both clients (assuming two clients are involved in the conflict) consent to GRS providing the advice or service AND if the GRS consultant believes he or she is capable of rendering impartial advice, GRS will provide the advice or service requested. Otherwise, GRS will discuss options for obtaining the needed advice or service. Conflicts of Interest are rare, and in practice a mutually agreeable solution is usually available.

SECTION 4.2

CAPABILITIES AND EXPERIENCE

4.2 CAPABILITIES AND EXPERIENCE

Each proposal shall describe the firm's capabilities and recent experience (at least during the last five years) in performing actuarial valuations, audits, or studies of public employee retirement systems. The response should include information on the types and sizes of public employee retirement systems for which past work has been performed, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to STRS. You should include other information you believe may be relevant in demonstrating your capabilities in performing the actuarial audit, including other professional experience and data processing capabilities.

Capabilities

GRS focuses on public sector defined benefit plans and is currently the retained actuary for 36 statewide systems. We are therefore very familiar with Public Sector Defined Benefit Systems. In addition to that work, we do extensive actuarial audit work. The table below is a sampling of recent audit work that we have done for defined benefit plans. Many of the systems that we have audited are comparable in size to Ohio STRS. Examples would include Employees Retirement System of Texas, Texas County and District Retirement System, CalSTRS, and Nevada PERS. The fact that we have audited some of these plans multiple times attests to the quality of our work.

Client Name	Year of Audit	Firm Audited	Plans in Audit	Scope of Audit
New Castle County Employees' Retirement Plan	2020	Boomershine Consulting Group	New Castle County Employees' Retirement Plans (NCCERP) and County Contributions to State for Police Officers	Actuarial audit of the January 1, 2019 actuarial valuation for the New Castle County Employees' Retirement Plans
Alaska Retirement Management Board	2020	Buck	PERS DB, TRS DB, PERS DCR, and TRS DCR.	Actuarial review of June 30, 2019 valuations for the State of Alaska Public Employees' Retirement System Defined Benefit Retirement Plan (PERS DB) and Teachers' Retirement System Defined Benefit Retirement Plan (TRS DB) Actuarial review of June 30, 2019 valuations for the State

				of Alaska Public Employees' Retirement System Defined Contribution Retirement Plan (PERS DCR) and Teachers' Retirement System Defined Contribution Retirement Plan (TRS DCR)
Iowa PERS	2020	Cavanaugh McDonald	IPERS	Full Replication Audit of 2019 valuation. Includes audit of experience study, option factors, and projection tool.
Employees Retirement System of Texas	2020	Rudd & Wisdom	Texas ERS	Actuarial audit of the August 31, 2019 GASB 74 valuation for the Employees Retirement System of Texas Group Benefit Plan
Tacoma Employees' Retirement System (TERS)	2019	Milliman	TERS	Actuarial audit of the January 1, 2019 actuarial valuation for the Tacoma Employees' Retirement System (TERS)
Oregon Public Employees Retirement System (Oregon PERS)	2019	Milliman	Oregon PERS	A study was conducted pursuant to the 2018 Oregon House Bill 4163, Section 11. The study looked at the reasonableness and consistency of the methods, assumptions, data used in the December 31, 2017 actuarial valuation
Public Employees' Retirement System of Nevada	2018	Segal	Nevada PERS	Actuarial review of June 30, 2017 valuation for the Public Employees' Retirement System of the State of Nevada and the June

				30, 2016 Experience Study
Lower Colorado River Authority	2018	Rudd & Wisdom	Lower Colorado River Authority Retirement Plan	An actuarial audit of the January 1, 2018 actuarial valuation for the Lower Colorado River Authority Retirement Plan
Florida Retirement System	2018	Milliman	FRS, DBP, HIS	Actuarial review of the June 30, 2018 actuarial valuations for the Florida Retirement System (FRS) Defined Benefit Plan (BDP) and Health Insurance Subsidy (HIS) with respect to GASB Statement No. 67 disclosures
Florida Auditor General	2018	Foster and Foster	Florida Department of Management Services (DMS)	Actuarial review of the July 1, 2017 actuarial valuation for the State of Florida, including GASB Statement No. 76 disclosures for the fiscal year ended June 30, 2018 for the OPEB program
Delaware Public Employees Retirement System	2019	Cheiron	DPERS	Full Replication Audit of 2018 actuarial Valuation for 8 separate Plans
Virginia Retirement System	2018	Cavanaugh Macdonald Consulting	Virginia Retirement System	A non-replication actuarial audit of the assumptions, methods, procedures and conclusions used in the June 30, 2017 actuarial valuations for the Virginia Retirement System
Ventura County Employees' Retirement Association	2017	Segal	Ventura County Employees' Retirement Association	Actuarial Audit of the July 1, 2016 Actuarial Valuation, the July 1, 2011 through June 30,

				2014 Experience Study and the June 30, 2015 Economic Actuarial Assumption Review of the Retirement System administered by the Ventura County Employees' Retirement Association (VCERA)
Clinton Township Fire and Police Retirement System	2017	Rodwan Consulting Company	Clinton Township Fire and Police Retirement System (CTFPRS)	Actuarial Audit of the March 31, 2016 Actuarial Valuation
Texas County & District Retirement System (TCDRS)	2017	Milliman	Texas County & District Retirement System	Audit of the December 31, 2016 Actuarial Valuation
California State Teachers' Retirement System (CalSTRS)	2017	Crowe Horwath LLP	State Teacher's Retirement Plan	We reviewed the following State Teachers' Retirement Plan component programs: • Defined Benefit (DB) Program • Defined Benefit Supplement (DBS) Program • Cash Balance Benefit (CBB) Program and • Supplemental Benefits Maintenance Account (SBMA) We also performed a review of the Medicare Premium Payment (MPP) Program
Alaska Retirement Management Board	2017	Conduent	PERS DB, TRS DB, PERS DCR, TRS DCR	Actuarial Review of June 30, 2017 valuations for the State of Alaska Public Employees' Retirement System Defined Benefit Retirement Plan (PERS DB) and Teachers' Retirement System Defined Benefit Retirement Plan (TRS

				DB) Actuarial Review of June 30, 2017 valuations for the State of Alaska Public Employees' Retirement System Defined Contribution Retirement Plan (PERS DCR) and Teachers' Retirement System Defined Contribution Retirement Plan (TRS DCR)
Florida Retirement System	2017	Department of Management Services (DMS)	FRS, DBP, HIS	Scope of Audit Actuarial Review of Actuarial Analysis and Reporting Requirements Related to GASB Statement No. 67 for the Florida Retirement System. Actuarial Valuations for the FRS DBP and HIS with respect to GASB Statement No. 67 Disclosures for the fiscal year ended June 30, 2017
Public Employees' Retirement System of Mississippi	2017	Cavanaugh Macdonald Consulting	MRS, MHSPRS, SLRP, PERS	Actuarial Audit of the June 30, 2016 Actuarial Valuations for various Mississippi plans - MRS, MHSPRS, SLRP & PERS
Maine Public Employees Retirement System	2016	Cheiron	State/Teacher; Judicial; Legislative; Consolidated for Participating Local Districts	Audit of the June 30, 2015 Actuarial Valuation of the Maine Public Employees Retirement System (MainePERS) • MainePERS

				State/Teacher Retirement Program • Maine Judicial Retirement Program • Maine Legislative Retirement Program • MainePERS Consolidated Plan for Participating Local Districts ("PLD" plan)
San Joaquin County Employees' Retirement Association	2016	Cheiron	San Joaquin County Employees' Retirement Association	An Actuarial Audit of the January 1, 2016 Actuarial Valuation and the January 1, 2013 through December 31, 2015 Experience Study of the Retirement System administered by the San Joaquin County Employees' Retirement Association (SJCERA)
Florida Retirement System	2016	Department of Management Services (DMS)	FRS, DBP, HIS	Actuarial Review of Actuarial Analysis and Reporting Requirements Related to GASB Statement No. 67 for the Florida Retirement System. Actuarial Valuations for the FRS DBP and HIS with respect to GASB Statement No. 67 Disclosures for the fiscal year ended June 30, 2016

Based on our experience with 36 statewide retirement systems and over 1,000 local governments, we provide more year end reporting for public sector clients than any other consulting firm in the nation. Virtually all of the statewide systems we work on, as well as local municipalities, require timely and accurate information for the system's annual financial report.

This information is typically needed within a month or two after the close of the fiscal year. This requires reconciling the valuation data, producing data schedules, reviewing financial information, computing actuarial liabilities and contribution requirements, as well as providing the various disclosure

requirements all in a short period of time. Since all of our valuation software and technology tools have been designed specifically for public sector clients, we have the capability of providing all of the necessary information for year-end reporting in a fast and efficient manner.

Unlike most of our competitors, GRS is focused on the public sector. Every GRS consultant is well versed in public sector issues. Public Sector work is not a sideline for our primary work, it is our primary work. Nearly 100% of our revenue derives from actuarial and related consulting services for the public sector.

Some key characteristics of our client base offer an insightful overview of our public plan experience:

- GRS has the largest and most diverse public sector client base, both based on region and size.
- More than 1,000 actuarial clients covering pension and OPEB plans – 500+ clients each.
- 36 state or statewide retirement systems covering a total of over 6 million participants and over $800 billion in assets.
- 27 statewide retirement systems with 50,000 or more participants.
- Most of our clients have multiple benefit structures and employer groups; therefore, it is unlikely that there is any public sector benefit design or funding issue that GRS has not already helped another client manage or solve.
- GRS has worked in most of the 50 states, including Hawaii and Alaska. The majority of our client relationships span decades. We have been associated with more than half of our clients for at least 30 years, many for more than 50 years, and some for over 80 years. We believe that our clients' long association with our company results from our focus on technological innovation, research, and employee professional growth efforts solely attentive on managing the challenges faced by benefit plans.

Data Processing Capabilities

GRS works on plans of all sizes, from very small plans with a few hundred participants to large state plans with hundreds of thousands of participants. We can receive and process data in almost any available format, including system data files with a file layout, Sequel Server and Oracle data bases, excel spreadsheets, etc. We use Secure File Transfer to move data to and from our clients. We recommend that our clients refrain from including social security numbers, names, addresses, etc. in the data that is sent to us, unless for some particular assignment, such information is necessary.

We have an annual Soc-2 Type 2 audit attesting to the security of our procedures.

SECTION 4.3

STAFF QUALIFICATIONS

4.3 STAFF QUALIFICATIONS

Each proposal shall, at a minimum, describe the qualifications of all management and lead professional personnel who will participate in the audit. Each personnel description shall include: (1) a resume; (2) a summary of experience each has had in performing actuarial valuations, audits, or studies of public employee retirement systems; and (3) a management plan identifying the responsibilities each will have on the audit.

Each resume should include information on the current and past positions held with the firm, educational background, actuarial and other relevant credentials, and other relevant information to demonstrate the person's qualification.

The experience summaries should include information on the types and sizes of public employee retirement systems for which the designated staff have completed actuarial work, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to STRS. You may reference, rather than repeat, duplicative information provided in Paragraph 4.2 Capabilities and Experience. The experience summaries also should describe the work performed and detail the roles and responsibilities that the individual staff had on the projects.

The management plan should specify the roles and responsibilities that each of the management and professional staff will have on the actuarial audit and include an estimated portion of the audit's time that will be spent by each on the audit.

Actuaries included on the project team should meet the following criteria:

- Be members of the American Academy of Actuaries;
- Be enrolled actuaries with experience in governmental plans;
- Be, at a minimum, associates with at least five years of experience in public practice, although preference will be given to actuaries that are Fellows of the Society of Actuaries; and
- Have performed an actuarial valuation, audit, or study of a public employee retirement system within the last two years.

Brian B. Murphy, FSA, EA, FCA, MAAA, PhD, will serve as Lead Actuary for the STRS audit project. He has more than 40 years of public sector actuarial and consulting experience. He will bear ultimate responsibility for the success of the project and will peer review all of the work that GRS does in connection with this project.

Brian was originally hired as a technical programmer and progressed through the ranks. He served as GRS' President from 2004 through 2014. He continues to serve on GRS' executive management team and is also a senior consultant with the firm.

Brian's consulting experience with statewide pension plans includes systems in Arizona, Arkansas, Colorado, Illinois, Iowa, Maryland, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin. His local government experience covers plans in Florida, Michigan, and Virginia. Brian has worked on actuarial audits for Iowa PERS, Mississippi PERS, Texas County and District Retirement System, Colorado PERA, the Tennessee Consolidated Retirement System, as well as for local governments in Ohio and Virginia.

Bonnie Wurst, ASA, EA, FCA, MAAA will serve as Project Manager for the STRS audit. She will monitor data coming in and going out and will ensure that deliverables are produced on schedule. She will serve as primary review on all work produced by the team. She has over 30 years of actuarial and consulting experience. Bonnie has served public sector clients in Delaware, Illinois, Indiana, Michigan, Minnesota, Mississippi, Missouri, and North Dakota. Her recent actuarial audit experience involves auditing 8 separate plans for the Delaware Public Employees' Retirement System.

Bonnie joined GRS from another firm as a senior consultant. She was recently promoted to Team Leader.

Bonnie consults to church-sponsored plans, statewide public plans, and large municipal retirement systems. Her actuarial experience covers OPEB and pension actuarial valuation services, funding projections, plan design studies, experience studies, plan merger and implementation consulting, and benefit administration services.

Sheri Christensen, ASA, EA, FCA, MAAA will serve as Support Actuary for the STRS Audit. She has more than 25 years of actuarial and consulting experience. Sheri has served clients in Colorado, Delaware, Illinois, Indiana, Iowa, Kansas, Maryland, Michigan, Minnesota, Missouri, North Dakota, South Dakota, West Virginia, and Wisconsin.

Sheri joined GRS from another firm as a Consultant in 2012.

During Sheri's career, she has worked with statewide and municipal retirement systems, church plans, not-for-profit organizations, and corporate plans. Sheri's areas of expertise include valuations of traditional and hybrid defined benefit plans, including actuarial audits, and retiree health care plans. She regularly provides cost analyses for proposed plan and/or assumption changes, experience studies, funding projections, and service purchase calculations. Sheri also has experience advising clients on benefit administration issues.

Together with Jamal, she will verify that STRS benefits and valuation method are properly modeled.

Jamal Adora, ASA, EA, MAAA will serve as Technical Support Actuary for STRS. He has over seven years of experience working with statewide and local public employee retirement systems and post-retirement healthcare programs. He has served clients in Illinois, Michigan, and Missouri.

Jamal will be responsible for modeling all STRS benefits and valuation methods in the GRS valuation system.

Jamal's entire career has been at GRS.

Staff Qualifications

Jim Pranschke, FSA, FCA, MAAA will serve as primary technical resource for the health care review. During his more than 35-year career, Jim has worked extensively with insurers, employers, public sector retirement systems, underwriters, and third-party administrators. Jim's public sector clients have included statewide and municipal health programs in Michigan, Ohio, and Rhode Island. Jim is a dedicated and innovative leader who helps GRS clients navigate the challenges surrounding health care program sustainability and costs.

Jim has worked at GRS for 12.5 years. He has also worked as a Healthcare Actuary involved in pricing, financial planning, and analysis at Blue Cross Blue Shield of Michigan for 6.5 years and at American Community Mutual for over 15 years.

The following chart shows the estimated portion of time expected to be spent by each team member on the audit.

Name	Role	Allocation of Time
Brian Murphy	Lead Actuary	15%
Bonnie Wurst	Project Manager	20%
Sheri Christensen	Support Actuary	20%
Jamal Adora	Technical Support Actuary	30%
Jim Pranschke	Health Care Actuary	15%
		100%

Please see Appendix 1 for detailed resumes.

In the event that the firm has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, the firm shall provide a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review, or, if necessary, an explanation of the actions that will be taken to ensure an independent review.

GRS is currently the retained actuary for the Ohio Public Employees Retirement System (PERS). Within the past five years, we have also served the Ohio State Highway Patrol Retirement System (SHPRS). Our Health Care group did project work for the Ohio Police and Fire System (OP&F) in 2017 and 2018. The relationship with OPERS does not constitute a conflict of interest because our role with respect to the actuarial audit is to assess the quality and accuracy of the work of the STRS retained actuary. The STRS retained actuary is not currently involved in any project for PERS and has no responsibility to assess our work there. There is no direct or indirect relationship between GRS and the STRS actuary. The former relationship with SHPRS does not constitute a conflict because we have no current responsibilities to SHPRS, and of course the SHPRS and STRS are served by different actuarial firms. The former relationship with OP&F does not constitute a conflict of interest. There is no current relationship with OP&F.

In the very unlikely event that a conflict is discovered during this assignment we will abide by the Academy of Actuaries' Code of Conduct. The Code requires us to notify the client or clients involved and discuss potential options. If given knowledge of the conflict, both clients (assuming two clients are

involved in the conflict) consent to GRS providing the advice or service AND if the GRS consultant believes he or she is capable of rendering impartial advice, GRS will provide the advice or service requested. Otherwise, GRS will discuss options for obtaining the needed advice or service. Conflicts of Interest are rare, and in practice a mutually agreeable solution is usually available.

SECTION 4.4

REFERENCES

References

4.4 REFERENCES

Each proposal must include a list of at least three organizations, but no more than five, that may be used as references for your work on actuarial audits or studies. References may be contacted to determine the quality of the work performed, personnel assigned to the project, and contract adherence. The following should be included for the references listed:

- Date of the actuarial audit work;
- Name and address of client;
- Name and telephone number of individuals in the client organization who is familiar with the work; and
- Description of the work performed.

Entity Name	Ohio Public Employees Retirement System
Entity Address	277 East Towne Columbus, Ohio 43215
Website	www.OPERS.org
Nature of Business	Actuarial Consulting Services
Assets Under Management	$100 Billion
Total Plan Members	1.1 Million
Primary Contact Name, Title, Telephone Number, and Email	Ms. Karen Carraher, Executive Director Telephone: 614-222-0011 KCarraher@Opers.org
Nature and Length of Relationship	Retained Actuary 1954 - Present
Description of Services	Annual actuarial valuations, experience studies, benefit calculations, supplemental valuations

Entity Name	Iowa Public Employees' Retirement System
Entity Address	7401 Register Drive, P.O. Box 9117, Des Moines, IA 50321
Website	www.ipers.org
Nature of Business	Actuarial Audit
Assets Under Management	$34 billion
Total Plan Members	360,000
Primary Contact Name, Title, Telephone Number, and Email	Gregory Samorajski Chief Executive Officer Telephone: (515) 281-0020 greg.samorajski@ipers.org
Nature and Length of Relationship	Actuarial Audit of 2019 Actuarial Valuation; Work product delivered March, 2020
Description of Services	An Audit of the June 30, 2019 Actuarial Valuation of the Iowa Public Employees' Retirement System (IPERS).

References

Entity Name	Delaware Public Employees Retirement System
Entity Address	860 Silver Lake Boulevard, Suite 1 Dover, DE 19904
Website	https://open.omb.delaware.gov/
Nature of Business	Actuarial Audit Services
Assets Under Management	$9 billion
Total Plan Members	71,000
Primary Contact Name, Title, Telephone Number, and Email	Ms. Joanna Adams Pension Administrator 302-739-4208 Joanna.adams@state.de.us
Nature and Length of Relationship	Audit of the 2018 valuation and experience study delivered in 2019
Description of Services	Audit of the 2018 valuation and experience study delivered in 2019

Entity Name	Wisconsin Retirement System
Entity Address	4822 Madison Yards Way Madison, WI 53705-9100
Website	www.etf.wi.gov
Nature of Business	Actuarial Consulting Services
Assets Under Management	$100 Billion
Total Plan Members	640,000
Primary Contact Name, Title, Telephone Number, and Email	Ms. Cindy Klimke-Armatoski Telephone 608 267-0745 Email: cindy.klimke@etf.wi.gov
Nature and Length of Relationship	Retained Actuary 1979-Present
Description of Services	Annual actuarial valuations, gain/loss analysis, dividend calculations, experience studies, supplemental valuations, projections, stress tests

Entity Name	Minnesota PERA
Entity Address	60 Empire Drive, Suite 200 | St. Paul, MN 55103
Website	www.MNPERA.org
Nature of Business	Actuarial Consulting Services
Assets Under Management	$31.6 Billion
Total Plan Members	440,000
Primary Contact Name, Title, Telephone Number, and Email	Mr. Doug Anderson, Executive Director Telephone: 651-201-2690 Doug.anderson@mnpera.org
Nature and Length of Relationship	Retained Actuary 2012-Present
Description of Services	Annual actuarial valuations, experience studies, benefit calculations, supplemental valuations

SECTION 4.5

METHODOLOGY, WORK PRODUCT, AND TIMELINE

4.5 METHODOLOGY, WORK PRODUCT, AND TIMELINE

Each proposal shall describe the proposed methodology for each element of the components listed in Section II, Scope of Audit. The description should include specific techniques that will be used, including anticipated sampling techniques and sizes, and proposed sources of data and information. You may propose alternative ways of addressing the elements of the audit's scope.

In describing the proposed methodology, also identify the type and level of assistance that you anticipate will be needed from the staff of STRS and the consulting actuary, including: assistance to understand the operations and records of STRS; assistance to understand the actuarial assumptions, method, and procedures; and assistance to access, obtain, and analyze information needed for the audit. The description of the proposed methodology shall also identify meetings, interviews, programming support, space needs, etc., that you anticipate requiring from STRS and the consulting actuary.

Each proposal shall also include one or more examples of work product(s) from actuarial valuations or audits that may help to illustrate the proposed methodology and final work product.

Each proposal shall provide an estimated date that the final report will be submitted and the projected timeline or the anticipated work requirements and milestone dates to reach that date.

Listed below is the general approach we would use to satisfy the specific audit requirements in Section 2.1 of the RFP. A proposed detailed plan and schedule is provided in this section. Monthly updates will be provided to the ORSC during the project.

a) **Review of Annual Valuation Reports.** GRS will review each report (pension valuation, experience review, and retiree health care valuation) for compliance with actuarial standards. The review will also help us gain an understanding of the operation of Ohio STRS and of the actuarial methods and assumptions the retained actuary uses in their work for STRS. Further, this review will provide us with an understanding of the benefit provisions being valued, and the overall plan population characteristics. This is important for later steps of the parallel valuation.

   Estimated time: GRS 10 hours, Retained actuary 0 hours, STRS staff 0 hours, ORSC staff 0 hours

b) **Initial Discussions with System Staff**
   Initial discussions with STRS and ORSC staff will provide an opportunity for introductions of GRS team members and to discuss the anticipated timeline for the specific task.

   GRS will provide a list of information to discuss that we believe would be needed in order to complete each of the parallel valuations. The list would include items such as:

   - Description of data items that are provided to the retained actuaries for the annual actuarial valuation. For data files, GRS would need a full data layout and glossary of data items.

- Copy of the individual participant data that the retained actuaries used for the actuarial valuations, along with instructions for data edits, if applicable.
- A complete set of actuarial assumptions (ideally in electronic format) from the retained actuaries.
- A breakdown of specific actuarial valuation results required from the retained actuaries for parallel valuations being performed.
- Description from the retained actuaries of any special adjustments, approximations, or techniques that are used in the actuarial valuations.
- Copies of benefit provisions, statutes, and member handbooks.
- Copies of applicable Board rules and regulations.
- Discussion of any particular issues that are of interest to ORSC staff.

Estimated time: GRS 5 hours, Retained actuary 5 hours, STRS staff 10 hours, ORSC staff 2 hours

c) Data Validity

We will provide an assessment of the validity, completeness, and appropriateness of the demographic and financial data used in the valuation. Items to be reviewed will include without limitation the following.

- Benefit codes and participant type (active, inactive/active, retired, etc.), to ensure that the benefit provisions affecting each participant are understood.
- Service amounts, to ensure that all types of service, credited, participation, eligibility, that affect the actuarial valuations are being reported to the actuary.
- For active members, pay amounts (rates, pensionable, annualized), to ensure complete understanding of the pays that are reported to the actuary. The distinction between full-time and part-time employees is important, as is the timing of reported pays and pay increases (i.e., what period did the reported pay cover and when is the next pay increase expected). Teaching employees many need special consideration due to Covid-19, 9- or 10-month contracts, summer absences. If prior year pays are reported, do they represent any furloughs, 27 pay periods, or other anomalies? For STRS we will be interested in the timing of retirements and the manner in which retirees show up in the retiree data. For example, are July 1 retirees reported as active on June 30? If not, how is the payroll adjusted?
- Inclusion of post-retirement benefit increase amounts in the data, including timing of future increases.
- Assumptions made by the retained actuaries regarding the data and the appropriateness of those assumptions.
- System financial statements including the balance sheet and the income statement.
  In connection with the data validity review, we will select sample cases of active, inactive, and retiree data and ask STRS to verify the accuracy of the reported data. Based upon our review of the actuarial report we will determine whether or not the reported data is sufficient to evaluate all material STRS benefits. We will review the financial statements for consistency with the expected cash flows.

Estimated time: GRS 35 hours, Retained actuary 5 hours, STRS staff 10 hours, ORSC staff 0 hours

d) Actuarial Valuation Methods and Procedures.

In conjunction with our review of the actuarial report itself, we will gain an understanding of the methods and procedures and will be able to opine on the general reasonability. Since the actuarial accrued liability is also used as the GASB Total Pension Liability, we will separately review the valuation method for compliance with GASB requirements. As we progress through the parallel valuation we will gain further understanding. Our report will outline any deviations from actuarial standards of practice and the rationale for the deviation. For any material deviation we will estimate the monetary effect.

Estimated time: GRS 15 hours, Retained actuary 2 hours, STRS staff 2 hours, ORSC staff 0 hours

e) Review of Non-Economic Assumptions Used in the Actuarial Valuation

We will review the non-economic (decrement) assumptions used in the annual actuarial valuation to determine:

- Do the assumptions comply with generally accepted actuarial principles and standards of practice?
- Are the recommended assumptions reasonable when compared to STRS experience, similar plans and national trends?

For this portion of the review we will obtain and review the 2011-2016 experience study for the system. We will request counts from STRS regarding the numbers of retirements, deaths, disabilities (and recoveries therefrom), vested and non-vested terminations (and returns to work), etc. that occurred during the study period and compare those figures with corresponding figures shown in the experience study. We will review the exposures and the development of the crude rates for reasonableness. Following that we will review the methods used to graduate and smooth the crude rates. We will review the demographic gains and losses from the last four actuarial valuation reports. A particular point of careful review will be the post retirement mortality assumption, the amount of credibility given to STRS data, and the projection scale that is used. Our report will provide an opinion regarding the reasonableness of the assumptions and will include suggestions for improvement to the extent that we find areas in the study that can be improved.

Estimated time: GRS 40 hours, Retained actuary 5 hours, STRS staff 10 hours, ORSC staff 0 hours

f) Review of Economic Assumptions Used in the Actuarial Valuation

We will review the economic assumptions used in the annual actuarial valuation to determine:

- Do the assumptions comply with generally accepted actuarial principles and standards of practice?
- Are the recommended assumptions reasonable when compared to STRS experience (if applicable), similar plans and national trends?

We will carefully review assumptions related to price inflation, productivity, salary scale, payroll growth and investment return. We will review the gains and losses attributed to economic experience from the last four actuarial valuation reports. With the economic assumptions, specific past plan experience is less important than expected future trends. Thus, we will review the economic portion of the 2011 to 2016 experience study, but we will also consider more current information. For this review we will need to know the plan's current and target asset allocation. We will also want to see investment consultant reports, both current and historical, that provide the consultant's opinion of the expected return from the portfolio over time. Economic assumptions, like all actuarial assumptions, must be reasonable as of the measurement date. We will benchmark the STRS assumptions based upon the NASRA survey and other information, but we caution that the return assumption depends heavily on the asset allocation, so that such benchmarks have limited value. Finally, we will map the STRS allocation into our proprietary modeling tool and provide an opinion on reasonability related directly to the STRS asset allocation.

Estimated time: GRS 20 hours, Retained actuary 2 hours, STRS staff 2 hours, ORSC staff 0 hours

g) Develop Valuation Results through Parallel Valuation

We will perform a parallel valuation of the STRS for both pension and health using our proprietary software. Because we write and maintain our own valuation software, this will result in a completely independent check of the STRS valuation based upon completely different software than the current provider uses. We plan to request a matrix of sample lives from the retained actuary in order to gain an exact technical understanding of the retained actuary's valuation process.

The sample lives will consist of at a minimum:

- 5 active members with varying lengths of service
- 5 retirees with a mix of optional benefit forms
- 3 new retires
- 3 inactive vested members

For each of these cases. We will ask the retained actuary to provide detailed calculations that show the development of the liabilities, normal cost, and present value of future pay. In addition, for the new retirees, we will ask for the liability calculation from the previous valuation in addition to the current calculation. This will allow us to verify the consistency of the active and retiree valuations with each other.

We have used our software to perform thousands of valuations over the years from very small plans to very large statewide plans. We have every confidence in its ability to model the STRS benefits. Because our own work has been audited countless times, and because of our extensive internal review process we have every confidence in the accuracy of our software. We will compare STRS results with our own results using a chart shown on the following page. We plan to use a tolerance of 2% for differences between GRS and the retained actuary in present value of

future benefits and 5% for differences between GRS and the retained actuary in actuarial accrued liabilities and normal costs. Although we will report differences by decrement, the tolerances apply only to totals (total PVFB, Total Normal Cost, etc.). This chart shows an example of how we propose to report the results. We will produce a similar chart for both pension and retiree health.

	Results reported for audit by retained actuary	Published results in June 30, 2018 valuation report	GRS results	% Difference (to reported results)	Tolerance Pass/Fail
Active Valuation					
Number	37,068	37,068	37,068		
Projected Payroll	2,021,009,050	2,031,114,100	2,027,040,084	-0.2%	
Actuarial Accrued Liability (AAL)	3,977,676,403	3,977,676,400	3,965,724,698	-0.3%	
Total Present Value of Benefits (PVB)	$ 5,582,752,222	$ 5,582,753,900	$ 5,547,025,340	-0.6%	**4% pass**
Retiree Valuation (Retirees, Beneficiaries & Disableds)					
Number	27,677	27,677	27,677		
Total PVB	$ 6,167,524,967	Not provided	$ 6,162,876,021	-0.1%	**2% pass**
Terminated Vested & Long Term Disability Valuation					
Number	4,317	4,317	4,317		
Total PVB	$ 254,490,296	Not provided	$ 254,504,262	0.0%	**2% pass**
Additional Liabilities					
Terminated Non-vested members	2,673,975		2,673,975 *		
Pension supplement for retirees	10,751,600	10,751,600	10,751,600 *		
Total additional liability	$ 13,425,575	Not provided	$ 13,425,575	N/A	
Subtotal of Retiree, Beneficiary, Disabled, Terminated and Additional Liability	$ 6,435,440,838	$ 6,435,440,900	$ 6,430,805,858	-0.1%	**2% pass**
Summary of Principal Results					
Present Value of Benefits	12,018,193,100	12,018,194,800	11,977,831,200	-0.3%	**2% pass**
Total AAL	10,413,117,200	10,413,117,300	10,396,530,700	-0.2%	**5% pass**
Assets	8,950,957,800	8,950,957,800	8,950,957,800	0.0%	
Unfunded AAL (UAAL)	$ 1,462,159,400	$ 1,462,159,500	$ 1,445,572,900	-1.1%	
Adjusted UAAL (for PRI transfers & State Reimb.)		$ 1,435,677,700	$ 1,419,091,100 *		
Funded Ratio		86.0%	86.1%	0.1%	
Total Normal Cost (NC) %		9.92%	9.82%	-1.0%	**5% pass**
Employee Contribution %		3.59%	3.14%	-12.5%	
Employer NC%		6.33%	6.68%	5.5%	
Admin Expense Load		0.30%	0.30%	0.0%	
Employer UAAL Contribution %		5.33%	5.28%	-0.9%	
Total Employer Contribution %		11.96%	12.26%	2.5%	

* *Calculated by the retained actuary.*

Estimated time: GRS 120 hours, Retained actuary 15 hours, STRS staff 2 hours, ORSC staff 0 hours

h) Recommendations

We will present our recommendations in concise form using language intended to be understood by lay people. We will present the reasoning behind each recommendation and, if appropriate,

the governing actuarial standards. Recommendations will be classified according to their importance. Most typically in audits of this type, recommendations for change will be more on the nature of suggestions for improvement. To the extent outright material errors or deviations from actuarial standards are found, we will explain the nature of the issue and the suggested correction in lay person's terms. We will also estimate the financial effect of the error/deviation.

Estimated time: GRS 10 hours, Retained actuary 2 hours, STRS staff 2 hours, ORSC staff 2 hours

i) Review of Health Care

Based on the 2020 retiree health care valuation, STRS offers pre-Medicare retirees access to two PPO's and one HMO. Medicare retirees may choose between two PPO's and two Medicare Advantage plans. STRS subsidizes the premiums that retirees pay. The subsidy is a percentage of the total premium that depends on the amount of service credit the retiree has. In connection with the review we will determine whether or not the subsidy allocations are consistently applied and whether or not they are consistent with general policy pronouncements from STRS. We will review the assumptions, and in particular the trends used in the GASB 74 valuation. We will also do a parallel GASB 74 valuation as described above and will check for year to year consistency of the GASB results with respect to deferred inflows and outflows.

Estimated time: GRS 50 hours, Retained actuary 2 hours, STRS staff 5 hours, ORSC staff 0 hours

j) Prepare Final Actuarial Review Report

Upon completion of our work GRS will prepare a final actuarial report based on the following procedures:

- Prior to report drafting, discuss any important issues with ORSC, STRS and the retained actuaries. This will help us put the proper perspective on issues that we encounter in the audit.
- After resolving all issues with the retained actuaries, we will discuss any remaining issues with ORSC and STRS staff. This affords opportunity for discussions before any report drafts are circulated.
- Draft a preliminary report of our findings, and provide the draft to ORSC, STRS and the retained actuaries.
- Telephone conference with ORSC and STRS staff to discuss the draft report.
- Issue a final report that considers the comments received on the draft of our report.
- Forward 25 hard copies and one electronic copy of our final report to STRS staff and the ORSC.
- Meet separately with the ORSC Board and the STRS Board to present the final report.

Estimated time: GRS 30 hours, Retained actuary 2 hours, STRS staff 2 hours, ORSC staff 2 hours

Methodology, Work Product, and Timeline

		Groups Involved				Week											
Task No.	Description	GRS	ORSC	STRS	Cheiron	1	2	3	4	5	6	7	8	9	10	11	12
4.5a	Review Actuarial Reports	x				x											
4.5b	Discussion with Staff	x	x	x	x	x	x										
4.5c	Data Validity	x		x	x			x	x	x							
4.5d	Actuarial Valuation Methods	x		x	x		x	x									
4.5e	Non-Economic Assumption	x		x	x				x	x	x						
4.5f	Economic Assumption	x		x	x			x	x								
4.5g	Parallel Valuation	x		x	x					x	x	x	x	x			
4.5h	Recommendations	x	x	x	x									x	x		
4.5i	Review of Health Care	x		x	x			x			x	x					
4.5j	Final Report	x	x	x	x								x	x	x	x	x

We anticipate completing the final report within a 12-week period, depending on timely receipt of requested information.

SECTION 4.6

ADDITIONAL INFORMATION

4.6 ADDITIONAL INFORMATION

Each proposal shall include any additional information that might be helpful to gain an understanding of the proposal. This may include diagrams, excerpts from reports, or other explanatory documentation that would clarify and/or substantiate the proposal. Any material included here should be specifically referenced elsewhere in the proposal.

GRS is the only firm that has been dedicated to serving public sector plans since its very beginning. Most of our larger competitors have already exited public sector retirement consulting (Willis Towers Watson, Mercer, etc.). Many of our smaller competitors were formed in the recent past and cannot show the proven 80-year track record that we can. GRS is the most qualified to serve the Plan because we are a stable, proven, experienced firm. GRS has the following specific advantages as compared to our competitors.

Quality Assurance Program

GRS has a total quality management program we refer to as the Peer Review. Under the Peer Review process, one team member develops the plan costs and another verifies each value.

The project manager actuary will review everything as the valuation process continues to ensure that results not only look reasonable, but are correct. The lead actuary will review all work completed by the other team members as a final check. We document peer review guidelines for each member of a GRS client team.

These guidelines were developed by our Professionalism Committee and are reviewed and revised as appropriate. GRS uses its Peer Review process on all services that we provide to our clients.

In completing any client assignment, it is the goal of each employee of GRS to produce the highest quality work. This practice has been an integral component of our corporate culture throughout the entire history of GRS.

The following aspects of our Peer Review process attest to the strength of the quality controls we have built for providing actuarial services.

Professionalism Committee

Quality Assurance Procedures at GRS are developed and monitored by a standing Professionalism Committee. The GRS Professionalism Committee performs internal audits of the work we do for our clients. The Professionalism Committee reports to the firm's Board of Directors. The following paragraphs describe how our quality assurance procedures apply to three specific types of client assignments.

Actuarial Valuations

Each actuarial valuation for a defined benefit pension plan or a post-retirement health care program is supervised by a qualified consulting actuary, from the beginning of the process until the final product

is sent to the client. Actuarial valuations are prepared by an actuarial analyst and are initially checked by a more senior associate.

The two associates work very closely with the consulting actuary to resolve any issues that may arise throughout the process. After completion of the initial checking, the valuation is reviewed by the consulting actuary. The actuary reviews the results for reasonableness. Once the results are finalized and a report is prepared, the report is peer reviewed by another qualified actuary. Each step of the process is documented using the quality forms and the documentation is filed with the work papers.

Special Projects
All other projects other than actuarial valuations also follow our standard quality procedures. Initial calculations are prepared by an analyst, checked by a more senior associate and reviewed and peer reviewed by a qualified actuary. Each step of the process is documented using the quality forms and the documentation is filed with the work papers.

Client Correspondence
Any substantive client correspondence (letters – hard copy or electronic, reports, presentations, etc.) prepared by one of our actuaries or consultants is peer reviewed by another actuary or consultant. Each step of the process is documented using the quality forms and the documentation is filed with a copy of the correspondence.

Internal Audit
Our internal audit process ensures that our associates follow our quality procedures and that the services provided to our clients is continuously improving. Please note this is a procedural audit.

Through this process, a group of our actuaries and consultants audits the work performed for our clients. The various clients are selected randomly. A member of the Professionalism Committee begins the audit with conversations with the actuary or consultant and other client team members, and then reviews the work papers, the valuation report and other relevant files to see if quality procedures have been followed and documented.

After the Committee member has completed these steps, the findings are discussed with the actuary or consultant responsible for that client. The findings are shared with the other members of the Professionalism Committee at its next quarterly meeting, after which it is forwarded to the President.

External Audit
Our work on behalf of a variety of our clients has also been audited by other actuarial firms and our work has passed their scrutiny. Of course, as serious, committed professionals, we always welcome constructive suggestions of other qualified professionals.

Green Initiatives

GRS clearly recognizes the emphasis on sustainability and has weaved green initiatives into our corporate culture. A few of the ways that GRS has instituted green initiatives is by following the 3 Rs – Reduce, Reuse, and Recycle.

Reduce – We often work with electronic documents and files instead of hard copy versions to further reduce paper usage. We also have offices where, when not occupied, the lights automatically turn off. GRS cuts back on paper use by setting our printers and photocopiers to double-sided settings.

Reuse – GRS reuses business supplies as much as possible. If binders are used internally we do not throw them out but use them again for other internal projects.

Recycle – All of GRS' business systems are made from recyclable materials (e.g., business cards, binder covers, letterhead, etc.) We also have recycling bins located in high traffic areas – the office, kitchen, and near the photocopiers.

Research

GRS believes research and communication is an essential part of delivering quality services to its clients; as such we have robust research capabilities and resources. Our Research Group provides useful information on plan design, federal and state legislation, accounting rules, and other regulatory issues on topics of interest to employee benefit plans. In addition, our consultants routinely contribute articles to industry publications.

GRS communicates the results of its research through:

- GRS Insight, its newsletter on pension and health care related topics;
- GRS Perspectives, our consultant authored articles; and
- News Scan, brief news summaries produced by our Research Manager.

Our current publications are available on our website at www.grsconsulting.com. Clients may sign up at our website to receive GRS' publications alerts via e-mail. Clients also have access to archived publications through GRS Advantage™, our client services website.

The highlights below indicate our level of activity on issues relevant to employee benefit plans over the past decade.

- GRS has reported on over 600 benefit related news items in its News Scan publication.
- GRS has written over 80 in-depth articles and research reports, which were either published internally or written for other industry publications.
- The GRS Research Group has responded to over 600 client inquiries related to retirement plans, disability and death benefits, and retiree health care plans. For inquiries that require legal expertise, we have successfully worked with clients' legal counsel.

Additional Information

Topics we have covered include:

Actuarial	Funding
Actuarial Audits	Financial Economics
Actuarial Standards of Practice	Funding Policy & Strategies
Mortality	Pension Obligation Bonds
Negative Cash Flow	Risk Measures
Benefits	**Legislative & Regulatory**
COLAs	Accounting Standards (Pension & OPEB)
DB vs DC Debate	Affordable Care Act (Cadillac Tax, HHS Rules, etc.)
Disability Benefits	Employer Group Waiver Programs
DROPs	Social Security
Hybrid Plans	Tax Code (§ 415, Deferral Limits, etc.)
Medicare	EEOC (Americans with Disabilities Act (ADA), Genetic Information Nondiscrimination (GINA), etc.)
OPEB	COBRA
Pharmacy	Mental Health Legislation

In addition to internal research, GRS subscribes to various research sources, including:

- **Wolters Kluwer Intelliconnect Pension Library** – provides instant access to the most current IRS provisions related to employee benefits, updated daily by the staff of Wolters Kluwer. This package of services includes daily notices of changes or additions to IRS documents, current text of relevant federal benefit laws and regulations and detailed explanations by attorneys and other knowledgeable benefit professionals of how federal laws affect benefit practice.
- **Thomson Reuters Checkpoint Database** – provides access to all of the GASB's statements, guidelines and pronouncements.
- **Bureau of National Affairs Pension & Benefits Reporter** – provides online access to current (as well as previous) issues of the premier journal covering retirement and benefits news across the nation.

A sample of GRS publications are provided in Appendix 2. We provide our published materials to both public and private sector retirement plans, but the analysis offered in our publications is virtually 100% public sector focused.

Accountability

GRS will emphasize accountability, transparency, education, risk management, and honesty. We will make sure decision-makers are able to base their decisions on broad understanding of not only the top line numbers, but their limitations, their risks, what strategies have been implemented and how the System will react in adverse scenarios. We will also hold ourselves accountable to previous estimates and provide transparent discussions on either (1) how consistent the new information is, or (2) why the new information is different.

Additional Information

Our consulting philosophy rests on these fundamental principles. Our philosophy and approach bring STRS a broad strategic perspective to your retirement needs and the highest quality actuarial services available in the industry.

Undisputable Advantages

GRS has at least five advantages that are undisputable:

- GRS has the largest and most diverse public sector client base, both based on region and size;
- GRS has the most actuaries dedicated to public sector retirement systems;
- GRS has constantly invested significant resources in the public sector actuarial community;
- GRS has a proven track record of a commitment to public sector advocacy through research, communication, and support for national organizations; and
- GRS has its own technology department and products, specially designed for public sector retirement systems.

In addition, the following attributes distinguish us from our competitors:

- With over 1,000 clients, we provide actuarial and benefits consulting services to more public sector clients than any other firm in the country.
- We dedicate nearly 100% of our resources to serving public sector benefit plans.
- GRS public sector clients do not compete with corporate or Taft-Hartley plans for staff attention or resources.
- Our valuation software is written and maintained exclusively for public sector benefit plans.
- GRS' research group is nationally recognized for its in-depth analysis and publications focused on issues of importance to public sector benefit plans--all of the analysis is focused on the impact on your plans.
- GRS has worked in most of the 50 states, including Hawaii and Alaska. The majority of our client relationships span decades. We have been associated with more than half of our clients for at least 30 years, many for more than 50 years, and some for over 80 years. We believe that our clients' long association with our company results from our focus on technological innovation, research, and employee professional growth efforts solely attentive on managing the challenges faced by benefit plans.
- We have approximately 66 credentialed actuaries and consultants with decades of benefits experience.
- The employees of GRS are the company's shareholders. Since success of the company is determined by successful consulting relationships, our employees have a strong personal stake in the success of their relationships with clients. Our employees are strongly motivated to be the best they can be, and to do the best they can do for our clients. This leads to a high degree of professionalism and performance, and distinguishes us from most of our competitors, and all of our larger competitors. Because we are a not a large firm, our employees know that they can have an influence on the end result. People are therefore encouraged to innovate, to find new and better ways of doing things, and to continually improve their skills and our products.

SECTION 4.7

GLOSSARY

4.7 GLOSSARY

Each proposal shall provide a glossary of all abbreviations, acronyms, and technical terms used to describe the services or products proposed. This glossary should be provided even if the terms are described or defined when first used in the proposal response.

Accrued Service	Service credited under the system which was rendered before the date of the actuarial valuation.
Actuarial Accrued Liability (AAL)	The AAL is the difference between the actuarial present value of all benefits and the actuarial value of future normal costs. The definition comes from the fundamental equation of funding which states that the present value of all benefits is the sum of the Actuarial Accrued Liability and the present value of future normal costs. The AAL may also be referred to as "accrued liability" or "actuarial liability."
Actuarial Assumptions	These assumptions are estimates of future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income, and compensation increases. Actuarial assumptions are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (compensation increases, payroll growth, inflation, and investment return) consist of an underlying real rate of return plus an assumption for a long-term average rate of inflation.
Actuarial Cost Method	A mathematical budgeting procedure for allocating the dollar amount of the actuarial present value of the pension trust benefits between future normal cost and actuarial accrued liability. The actuarial cost method may also be referred to as the actuarial funding method.
Actuarial Equivalent	A single amount or series of amounts of equal actuarial value to another single amount or series of amounts, computed on the basis of appropriate actuarial assumptions.
Actuarial Gain (Loss)	The difference in liabilities between actual experience and expected experience during the period between two actuarial valuations is the gain (loss) on the accrued liabilities.
Actuarial Present Value (APV)	The amount of funds currently required to provide a payment or series of payments in the future. The present value is determined by discounting future payments at predetermined rates of interest and probabilities of payment.
Actuarial Valuation	The actuarial valuation report determines, as of the actuarial valuation date, the service cost, total pension liability, and related actuarial present value of projected benefit payments for pensions.

Glossary

Actuarial Valuation Date	The date as of which an actuarial valuation is performed.
Actuarially Determined Contribution (ADC) or Annual Required Contribution (ARC)	A calculated contribution into a defined benefit pension plan for the reporting period, most often determined based on the funding policy of the plan. Typically the Actuarially Determined Contribution has a normal cost payment and an amortization payment.
Amortization Method	The method used to determine the periodic amortization payment may be a level dollar amount, or a level percent of pay amount. The period will typically be expressed in years, and the method will either be "open" (meaning, reset each year) or "closed" (the number of years remaining will decline each year).
Amortization Payment	The amortization payment is the periodic payment required to pay off an interest-discounted amount with payments of interest and principal.
Cost-of-Living Adjustments	Postemployment benefit changes intended to adjust benefit payments for the effects of inflation.
Cost-Sharing Multiple-Employer Defined Benefit Pension Plan (cost-sharing pension plan)	A multiple-employer defined benefit pension plan in which the pension obligations to the employees of more than one employer are pooled and pension plan assets can be used to pay the benefits of the employees of any employer that provides pensions through the pension plan.
Covered-Employee Payroll	The payroll of employees that are provided with pensions through the pension plan.
Deferred Inflows and Outflows	The deferred inflows and outflows of pension resources are amounts used under GASB Statement No. 68 in developing the annual pension expense. Deferred inflows and outflows arise with differences between expected and actual experiences; changes of assumptions. The portion of these amounts not included in pension expense should be included in the deferred inflows or outflows of resources.
Deferred Retirement Option Program (DROP)	A program that permits a plan member to elect a calculation of benefit payments based on service credits and salary, as applicable, as of the DROP entry date. The plan member continues to provide service to the employer and is paid for the service by the employer after the DROP entry date; however, the pensions that would have been paid to the plan member are credited to an individual member account within the defined benefit pension plan until the end of the DROP period. Other variations for DROP exist and will be more fully detailed in the plan provision section of the valuation report.
Discount Rate	For GASB purposes, the discount rate is the single rate of return that results in the present value of all projected benefit payments to be equal to the sum of the funded and unfunded projected benefit payments, specifically:

1. The benefit payments to be made while the pension plans' fiduciary net position is projected to be greater than the benefit payments that are projected to be made in the period; and
2. The present value of the benefit payments not in (1) above, discounted using the municipal bond rate.

Entry Age Actuarial Cost Method (EAN)	The EAN is a cost method for allocating the costs of the plan between the normal cost and the accrued liability. The actuarial present value of the projected benefits of each individual included in an actuarial valuation is allocated on a level basis (either level dollar or level percent of pay) over the earnings or service of the individual between entry age and assumed exit age(s). The portion of the actuarial present value allocated to a valuation year is the normal cost. The portion of this actuarial present value not provided for at a valuation date by the actuarial present value of future normal costs is the actuarial accrued liability. The sum of the accrued liability plus the present value of all future normal costs is the present value of all benefits.
Fiduciary Net Position	The fiduciary net position is the market value of the assets of the trust dedicated to the defined benefit provisions.
GASB	The Governmental Accounting Standards Board is an organization that exists in order to promulgate accounting standards for governmental entities.
Long-Term Expected Rate of Return	The long-term rate of return is the expected return to be earned over the entire trust portfolio based on the asset allocation of the portfolio.
Money-Weighted Rate of Return	The money-weighted rate of return is a method of calculating the returns that adjusts for the changing amounts actually invested. For purposes of GASB Statement No. 67, money-weighted rate of return is calculated as the internal rate of return on pension plan investments, net of pension plan investment expense.
Multiple-Employer Defined Benefit Pension Plan	A multiple-employer plan is a defined benefit pension plan that is used to provide pensions to the employees of more than one employer.
Municipal Bond Rate	The Municipal Bond Rate is the discount rate to be used for those benefit payments that occur after the assets of the trust have been depleted.
Net Pension Liability (NPL)	The NPL is the liability of employers and non-employer contributing entities to plan members for benefits provided through a defined benefit pension plan.
Non-Employer Contributing Entities	Non-employer contributing entities are entities that make contributions to a pension plan that is used to provide pensions to the employees of other entities. For purposes of the GASB accounting statements, plan members are not considered non-employer contributing entities.

Glossary

Normal Cost	The portion of the actuarial present value allocated to a valuation year is called the normal cost. For purposes of application to the requirements of this Statement, the term normal cost is the equivalent of service cost.
Other Postemployment Benefits (OPEB)	All postemployment benefits other than retirement income (such as death benefits, life insurance, disability and long-term care) that are provided separately from a pension plan, as well as postemployment healthcare benefits regardless of the manner in which they are provided. Other postemployment benefits do not include termination benefits.
Real Rate of Return	The real rate of return is the rate of return on an investment after adjustment to eliminate inflation.
Service Cost	The service cost is the portion of the actuarial present value of projected benefit payments that is attributed to a valuation year.
Total Pension Expense	The total pension expense is the sum of the following items that are recognized at the end of the employer's fiscal year: 1. Service Cost 2. Interest on the Total Pension Liability 3. Current-Period Benefit Changes 4. Employee Contributions (made negative for addition here) 5. Projected Earnings on Plan Investments (made negative for addition here) 6. Pension Plan Administrative Expense 7. Other Changes in Plan Fiduciary Net Position 8. Recognition of Outflow (Inflow) of Resources due to Liabilities 9. Recognition of Outflow (Inflow) of Resources due to Assets
Total Pension Liability (TPL)	The TPL is the portion of the actuarial present value of projected benefit payments that is attributed to past periods of member service.
Unfunded Actuarial Accrued Liability (UAAL)	The UAAL is the difference between actuarial accrued liability and valuation assets.
Valuation Assets	The valuation assets are the assets used in determining the unfunded liability of the plan. For purposes of GASB Statement Nos. 67 and 68, the valuation assets are equal to the market value of assets.

SECTION 4.8

COST INFORMATION

4.8 COST INFORMATION

The pricing summary should include a breakdown of costs per element listed in Section II, Scope of Audit, including: personnel costs (including hourly rates and estimated hours for professional and clerical staff assigned to the audit), travel and lodging, data processing costs, materials, and any other potential costs. The cost estimates in the pricing summary must include all necessary charges to conduct the audit and must include a "not to exceed" figure.

The chart below shows the estimated hours and associated fees GRS will charge for this project. We propose to do this project for a fixed fee of $95,000.

	Hours	Cost
Review of Reports	10	$2,850
Initial Discussions	5	$1,400
Data Validity	35	$9,900
Actuarial Methods	15	$4,250
Non-Economic Assumption	40	$11,350
Economic Assumption	20	$5,650
Parallel Valuation	120	$34,050
Recommendations	10	$2,850
Review of Health Care	50	$14,200
Final Report	30	$8,500
Total Hours	335	$95,000

If the ORSC requests additional work beyond that outlined in the RFP, our standard rates will apply.

APPENDIX 1

TEAM RESUMES

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

Senior Consultant and Actuary
brian.murphy@grsconsulting.com

Expertise

Brian Murphy is a Senior Consultant with GRS. He has more than 35 years of public sector actuarial and consulting experience. Brian served as GRS' President from 2004 through 2014. He continues to serve on GRS' executive management team.

Brian's consulting experience with statewide pension plans includes systems in Arizona, Arkansas, Colorado, Illinois, Iowa, Maryland, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin. His local government experience covers plans in Florida, Michigan, and Virginia. Brian is located in GRS' Southfield, Michigan office.

Brian is a nationally recognized actuary in the public sector pension industry. His extensive experience in public employee benefits covers plans from the smallest to the largest, all major employee groups (general employees, teachers, public safety employees, and judges), and plan structures (single employer plans, agent multiple employer plans, and cost sharing multiple employer plans). In addition to annual valuation services, his defined benefit and hybrid expertise includes funding policy development, legislative testimony, experience studies, actuarial audits, advising plans with statutory contribution limits, plan redesign, projection work, and retiree health care funding solutions. Brian has been a key visionary and primary contributor to the development of GRS' actuarial software, which includes GRS' in-house valuation system and client specific applications for projection work, option factor calculations, and purchased service credit.

Professional Designations

- Fellow, Society of Actuaries
- Enrolled Actuary
- Fellow, Conference of Consulting Actuaries
- Member, American Academy of Actuaries

Presentations and Publications

Brian is a frequent speaker at various national meetings of public sector and other employee benefit associations. Brian has authored and co-authored many articles related to public pension issues during his career. The Government Finance Officers Association (GFOA), and the IFEBP have published his articles. In addition, he routinely conducts education and information-sharing sessions for trustees and administrative staff on public pension actuarial and plan design issues.

Education

Ph.D., Mathematics, Wayne State University, Detroit, Michigan

Bonita J. Wurst, ASA, EA, FCA, MAAA

Senior Consultant
bonnie.wurst@grsconsulting.com

Expertise

Bonnie Wurst is a Senior Consultant and Team Leader at GRS. She has over 30 years of actuarial and consulting experience. Bonnie has served public sector clients in Delaware, Illinois, Indiana, Michigan, Minnesota, Mississippi, Missouri, and North Dakota.

Bonnie consults to statewide, large municipal, and church-sponsored retirement systems. Her actuarial experience covers pension and OPEB actuarial valuation services, funding projections, plan design studies, experience studies, plan merger and implementation consulting, and benefit administration services.

During her career, she has provided consulting services to church, corporate, and public sector plans. Bonnie also has experience managing actuarial teams. As such, she is a resource to clients by ensuring smooth projects, quality results, and work that is on time and within budget.

Professional Designations

- Associate, Society of Actuaries
- Enrolled Actuary
- Fellow, Conference of Consulting Actuaries
- Member, American Academy of Actuaries

Presentations

Bonnie frequently provides client and employee education sessions, and has served as a speaker for professional association conferences. Bonnie's presentations have covered topics such as current public sector trends in pension benefit design and funding, overview of actuarial valuations, and client specific retirement program overviews. Bonnie currently serves as a member of Joint Program Committee for the Enrolled Actuaries Meeting.

Examples of recent speaking experience:

- 2021 Enrolled Actuaries Conference Session “Lessons Learned: Closed Public Pension Plans”
- 2019 Enrolled Actuaries Meeting Session “ASOP 51: Practical Approaches”
- 2015 NACPA Convocation Session “Best Practices for Priest Retirement Programs”
- 2014 Conference of Consulting Actuaries Webcast “Actuarial Assumptions”

Education

Bachelors, Mathematics and Speech Communication, Summa Cum Laude Graduate, Mankato State University, Mankato, Minnesota

Sheryl L. Christensen, ASA, EA, FCA, MAAA

Consultant
sheri.christensen@grsconsulting.com

Expertise

Sheri Christensen is a Consultant at GRS. She has more than 25 years of actuarial and consulting experience. Sheri has served clients in Colorado, Delaware, Illinois, Indiana, Iowa, Kansas, Maryland, Michigan, Minnesota, Missouri, North Dakota, South Dakota, West Virginia, and Wisconsin.

During Sheri's career, she has worked with statewide and municipal retirement systems, church plans, not-for-profit organizations, and corporate plans. Sheri's areas of expertise include valuations of traditional and hybrid defined benefit plans, including actuarial audits, and retiree health care plans. She regularly provides cost analyses for proposed plan and/or assumption changes, experience studies, funding projections, and service purchase calculations. Sheri also has experience advising clients on benefit administration issues.

Professional Designations

- Associate, Society of Actuaries
- Enrolled Actuary, ERISA
- Fellow, Conference of Consulting Actuaries
- Member, American Academy of Actuaries

Sheri is currently working toward attaining the designation of Fellow of the Society of Actuaries (FSA).

Education

Bachelors of Science, Mathematics (emphasis on actuarial science) and minor in Statistics, University of Minnesota, Institute of Technology

Jamal Adora, ASA, EA, MAAA

Senior Analyst

jamal.adora@grsconsulting.com

Expertise

Jamal is a Senior Analyst at GRS. He has more than seven years of experience working with statewide and local public employee retirement systems. He serves clients in Illinois, Michigan, and Missouri.

Jamal's actuarial experience covers both pension and retiree health plans. His work involves the preparation of annual valuations, experience studies, cost analyses of proposed plan changes, and actuarial projections and forecasting. Jamal has also assisted in the development of funding policies.

Professional Designations

- Associate, Society of Actuaries
- Enrolled Actuary
- Member, American Academy of Actuaries

Education

Master of Arts in Mathematics, Wayne State University

James Pranschke, FSA, FCA, MAAA

Senior Healthcare Consultant
jim.pranschke@grsconsulting.com

Expertise

James Pranschke is a Senior Healthcare Consultant at GRS. During his more than 35-year career, Jim has worked extensively with insurers, employers, public sector retirement systems, underwriters, and third-party administrators. Jim's public sector clients have included statewide and municipal health programs in Michigan, Ohio, and Rhode Island. Jim is a dedicated and innovative leader who helps GRS clients navigate the challenges surrounding health care program sustainability and costs.

Jim provides health care programs with actuarial and financial analysis, benefit design services, and analysis and recommendations on legislative and regulatory changes. His experience covers actuarial pricing, group insurance plan design (medical, dental and Rx), product development, retiree health care, health care trend projections, rate filings, and analytical support during employer-union negotiations. Jim has in-depth experience helping clients implement provisions of the Affordable Care Act (ACA), GASB accounting standards, and Michigan's Small Group Reform Legislation of 2004.

Jim has had many professional achievements during his career. For example, he designed a methodology to unblend fully-insured rates to comply with Actuarial Standards of Practice (ASOP #6); developed procedures for the evaluation of self-insured program experience; and implemented major improvements in trend projection and monitoring systems, which included pharmacy and participating hospital data modeling.

Professional Designations

- Fellow, Society of Actuaries
- Fellow, Conference of Consulting Actuaries
- Member, American Academy of Actuaries

Education

Bachelor of Science, Mathematics, Michigan Technological University

APPENDIX 2

PUBLICATION SAMPLES

OCTOBER 2020

GRS PERSPECTIVES

The Role of Actuarial Audits in Performing Due Diligence

Louise Gates, ASA, FCA, MAAA

Over the past several years, public sector defined benefit retirement plans have been receiving a great deal of attention. Some significant reasons for the increased attention may include:

- The aging of the U.S. population and a greater focus on financial security in retirement;
- Growing criticism of public sector retirement plans by think tanks and other ideological organizations; and
- Dwindling tax revenue and reductions in state and federal revenue sharing have put tremendous pressure on governmental budgets making it difficult for employers to contribute the full actuarially determined amounts to their retirement plans.

Public sector retirement plan governance is a responsibility shared by several stakeholders, including the retirement system board of trustees. The retirement board of trustees are fiduciaries tasked primarily with retirement system administration. With the increased focus on public plans, there is a heightened awareness of the need for due diligence on the part of retirement plan trustees in performing their fiduciary duties. Trustees have a duty to select plan service providers prudently, and once selected, to monitor the quality of their work.

This article discusses actuarial audits as a due diligence tool for plan trustees to help manage retirement plan risk. High quality actuarial work can do much to ensure the long-term financial strength of a retirement plan. Similarly, low quality actuarial work, when left undiscovered, can undermine a plan's financial security in a relatively short time period.

What is an Actuarial Audit?

An actuarial audit is the scrutiny of one actuary's work by another qualified actuary. The goal is to ensure that: 1) actuarial valuations are performed correctly; 2) the methods and assumptions used are reasonable; and 3) the advice given is sound. Actuarial audits provide assurance to plan trustees and other interested parties that the financial condition of the plan is accurate, as stated by the plan's actuary.

How Often Should Actuarial Audits Be Performed?

The Government Finance Officers Association (GFOA) recommends that actuarial audits be conducted at least every five years unless there is a change in actuary.[1] In some plans, audits are performed regularly based on the retirement board's policy or state law. In other plans, they are performed when danger signs appear in the financial structure of the plan.

Some examples of danger signs include:

- Retired life liabilities being less than fully funded with no significant progress toward full funding;
- A protracted period of decline in the funded ratio or increases in computed contributions without adequate explanation; and
- An inconsistent relationship among the various valuation assumptions (sometimes difficult for an untrained person to notice).

[1] GFOA Best Practices Procuring Actuarial Services
https://www.gfoa.org/materials/procuring-actuarial-services

What are the Benefits of an Actuarial Audit?

The outcome of the actuarial audit reveals whether the procedures used in the actuarial valuations of the plan are technically sound and if plan objectives are being met. Equally important, this type of review helps to generate a sense of security among those concerned with plan financing. The value of such knowledge may make the cost of the audit incidental.

The dialogue generated by the audit process usually has educational value. The basic funding principle of paying for a benefit when it is earned may be easy to grasp. However, the implementation of the concept is often confusing, particularly if the plan includes a Deferred Retirement Option Plan (DROP) or other complicated features. The proper utilization of qualified advisors provides an opportunity to get a good look at the forest rather than getting lost among the trees of technicalities.

If the advice a plan has been receiving is inaccurate or inappropriate, the actuarial audit should bring this to light so that remedial action can be initiated. Finally, we may all benefit from someone looking over our shoulder occasionally. The mere possibility that a fellow practitioner may analyze an actuary's work can result in additional care being taken in the valuation process.

What are the Different Types of Actuarial Audits?

There are different types of actuarial audits that can be classified depending upon the level of audit desired. The types of actuarial audits are described below as Levels One through Four (with Level One being the most comprehensive and Level Four being the least comprehensive).

TYPES OF ACTUARIAL AUDITS
Level One Audit A complete actuarial valuation of the plan based on the same census data, assumptions and actuarial methods used by the plan's actuary
Level Two Audit A review of the plan's actuarial reports and testing of valuation results using a sample of individuals included in the valuation
Level Three Audit A review of the previous actuarial valuation and experience study reports, including dialogue with the retained actuary and plan representatives, and a presentation of findings
Level Four Audit A review of the most recent available actuarial report and a disclosure of the findings in a letter format

Level One

A Level One audit is a complete actuarial valuation of the plan based on the same census data, assumptions and actuarial methods used by the plan's actuary. The goal is to replicate the results of the most recent valuation, which is sometimes called a replication audit. Generally, there is some testing of plan experience as part of the review, and also dialogue among the retirement plan representatives, the retained actuary, and the reviewing actuary. A detailed report and presentation of the findings in a meeting with plan representatives is standard.

Level Two

A Level Two audit includes a review of the actuarial reports of the plan and a test of the valuation results using a mathematical model of plan activity or sampling (as opposed to performing a complete replication of the retained actuary's valuation of the plan). As in a Level One audit, there is dialogue with the plan's actuary and plan representatives. A detailed report and presentation of the findings would be included. An auditing actuarial firm with broad public plan experience and technical capability can usually verify the retained actuary's previous results reasonably well with a Level Two audit. If results cannot be verified or explained, it may be necessary to expand the scope of the audit to Level One. This would be recommended before any action is taken as a result of the audit.

Level Three

A Level Three audit includes a review of the previous actuarial valuation and experience study reports, dialogue with the retained actuary and plan representatives, and a presentation of findings. At this level, there are no independent calculations. This approach may lead to savings of time and money, but the results may have less value. A Level Three audit may be of interest to smaller plans with limited budgets. Sometimes a plan can benefit by listening to the views of another trained actuary with different experiences and viewpoints than the retained actuary.

Level Four

A Level Four audit includes only a review of the most recent available actuarial report and a disclosure of the findings in a letter format. The actuarial report should state the actuarial findings and identify methods, procedures, assumptions and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuarial

work.[2] Since actuaries have a duty to follow actuarial standards of practice, this approach may also be useful although more limited in scope than the other levels.

What are the Alternatives?

A small number of people in the public retirement plan community have suggested changing actuaries every three to five years to get the benefit of different viewpoints and possibly savings in actuarial fees. Continuity and consistency in actuarial service providers help to ensure high quality actuarial work and saves time for retirement system staff since a new actuary does not have to be educated on system practices and plan provisions. Continuity in service providers may be critical during periods of stress or turnover in retirement system staff and trustees. Generally, this continuity helps to reduce retirement system costs through the efficient delivery of services and the historical knowledge of the retained actuary, which are disrupted or lost when there is a change in actuarial service providers.

What Guidelines Should Be Used When Selecting an Auditing Actuary?

GRS' experience with actuarial audits is considerable and was developed over time serving as both auditing actuary and audited actuary. The following guidelines have been developed as a result of our experience serving public employee retirement plans for over 80 years. The auditing actuary is typically selected through a competitive bidding process (i.e., the use of a Request for Proposal (RFP)). The auditing actuary should have experience with the type of plan being audited and the legislative environment in which the plan operates. In addition, the advice provided should be unbiased and the audit assignment should not be viewed as an opportunity to gain a new client.

An actuarial firm that offers audit services to public retirement systems should have the infrastructure necessary to perform public plan actuarial work, including:

- Valuation software designed to model the wide range of public retirement plan designs without the use of approximations;
- A secure file transfer site necessary to protect plan member data which may be transferred during the course of the audit;
- Robust tools for validating investment return and other key actuarial assumptions;
- A large number of current public retirement plan clients, in particular those with plan design features similar to the plan being audited; and
- Sufficient staff to provide the work promised to the retirement system in a timely manner.

Fees for an actuarial audit can vary widely depending on the complexity of the plan and the extent of the audit. A Level One audit could cost as much as the retained actuary's annual fees. A Level Four audit could cost as little as a few thousand dollars. In addition, depending upon the scope of the audit, fees may be charged to the system for the additional time spent responding to an auditor's questions and requests for information. Consider a plan with liabilities of $1 billion and, in this case, a 5% mistake is found. The value of that mistake would be $50 million, which makes the fees for the audit seem relatively small.

How are Audit Results Communicated to the Retirement System?

With any type of audit, there should be formal, written communication summarizing the auditing actuary's findings. Typically, with most types of audits, this would include an audit report. The audit report should provide constructive criticisms of the retained actuary's work and suggestions for improvement. This information should be listed in the order of relative importance and should clarify the difference between issues that the auditing actuary believes to be large and those that are minor or matters of judgement. Without this form of classification, the audit results may cause unnecessary confusion.

Depending on the type of audit that is performed, the auditing actuary should provide a comparison of their mathematical results to those of the retained actuary. The comparison should discuss whether or not the differences between the two sets of calculations are within reasonable bounds. It should also provide comments on the assumptions and methods used by the retained actuary. The audit should verify that the retained actuary is following Actuarial Standards of Practice.[3] An actuarial audit can include a critique of the plan actuary's judgment concerning the plan's exposure to risk.

[2] Actuarial Standard of Practice No. 41, Section 3.2
http://www.actuarialstandardsboard.org/wp-content/uploads/2014/02/asop041_120.pdf
[3] http://www.actuarialstandardsboard.org/standards-of-practice/

Generally, in actuarial work, there is no unique, correct answer, but rather a range of reasonableness. Commonly, no two actuaries will ever agree exactly on the results of an actuarial valuation. In light of this, one might wonder what constitutes an actuarial mistake. In our experience, there are two basic types of errors: 1) actuarial results that fall outside of a reasonable range; and 2) actuarial results that are in a reasonable range, but contain math errors, show poor judgment or are based on false premises or bad data. The second type of mistake is more common than the first.

An actuarial valuation is a complex process involving many assumptions, methods and calculations. If the reviewing actuary believes that the plan has been getting good advice, this should be stated as part of the findings that are communicated to the retirement system. If areas of concern are discovered during the audit, the reviewing and retained actuary should ideally work together to resolve any concerns. If errors are found, these errors should be corrected in a professional manner. Furthermore, the next audit should verify that the corrections have been made.

Conclusion

From GRS' perspective, an actuarial audit is an important process with a goal of sound financial management of public employee retirement plans. An actuarial audit is an important tool available to plan trustees in fulfilling their fiduciary duties. It is in everyone's best interest to ensure that the retained actuary is following the Actuarial Standards of Practice, providing sound advice and accurate financial measurements to enable the system to meet its financial obligations today and in the future.

About the Author

LOUISE GATES, ASA, FCA, MAAA is a Senior Consultant who has more than 30 years of public pension and retiree health plan consulting experience. She is the lead consulting actuary for several large retirement systems in Michigan, Oklahoma, and South Dakota.

Louise has significant experience with public employee retirement plan design, including Deferred Retirement Option Plans (DROP), defined benefit to defined contribution conversion studies, benefit tiers, hybrid plans and Early Retirement Incentive Programs. She also has extensive experience with actuarial audits for municipal and statewide retirement systems and retirement plan obligation bonds.

Contact Louise at: louise.gates@grsconsulting.com

The author thanks Brian Murphy and Mary Ann Vitale for their review and helpful comments.

About GRS

GRS is a national actuarial and benefits consulting firm. We help our clients develop and maintain fiscally sustainable benefit programs that preserve financial security for millions of Americans. Our reputation for providing independent advice and quality consulting services has remained unmatched for more than 80 years. To locate a GRS office, visit our website at: www.grsconsulting.com.

OCTOBER 2020

GRS PERSPECTIVES

Fundamentals of Internal Revenue Code Section 415(b)

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

What is IRC Section 415(b)?

Final regulations governing Internal Revenue Code (IRC) Section 415(b) were issued on April 4, 2007. Code §415(b) places limits on amounts that may be paid from defined benefit (DB) retirement plans that are "qualified" under Code §401(a).

What is the basic §415(b) limit and how does it apply to defined benefit plans?

In 2020, the benefit limit for DB plans is $230,000. Unfortunately, compliance with §415(b) and the associated regulations is not as simple as limiting all retirement benefits from a DB plan to $230,000 per year. In fact, there are cases where §415(b) permits benefits to exceed that amount, and other cases where §415(b) might only permit a fraction of that amount to be paid.

The basic §415(b) dollar limits are adjusted annually in a manner that is similar to the method used to adjust Social Security benefits. When they occur, annual adjustments to the §415(b) limit are made in $5,000 increments.

Given the magnitude of these limits, why should plan administrators bother with §415(b)?

The basic IRC §415(b) limit is a fairly large number. It may be surprising, but in any plan, there can be individuals whose benefits come close to or exceed the limits. If the benefit of even one person exceeds the limits, the plan would be out of compliance with §415(b).

Compliance with §415 is a *plan qualification* issue and, therefore, the IRS could disqualify a non-compliant plan. In the case of disqualification, investment income to the trust would become taxable, and plan participants would be taxed on contributions to the trust *as they are made* (as opposed to when they are distributed in the form of retirement benefits) – a severe penalty indeed. So far, the author is not aware of this extreme penalty having been imposed on a governmental plan.

What are the differences in applying §415(b) regulations to ERISA plans versus governmental and non-electing church plans?

There are significant differences in the application of §415(b) and the associated regulations between "ERISA plans" and "other plans." In this context, the term "ERISA plan" means a plan that is subject to the vesting rules in IRC §411. The term "other plans" consists of governmental plans within the meaning of IRC §414(d) and of those church plans that have elected not to be covered under the participation, vesting, and funding requirements of Title II of ERISA. Such church plans are called "non-electing" church plans and, for obvious reasons, most church plans are non-electing. (Note: This *GRS Perspectives* does not discuss issues related to multiemployer plans).

The key differences in application of the regulations between ERISA plans, and governmental and non-electing church plans are summarized below:

KEY DIFFERENCES IN THE APPLICATION OF IRC SECTION 415(b) FOR ERISA PLANS VERSUS GOVERNMENTAL/NON-ELECTING CHURCH PLANS
ERISA plans must limit the benefit paid to 100% of three-year highest average compensation; whereas, governmental plans do not have a percent of pay limit. In addition, there is no percent of pay limit for certain non-electing church plans except with respect to benefits earned during a period in which the individual is a highly compensated employee under 414(q).[1]
ERISA plans must limit the accrued benefit; whereas, governmental and non-electing church plans must only limit the benefit actually paid.[2]
As a general rule, benefits are adjusted (reduced) for commencement ages prior to age 62. In governmental plans, there is no reduction for public safety employees or members of the U.S. Armed Forces with at least 15 years of "qualifying" service. There is also no age adjustment for pre-retirement death and disability benefits in governmental plans.

It should be noted that virtually all private-sector employees, and in particular those participants in ERISA plans, are covered by Social Security. By comparison, only about 75% of governmental employees are covered by Social Security. *However, no distinction is made in the application of §415(b) limits based upon the presence or absence of Social Security coverage.*

How are §415(b) regulations applied to governmental plans and non-electing (i.e., most) church plans?

The remainder of this issue of *GRS Perspectives* focuses on the application of the §415(b) regulations to governmental plans and to non-electing (i.e., most) church plans.

Testing for compliance with §415(b) can be quite challenging. The regulations covering §415(b) are extensive and complex. Although the 2007 regulations eliminated many ambiguities and previously unaddressed issues in application of the limits, they are not completely definitive. In some cases, correct application of the §415(b) regulations will depend on how a particular pension plan document is written. In other cases, there are multiple ways to interpret the regulatory language or to apply a principle and the plan administrator must determine which interpretation will be applied. The final interpretation should ideally be included in the plan document or, otherwise, recorded in a manner that ensures consistent treatment of individuals. The plan administrator should make this determination based upon discussion with legal counsel and perhaps other professionals.

The following paragraphs outline the main concepts of §415(b) and the associated regulations.

The §415(b) limit applies to benefits paid in the "limitation year." The limitation year defaults to the calendar year, but can be defined differently in the plan document. Using a non-calendar limitation year complicates the testing process and should be selected only after a careful review of legal and administrative issues. If the limitation year is the calendar year, the amount of the limit is known at the start of the year and can readily be applied. Otherwise, both the calendar year limit and the limitation year limit must be separately applied. In the case of non-calendar limitation years, the ultimate limit is the limit that becomes effective for the calendar year that begins in the limitation year.

[1] Code §415(b)(11).
[2] Treas. Reg. §1.415(b)-1(a)(7)(iii).

Therefore, the ultimate limit is usually unknown at the beginning of the limitation year.

For instance, if the limitation year is April 1 through March 31, and a member retires on April 1, 2020, the annual §415(b) limit would be based on the limit in effect for the 2021 calendar year (i.e., the calendar year limit that begins in the limitation year), which would not be known until the last quarter of 2020. In addition, although there is no precise IRS guidance on the matter, most practitioners believe that the limit in effect for the calendar year in which the limitation year begins remains in effect for the plan until the last day of the calendar year. This means that benefits paid in the fractional part of the limitation year ending on December 31 cannot exceed the (preceding) calendar year limitation amount (calendar year 2020 in the above example). Thus, for non-calendar limitation years, two separate calendar year limits must be tracked.

For example:

- A plan has a limitation year that begins on April 1 and a member retires on April 1, 2020 with an annual benefit (i.e., before application of §415) of $204,000 (or $17,000 per month).
- Suppose the §415(b) limit adjusted for age and all other applicable factors for this individual for the 2020 calendar year is $100,000. This means that the member's total payments allowed from the plan from April 1, 2020 to December 31, 2020 are limited to $100,000 instead of the $153,000 (i.e., $17,000 x 9) that would otherwise have been paid from the plan if the §415(b) limit had not applied.
- If the limit for the full limitation year (i.e., April 1, 2020 through March 31, 2021) is $105,000 (which is based on the §415(b) limit in effect for calendar year 2021: the calendar year that begins during the limitation year), the plan could only pay the member $5,000 from January 1, 2021 to April 30, 2021.
- Any benefits in excess of the amounts limited by §415(b) would need to be paid to the member from the employer's excess benefit plan, if applicable (i.e., $204,000 - $105,000 = $99,000).

The limit applies to a benefit paid in the straight life form. The effective limit is adjusted to the extent that the benefit being paid is not a straight life benefit. The actual benefit being paid may involve a joint and survivor type benefit, a period certain, a benefit that reduces at Social Security age, a partial (or even full) lump sum amount, a cash refund annuity of some type, a significant death after retirement benefit, or a distribution from a Deferred Retirement Option Plan (DROP). Such benefits must be converted to the equivalent straight life form for comparison with the §415(b) limit. The regulations describing the conversion of the benefit being paid into the straight life form and the associated adjustment to the effective limit are complicated and depend on the specifics of the benefit itself. It is not just a matter of using the plan's straight life form for the calculation.

- In some cases (benefits addressed in §417(e)(3) even where §417(e)(3) does not apply to the plan) which include lump sum benefits, significant life insurance type benefits, and generally benefits payable over a period shorter than the retiree's lifetime, three different calculations must be made: (1) the first calculation involves the plan factors, if there are any; (2) the second calculation is based upon 5.5% interest and the applicable mortality table specified by the IRS, which the IRS updates annually; and (3) the third calculation involves "minimum present value segment rates" defined in connection with §417(e)(3)(D) and the applicable mortality table. There is also a division by 1.05 in this third calculation. *The calculation that produces the lowest effective limit is then chosen.*
- In other cases, which would include most routine types of benefits, two calculations are made: (1) the first calculation involves plan factors, if there are any; and (2) the second calculation involves 5% interest and the applicable mortality table. *The calculation that produces the lesser effective limit is then chosen.*

Qualified Joint and Survivor Annuity (QJSA) options

(i.e., joint and survivor options from 50% to 100% in favor of a spouse) can normally be ignored in the calculations. However, if the QJSA includes a certain period, or some other non-QJSA benefit, the value of the non-QJSA portion of the benefit must be calculated and converted to the straight life form. Doing so will reduce the effective limit from what it would have been otherwise. Some practitioners think that the "pop-up" portion (if any) of a QJSA benefit payment should not be treated in this manner. In the case of a pop-up, such treatment would further complicate an already complicated process, particularly if the beneficiary dies prior to the retiree.

The limit applies to the employer-provided benefit. This rule means that employee contributions, if any, may act to increase the effective §415(b) limit. While this sounds simple, it actually can be rather complicated. Many governmental plans require employee contributions, and not all employee contributions are created equal. IRC §414(h) "pick-up" contributions, although made by the employee, are treated as employer contributions. Loan repayments and repayments of withdrawn contributions are also considered as part of the employer provided benefit.[3] In the case of repayment of withdrawn contributions, only the original contribution (not the amount withdrawn or repaid) is considered to generate an employee-provided benefit.[4] After-tax employee contributions and service purchases, including those made with rollover contributions,[5] are considered employee provided (assuming the requirements of §415(c) limiting the amount of annual contributions to a plan have been met) and act to increase the effective §415(b) limit. It is very common (at least for people retiring today) for there to be a combination of §414(h) pick-up contributions, after-tax employee contributions, formerly withdrawn but repaid contributions, and service purchase contributions in the member's employee contribution account.

Determining how much the effective limit is increased by these contributions involves historical research, possibly 30 or more years into the past, and quite a few calculations. Each after-tax contribution, rollover, etc. must be assigned to a specific plan year and credited with interest at rates specified in IRC §411(c).[6] For plan years beginning prior to 1976, the specified interest rate is the plan's crediting rate for member contributions. For plan years beginning after December 31, 1975 through December 31, 1987, the specified interest rate is 5%. For plan years beginning after December 31, 1987, the specified interest rate is 120% of the midterm applicable federal rate (AFR) in effect for the first month of the plan year (not the limitation year).

The accumulated value of after-tax contributions and service purchases (that met the requirements of §415(c)), must then be converted into an annuity in straight life form in order to determine the effect on the §415(b) limit. The conversion to an annuity is done using "minimum present value segment rates" and the applicable mortality table. The IRS updates the segment rates each month and the applicable mortality table annually.

The stated dollar limit applies to individuals retiring between ages 62 and 65. For those retiring prior to age 62, the limit may be less than the limit that applies at age 62. In governmental plans, the limit is not reduced for public safety personnel with at least 15 years of full-time service providing Police, Fire or EMS services. It is also not reduced for members of the U.S. Armed Forces with 15 years of service[7] and in cases of pre-retirement death and disability benefits. In order to determine the reduced limit, two separate calculations are made and an amount equal to the lesser of items 1) and 2) is chosen, as follows:

1) The first calculation is the actuarial equivalent of a straight life annuity commencing at the annuity starting date that has the same actuarial present value as a deferred straight life annuity in an amount equal to the unreduced limit commencing at age 62. For this calculation, actuarial

[3] Treas. Reg. §1.415(b)-1(b)(2)(ii).
[4] Treas. Reg. §1.415(b)-1(c)(6) Example 12.
[5] Treas. Reg. §1.415(b)-1(b)(2)(v).
[6] Treas. Reg. §1.415(b)-1(b)(2)(iii).
[7] Treas. Reg. §1.415(b)-1(d)(3).

equivalence is based upon 5% interest and the "applicable mortality table" that the IRS publishes annually. This calculation reduces the limit by approximately 6% to 7% for each year that retirement occurs prior to age 62. Commonly, mortality before age 62 is taken into account for this calculation. Mortality prior to age 62 can be ignored in certain situations, resulting in a somewhat higher limit. One example wherein pre-62 mortality can be ignored would be a plan that provides a qualified pre-retirement survivor annuity (as defined in IRC §417(c)) at no cost to the participant both before age 62 and after age 65.[8] (See Revenue Ruling 98-1 Q&A 6.)

2) For the second calculation, the ratio of (a) to (b) below is calculated without regard to the provisions of §415(b), where:

   (a) is the benefit payable under the plan at commencement age; and
   (b) is the deferred benefit that would be payable if the participant terminated employment on the retirement date and waited until age 62 to draw the benefits.

   To complete the second calculation, the unreduced age 62 §415(b) limit is then multiplied by the ratio of (a) to (b).

For example, a member retires at age 55 with a formula benefit of $250,000 payable at age 62. Instead of waiting until age 62, the plan allows the member to receive a reduced benefit of $145,000 at age 55. Suppose the statutory limit at age 62 is $230,000 and the age-adjusted statutory limit (based on 5% interest and the applicable mortality table) at age 55 is $141,000. To calculate the age-adjusted §415(b) limit for this member, a comparison of the following is made:

1) (a) Statutory limit at age 62: $230,000
   (b) Age adjusted limit (based on 5% and applicable mortality table) at age 55: **$141,000**

2) (a) Plan benefit at age 62: $250,000
   (b) Plan benefit at age 55: $145,000
   (c) Ratio (b ÷ a): 0.58
   (d) Statutory limit at age 62 x ratio: $230,000 x 0.58 = **$133,400**

The age-adjusted §415(b) limit is the lesser of 1(b) and 2(d), or **$133,400.**

The limit may be increased for retirements after age 65. This only occurs in plans that provide a "late retirement adjustment." (Note: Benefit accruals that continue after age 65 are not considered a late retirement adjustment.) The increased limit is calculated as the lesser of two values in a manner very similar to the above.

The limit is reduced proportionately for people with less than 10 years of participation in the plan. The participation requirement is ignored in the case of pre-retirement death and disability benefits in a governmental plan.[9]

There are special rules regarding the treatment of Cost-of-Living Adjustments or "COLAs." Internal Revenue Code §415(b) and the associated regulations were written mostly from the perspective of ERISA plans, which rarely provide any type of COLA. Many governmental plans and church plans (particularly those covering ordained ministers) provide COLAs. The term "straight life annuity" in the regulations, and as used above, refers to an annuity whose monthly or annual amount is a level amount that never changes, not even for a COLA.

For example, suppose that a plan participant retires at age 62 with a benefit of $200,000 per year in a year when the age 62 limit is $230,000. In addition, suppose the plan also provides a guaranteed annual COLA of 3%. Since the $200,000 that will be paid is less than the §415(b) limit, it would be easy to

[8] Treas. Reg. §1.415(b)-1(d)(2)(ii).
[9] Code §415(b)(2)(I).

imagine that the full benefit can be paid from the plan in the year of retirement. Unfortunately, that is not necessarily the case. It depends on the specifics of the plan document. Absent special provisions in the plan document, the regulations require that for testing purposes the benefit be converted to an equivalent straight life benefit (i.e., without a COLA) before comparison with the limit. A straight life benefit (in other words, a benefit with no COLA) equivalent to the $200,000 plus COLA benefit described above might be approximately $275,000, which would be $45,000 over the limit. As a result, only $155,000 could actually be paid from the qualified plan. Some plans apply the §415(b) limit in this manner, although the result is not intuitive. After all, the benefit to be paid in the year of retirement is less than the §415(b) limit and, depending on the rate at which the limit goes up, it might actually be less than the limit in every future year. When the calculation is done this way (testing with benefit converted to an amount reflecting future COLAs), no future testing is required. If the benefit passes this initial test, the plan benefit with the formula COLA can always be paid even if, in some future year, the benefit with COLA exceeds the future limit.

The regulations provide for a different treatment of COLAs if the plan is written to permit it. The form of benefit without regard to the COLA must satisfy the requirements of §415(b) and the plan must provide that "in no event will the amount payable to the participant under the form of benefit in any limitation year be greater than the §415(b) limit applicable at the annuity starting date…as increased in subsequent years pursuant to §415(d) and Treas. Reg. §1.415(d)-1."[10] The required language is specified in Treas. Reg. §1.415(b)-1(c)(5)(iii). In simple terms, this means that with the proper plan language, automatic COLAs can be ignored for §415(b) testing provided that each year's benefit is retested against the then current limits. The regulations provide a "safe harbor" method[11] for the retesting that usually results in (employer-provided) benefits being permitted to increase at the same rate as the age adjusted 415(b) limit increases each year.

In a large plan, additional administrative costs may apply because hundreds of cases may require annual retesting which involves maintaining data related to §415(b) calculations for certain individuals for 20, 30 or 40 years.

After Retirement …

For plans that have incorporated the language of Treas. Reg. §1.415(b)-1(c)(5)(iii), detailed testing is done in the year of retirement and the original limited amount payable from the plan, the age at retirement, the age adjusted limit, and the amount attributable to employee contributions ("Ee Portion") are computed as of the retirement year and stored indefinitely. The safe harbor method provided in §1.415(d)-1(a)(6) can then be applied in future years to determine the amount payable from the plan in those years. For such plans, the safe harbor method then provides that the amount payable in the current year is:

$$\text{(Original Amount Payable - Ee Portion)} \times \frac{\textit{Age Adjusted Limit in Current Year}}{\textit{Age Adjusted Limit at Retirement}} + \text{Ee Portion}$$

A nearly equivalent version of this formula, that may be easier to implement, is based upon amounts payable in the preceding year and is shown below.

$$\text{(Amount Payable Preceding Year - Ee Portion)} \times \frac{\textit{Age Adjusted Limit in Current Year}}{\textit{Age Adjusted Limit in Preceding Year}} + \text{Ee Portion}$$

The age adjusted limits are always based upon the age at original retirement. The amount designated as "Ee Portion" normally does not change. In particular, it does not increase with the plan's cost-of-living adjustment.

Adjustments to the safe harbor formula may be required if the benefit amount changes for reasons other than the plan's cost-of-living adjustment. There can be cases where the safe harbor method cannot be applied exactly in this form. One example would be a case of a benefit that changes at Social Security age.

[10] Treas. Reg. §1.415(b)-1(c)(5)(iii).
[11] Treas. Reg. §1.415(d)-1(a)(6).

Code §415(b) limits apply to benefits provided through a "*qualified plan*" by an *employer*. For testing benefits against §415(b) limits, all qualified defined benefit plans maintained by a given employer are combined and treated as one plan. Although it goes without saying, §415(b) limits the benefits an *employer* can provide through its defined benefit plans. Conceivably, an individual could work for two separate employers (i.e., two different governments, one church and one government, etc.) and accrue two separate benefits that, in total, would exceed the §415(b) limit. There are no rules against that situation. Additionally, Code §415(b) does not in any way place a limitation on what an individual can receive in the form of retirement benefits. Unfortunately, at least in the governmental sector, it is not always completely clear when two employers are different from each other. In cases of doubt, plan administrators should obtain legal advice.

Can an employer pay the remaining benefit to the member if the member's benefit is more than the §415(b) limits? Yes, employers can provide the amount of the benefit that exceeds the §415(b) limits through "Excess Benefit Plans." Code §415(m) provides for "Qualified Governmental Excess Benefit Arrangements" or "QEBAs." Such QEBAs are commonly used to pay the portion of benefits that would otherwise be prohibited by §415(b), although they cannot be used to provide benefits that would otherwise be prohibited by the §401(a)(17) compensation limit. QEBAs are separate entities from the qualified plan, although they may be administered by the same staff.

There are unresolved §415(b) issues related to ad hoc COLAs and other types of one-time adjustments to benefits after retirement. These issues also occur in connection with return to work retirees who accrue a new benefit and in case of retirees who participate in more than one plan provided by the same employer and who begin drawing benefits from the plans at different times.

In such situations, the amount of the benefit increase (or the additional benefit due to the second retirement) is treated as a new retirement benefit at a new retirement date. The terminology for this situation is "multiple annuity starting date." The subject of multiple annuity starting dates appears in the regulations, but the description of how to handle them is incomplete. The regulations require the plan to "actuarially adjust the past and future distributions with respect to benefits that commenced at the other starting dates" in order to determine the annual benefit for a participant at a particular starting date.

The regulations also state that in the case of limitation years to which Treas. Reg. §1.415(b)-2 applies, the adjustment is to be made using the rules in Treas. Reg. §1.415(b)-2. Unfortunately, Treas. Reg. §1.415(b)-2 is blank at the time of this writing, so there is no definitive guidance. Until the IRS completes Treas. Reg. §1.415(b)-2, multiple annuity starting dates have to be resolved by a good faith effort to comply with the provisions of §415(b). A discussion with qualified tax counsel would be appropriate when this situation occurs.

TAMRA Election

The Technical and Miscellaneous Revenue Act (TAMRA) of 1988, Public Law 100-647 (102 Stat. 3342), added §415(b)(10). Section 415(b)(10) provides rules for state and local government plans where the employer elected before the close of the first plan year beginning after December 31, 1989, to have § 415(b) apply. These rules provide that for participants who commenced participation in such a plan prior to 1990, the §415(b) limitation shall not be less than the accrued benefit under the plan, determined without regard to any amendments made to the plan after October 14, 1987. Thus, for these participants, benefits which continue to accrue under the terms of the plan as of October 14, 1987, will be treated as not exceeding the §415(b) limitation. For example, an individual who was a member of a plan prior to January 1, 1990 that made the TAMRA election at the appropriate time retires in 2020 with a benefit of $300,000. This member would be able to receive the full $300,000 (which exceeds the current dollar limit) directly from the plan provided that the

$300,000 was calculated based on the plan provisions in effect as of October 14, 1987 (using current service and earnings, but based on the definition of those items as of October 14, 1987). For participants who first became members on or after January 1, 1990, the applicable §415(b) limitation is determined without regard to the TAMRA election.

Conclusion

We encourage all retirement plans to have a well-planned process for testing compliance with IRC §415 and, in particular, for testing compliance with §415(b) and its regulations. A model process would have both legal and computational aspects.

Legal Aspects: The plan document should describe how §415(b) is to be implemented and how benefits are to be determined in cases where the §415(b) limit may affect the amount that can be paid. A number of ambiguities can be eliminated if the plan document defines whether the §415(b) limit is applied to the straight life form of payment prior to the election of any optional forms, or only to the optional form after it has been determined. (Recall that in the plans that are the subject of this *GRS Perspectives*, the accrued benefit is not limited by §415(b), only the benefit that is actually paid).

For example, suppose that the plan document applies the limit to the normal form, and the normal form is a straight life annuity, and that a plan participant retires at age 62 and elects a joint and 50% survivor option covering the spouse. If the retired participant dies prior to the spouse, the spouse is eligible to receive only 50% of the §415(b) limited benefit (directly from the plan). However, if the plan document applies the limit to the optional form (in this case the 50% joint and survivor), the spouse may be eligible to receive up to half of the formula benefit without regard to the §415(b) limit.

In plans that provide an automatic COLA, consideration should be given to the treatment of the COLA, and in particular to the language described in Treas. Reg. §1.415(b)-1(c)(5)(iii) and the special rules regarding COLAs on pages 5 and 6. Creation of such a document would usually involve the services of an attorney who is an expert in these matters.

Computational Aspects: In most plans, simplified procedures may be applied to test the vast majority of retiring participants' benefits against the §415(b) limit and to isolate those few, if any, individuals whose benefits are close enough to the applicable limit to warrant detailed testing. Detailed testing can be complicated and may require the services of one or more outside experts, including actuaries, attorneys, accountants or auditors. For plans that have not elected the special treatment of COLAs provided in Treas. Reg. §1.415(b)-1(c)(5)(iii), detailed testing is normally done only once at the time of retirement and determines the amount payable from the plan in all future years. For plans that have incorporated the language of Treas. Reg. §1.415(b)-1(c)(5)(iii), detailed testing is done in the year of retirement and in each subsequent year up to and until the person passes by a sufficient margin to eliminate risk of a future failure. In such cases, care must be taken to ensure that data sufficient for future testing is retained. Data requirements are fairly simple if the safe harbor method is chosen for future testing (and can be used). However, other testing methods may require different data.

Please refer to Appendix A for a concise summary of key §415 provisions for governmental DB plans. If your plan needs additional information regarding §415(b) or assistance with testing, please contact your GRS consultant.

APPENDIX A: SUMMARY OF KEY §415(b) PROVISIONS FOR GOVERNMENTAL DB PLANS (2020)

NOTE: THIS TABLE SUMMARIZES KEY PROVISIONS OF CODE §415, BUT IS NOT INTENDED AS A COMPLETE DESCRIPTION.

TOPIC	SUMMARY
Plan Qualification	The §415 limits are qualification requirements under Code §401(a). A plan that does not adhere to the limits may risk disqualification.
Limitation Year	The §415 limits apply over the "limitation year" which is the calendar year by default. However, an employer may elect any other consecutive 12-month period as the limitation year through a written plan amendment.
§415(b) Dollar Limit	For governmental DB plans, benefits are tested under the §415(b) dollar limit. The unadjusted dollar limit ($230,000 in 2020) applies to benefits commencing between the ages of 62 and 65.
Adjusted Dollar Limit for Benefits Commencing Before Age 62	For a benefit commencing before the participant attains age 62, the dollar limit is reduced to the annual amount of an equivalent straight-life annuity (SLA) at the benefit starting date using a 5% interest rate and applicable mortality table. If the plan provides for a SLA at both the benefit starting date and age 62, a second dollar limit is calculated as the unreduced dollar limit multiplied by the ratio of the plan's annual SLA at the benefit starting date and the plan's annual SLA commencing at age 62. The age-adjusted dollar limit is the lesser of the two dollar limits.
Adjusted Dollar Limit for Benefits Commencing After Age 65	For a benefit commencing after the participant attains age 65, the dollar limit may be increased to the annual amount of an equivalent SLA at the benefit starting date using a 5% interest rate and applicable mortality table. If the plan provides for a SLA at both the benefit starting date and age 65, a second dollar limit is calculated as the unreduced dollar limit multiplied by the ratio of the plan's annual SLA at the benefit starting date and the plan's annual SLA commencing at age 65. The age-adjusted dollar limit is the lesser of the two dollar limits. This increase would only be allowed if the plan's provisions increase the participants' benefits on account of the delayed benefit commencement.
Exception to Age-Adjusted Dollar Limit	In governmental DB plans, no age reduction in the §415(b) dollar limit before age 62 is required for a participant who has at least 15 years of service in the plan as: (1) a full-time employee of a governmental police or fire department providing police, firefighting, or emergency medical services; or (2) as a member of the U.S. Armed Forces.
Benefits Taken into Account for Testing Under §415(b)	The §415(b) limit applies to the employer-provided portion of the benefit and does not include the portion attributable to mandatory, after-tax employee contributions. Employee contributions picked-up by the employer under 414(h)(2) are included in the employer-provided benefit. Voluntary employee contributions are treated as made to a separate defined contribution plan and are not included in the benefit tested under §415(b), but are included in the defined contribution benefit tested under §415(c).
Benefits Not Taken into Account	Certain ancillary benefits are not taken into account for testing under §415(b), including: (1) the additional dollar value of a qualified joint and survivor annuity; (2) pre-retirement disability benefits that do not exceed the retirement benefit payable at normal retirement age; (3) pre-retirement incidental death benefits; and (4) post-retirement medical benefits.
Form of Benefit Tested	If the DB benefit is in a form other than a SLA, it is converted to an actuarially equivalent SLA beginning at the same age for testing against the §415(b) dollar limit. The factors used to convert a benefit depend on whether the form of benefit is "subject to §417(e)(3)" or "not subject to §417(e)(3)." Benefits that are subject to §417(e)(3) include: full and partial lump sum distributions, period certain only distributions, and others. Benefits that are not subject to §417(e)(3) include: nonqualified joint and survivor annuities, period certain and life annuities, pop-up options, and others.
Adjusting Benefits Not Subject to §417(e)(3)	In adjusting a benefit not subject to §417(e)(3), the value of the equivalent SLA is the greater of: (1) the annual amount of a SLA (if any) payable to the participant under the plan at the same annuity starting date; and (2) the annual amount of a SLA at the same annuity starting date determined using a 5% interest rate and the applicable mortality table.
Adjusting Benefits Subject to §417(e)(3)	In adjusting a benefit subject to §417(e)(3), the value of the equivalent SLA is the greatest of the annual SLA commencing at the same annuity starting date that has the same present value as the benefit payable, computed using: (1) the interest rate and mortality table specified by the plan for actuarial equivalence; (2) a 5.5% interest rate and applicable mortality table; and (3) the applicable §417(e)(3) interest rate and applicable mortality table with the result divided by 1.05.
Adjusting the Benefit for Mandatory, After-Tax Employee Contributions	Mandatory after-tax employee contributions are not included in the employer-provided benefit tested under §415(b). The value of the benefit attributable to these contributions is determined by: (1) applying interest on the contributions using interest rates specified under Code §411(c); and (2) converting the value of the contributions plus interest to an annuity using the applicable §417(e)(3) interest rates and applicable mortality table. The benefit attributable to these contributions is excluded from the employer-provided benefit tested under §415(b). A similar approach is used for rollovers to purchase service credit in a DB plan.
Adjusting the Benefit for Automatic COLAs	Automatic cost-of-living adjustments (COLAs) may be excluded from the benefit tested under §415(b) provided the following conditions are met: (1) the plan document specifically limits the actual benefit paid in any year to no more than the §415(b) dollar limit for that year, adjusted for commencement age and form of payment; and (2) the form of benefit is not subject to §417(e)(3). Otherwise, the value of the benefit tested under §415(b) would need to include the full value of the automatic COLAs.
Adjusting the Dollar Limit for Inflation	Under Code §415(d), the IRS periodically adjusts the §415(b) limits for inflation, based on the CPI, and rounded down to a multiple of $5,000. The adjusted dollar limit is effective as of January 1 of each calendar year and applies with respect to limitation years ending with or within that calendar year. A plan may increase benefits otherwise limited by the §415 limit, including those for participants who have retired, but only if the plan explicitly permits such increases and does so in accordance with the regulations.

About the Author

BRIAN B. MURPHY, FSA, EA, FCA, MAAA, PhD is a Senior Consultant and Actuary who has more than 40 years of public sector actuarial and consulting experience. Brian's consulting experience with statewide pension plans includes systems in Arizona, Arkansas, Colorado, Illinois, Iowa, Maryland, Mississippi, Missouri, Ohio, Tennessee, and Wisconsin. His local government experience covers plans in Florida, Michigan, and Virginia.

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The author thanks Judith Kermans, Melissa Moskovitz and Mary Ann Vitale for their review and helpful comments.

This issue of GRS Perspectives provides a general overview of §415(b) and related matters. However, it is not intended to be definitive. Although the author has taken great care to provide accurate information based on the regulations and interpretations at the time of this article's publication, these are complex matters and accuracy cannot be fully guaranteed. In addition, regulations and interpretations may change from time to time. Readers are cautioned to examine original source material and to consult with subject matter experts before making decisions related to the subject matter discussed herein. GRS assumes no liability for the use or misuse of the information in this GRS Perspectives.

The author of this GRS Perspectives is neither an attorney nor a tax expert. GRS does not provide legal advice, tax advice or investment advice. Consequently, this communication must not be construed to provide legal advice, tax advice or investment advice.

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JANUARY 2019

GRS PERSPECTIVES

Understanding Actuarial Assumptions

Brian Murphy

Most public defined benefit retirement plans engage an actuary to perform an annual actuarial valuation. The actuarial valuation presents the plan's funding requirements calculated in accordance with the plan's funding policy. Performing an actuarial valuation is a complex process which involves extensive data requirements and various assumptions. In order to fund pension benefits, several projections about future events are developed based on "actuarial assumptions." The selection of those assumptions is a critical part of the actuarial valuation process. Properly chosen assumptions can help stakeholders understand the plan's financial condition and can help to ensure future sustainability.

In order to perform the valuation, the actuary needs data regarding the following:

Retired and non-retired plan participants;
Retirement plan provisions; and
Retirement plan assets.

The actuary produces the actuarial valuation using computer programs and specialized actuarial techniques that apply assumptions about the future to the above data. The results of the actuarial work include measurements of the plan's funded status, its future contribution needs, and other typical actuarial information. In addition, the actuary usually provides the actuarial portion of information needed for financial reporting.

What Are Actuarial Assumptions?

There are two broad categories of actuarial assumptions:

1. **Demographic assumptions** which are related to a pension plan's membership such as future rates of retirement, turnover, disability and death before and after retirement; and
2. **Economic assumptions** which are related to other factors such as future rates of investment return, inflation, payroll growth, and pay increases among individual plan participants.

The actuary also makes other more minor assumptions including, but not limited to: rates of marriage, rates of benefit option elections, etc.

How Are Actuarial Assumptions Determined?

It is important that assumptions be carefully chosen and continually monitored because the choice of assumptions can have a dramatic effect on the results of the valuation and, therefore, on the funding of the plan. The assumption selection process is guided by certain Actuarial Standards of Practice or "ASOPs."

- **ASOP No. 35** (*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*) governs the selection of demographic assumptions;
- **ASOP No. 27** (*Selection of Economic Assumptions for Measuring Pension Obligations*) governs the selection of economic assumptions; and

- **ASOP No. 4** (*Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*) is a general standard covering the measurement of pension obligations.

All of these ASOPs are being revised at the time of this writing. Information regarding the Actuarial Standards of Practice can be found at: http://www.actuarialstandardsboard.org/standards-of-practice/

Someone once jokingly said that actuaries are like race car drivers who steer by looking in the rear view mirror, implying that actuarial assumptions are based solely on past behavior projected into the future. That is not true, though. Actuarial assumptions are intended to be forward-looking estimates of expectations for future behavior, and their development must reflect that intention. It is true that actuaries consider historical information when developing actuarial assumptions, but they also consider current trends, external conditions, and future projections.

For a public pension plan, an actuary may perform an actuarial experience study to review the differences between the plan's assumed and actual experience over multiple years. The study can help analyze related trends and can serve as the basis for recommending assumption changes, if necessary.

What Is an Experience Study?

An "Experience Study" is the process by which actuaries develop new assumptions or adjust existing assumptions. The studies are based upon a review of data, emerging trends, and future expectations. Experience studies are typically performed every three to five years, although some plans (particularly smaller plans) may perform them less frequently. Actuarial standards require that the actuarial assumptions used in a valuation be reasonable at the time the valuation is performed. The shorter the period between experience studies, the less likely it is that the actuary will need to modify assumptions between studies.

How Are Demographic Assumptions Developed?

When developing demographic assumptions, the actuary first tallies up rates of retirement, death, disability, turnover, etc. that occurred during the "experience period." Commonly, the experience period is a three- or five-year period preceding the experience study, as discussed above. Initial "crude" rates may be tallied by age, service, gender, occupation, etc. In the past, actuaries usually tallied rates in terms of pure headcounts of people. For example, the actuary would develop a ratio consisting of the number of people age 40 who terminated employment divided by the total number of people age 40. That ratio would be called "the crude rate of employment termination at age 40."

Some actuaries today use a "liability weighted" approach to assumption development. With a liability weighted approach, the crude rate of termination at age 40 would be calculated as the ratio of the liabilities of the 40-year-olds who quit divided by the total liabilities of all 40-year-olds. The approach can make a difference because the total liability of people who quit, die, retire, or become disabled may affect the plan's finances to a greater degree than the number of people who do so. If a person with a liability of $100,000 quits, that has a much larger effect on the

plan than if a different person with a liability of $25,000 quits. Using liability weighting instead of headcount ratios takes that different effect into account.

The actuary may also review observed rates for similar groups, rates that were observed for the group in question in prior studies, or so called "standard tables." In some cases, there are also external conditions that are relevant and may need further consideration, such as:

- Is a recession exerting a short-term effect on turnover rates?
- Is there an impending curtailment of a retiree health care plan that may affect retirement rates?

An experience study will usually result in adjusted rates of retirement, turnover, disability, mortality, etc. to be used in future valuations.

Mortality

Mortality rates and, in particular, mortality rates after retirement have received increased attention in recent years, arguably because liabilities today are much more heavily weighted toward retirees than they were in the past. For example, it is not uncommon for close to 60% of a plan's liabilities to be liabilities for current retirees and beneficiaries. Such a ratio would have been rare 30 years ago.

It is well known that mortality rates have been declining, or in other words, life expectancies have been increasing for many years. Increasing life expectancy is a very important trend, and one that actuaries cannot overlook, particularly as plans mature and the number of retirees increases relative to the number of active members. In the past, actuaries would account for this trend by assuming mortality rates that are somewhat lower than those observed in the experience study, but that would not be assumed to improve from that point. Today, the practice is shifting toward the use of "fully generational" mortality tables. In a fully generational mortality table, the mortality rates for a person depend on the person's year of birth, age and gender.

The following chart was developed based upon the RP-2014 (Total Dataset adjusted back to 2006) mortality table and the MP-2018 projection scale, both of which were produced by the Society of Actuaries.

Chart 1

	Years of Future Life Expectancy of a 65-Year-Old				
Year of Birth	**1955**	**1965**	**1975**	**1985**	**1995**
Year Turn Age 65	**2020**	**2030**	**2040**	**2050**	**2060**
Male	20.74	21.54	22.38	23.21	24.04
Female	22.74	23.52	24.34	25.15	25.95

Notice that life expectancy at age 65 increases by a little less than a year for each later decade of birth. The chart indicates that a male born in 1955 will have a life expectancy at age 65 (in 2020) of 20.74 years. A male born 10 years later will have a life expectancy at age 65 of 21.54 years. Female life expectancies at age 65 are approximately two years greater than male life expectancies for all illustrated years of birth. If the table is correct, and that will only be known about 100 years from now, the need for the fully generational technique is clear. An actuary who bases the mortality assumption solely on the life expectancy of people born in 1955 would be understating plan liabilities for younger people by 10% or so.

Many plans are too small to develop a mortality table based solely on plan experience. The practice in such plans is to base mortality assumptions heavily on standard tables with standard projection scales, such as illustrated above. Depending on the size of the plan, there may be a "credibility" adjustment that takes into account a portion of the plan's mortality experience.

How Are Economic Assumptions Developed?

When developing economic assumptions, the actuary may start by looking at the past, but the actuary knows that past performance is not indicative of future results. Consequently, the actuary will also look to estimates of future economic conditions inherent in current market data, expert opinions, investment consultant expectations, etc.

Inflation

An inflation assumption usually forms the foundation for the development of other economic assumptions. Bond investors, for example, expect yields that at least offset inflation and that provide some real return. Workers expect wages to increase at least as fast as prices, and hopefully faster.

When developing an inflation assumption, actuaries consider various forward-looking expectations, such as those developed by the Congressional Budget Office, the Quarterly Survey of Professional Forecasters, various Federal Reserve Banks, the excess yield of non-indexed Treasuries over indexed Treasures, the Social Security Trustees Report, etc. At the time of this writing, those forecasts are primarily in the 2% to 2.5% range. The 2018 Social Security Trustees Report provides a range for the inflation assumption from 2% to 3.2%, with an intermediate expectation of 2.6%.

Payroll Growth

In the late 1970s, prices rose faster than payroll, but historical statistics show that payroll increases tend to outpace price increases in the range of about 0.5% to 1.0%, on average. While most people expect a positive relationship between the two rates to continue, the amount by which it may do so is uncertain. The 2018 Social Security Trustees Report provides a range of about 0.6% to 1.8% for the difference, with an intermediate assumption of 1.2%. This assumption is important in plans that use level percent-of-payroll funding of unfunded actuarial accrued liabilities.

Investment Return

Today, almost all of the attention is on the assumed rate of investment return, but we could not really discuss investment return without considering inflation and payroll growth first. Typically, the investment return assumption contains two components: 1) inflation (defined above); and 2) the real rate of return. The real rate of return is the return on investment after adjusting for inflation. The total of these two components is known as the nominal return rate.

On the following page, Chart 2 gives approximate return information over various time periods on a sample portfolio that is invested with 60% in common stock, 15% in corporate bonds, 15% in government bonds and 10% in Treasury Bills (T-Bills).

Focusing only on the total column, and looking only at the past, it would be easy to say that the top half of the chart provides support for a return assumption in the 8% area, particularly if the 30+ year time horizons are considered. However, when looking at the bottom half of the chart, it appears that the longer term returns were influenced by extraordinary returns for the 1980s and 1990s (the period during which the baby boomers became a significant driving force in the economy) which may or may not recur. Is it wise to fund a retirement plan by assuming that the 1990s will happen again? On the other hand, the bottom half of the chart also includes the influence of the tech bubble in the early 2000s and the 2008 financial crisis as well as the high inflation environment of the 1970s. Will any of those happen again?

Because of the historical volatility of investment return, it is particularly important to consider forward-looking expectations of professional investment consulting firms when developing the investment return assumption. For the most common asset allocations

Chart 2				
	Portfolio Return			Risk Free Rate
Time Period	Total[1]	Inflation Portion	Real Portion	(T-Bills)
Returns for Long Periods				
2008-2017	8.1%	1.6%	6.4%	0.30%
1998-2017	7.3%	2.1%	5.1%	1.90%
1988-2017	9.8%	2.6%	7.0%	3.10%
1978-2017	10.6%	3.5%	6.9%	4.60%
1968-2017	9.4%	4.0%	5.2%	4.80%
Returns by 10-Year Periods				
2008-2017	8.1%	1.6%	6.4%	0.30%
1998-2007	6.5%	2.7%	3.7%	3.50%
1988-1997	14.8%	3.4%	11.0%	5.40%
1978-1987	13.2%	6.4%	6.4%	9.20%
1968-1977	4.7%	6.2%	-1.4%	5.70%

today, most of those firms would be looking for 10- to 20-year returns ranging from 6.5% to 7.5%. The returns at the upper end of the spectrum would require a more aggressive asset allocation than those at the lower end. In response to the current investment environment, many public funds have lowered their return expectations. According to the most recent National Association of State Retirement Administrators (NASRA) Public Fund Survey, the median investment return expectation that was 8% a decade ago is below 7.5% today.[2]

Conclusion

Actuarial assumptions are intended to be forward-looking expectations of future results, not just rote extrapolations of the past into the future. The experience study is the process by which those assumptions are selected. Currently, the experience study process is becoming much more exacting than it was in the past, possibly in response to plan liabilities being much larger and much more heavily weighted toward retirees than they were previously. At the same time, actuarial standards are being tightened.

Further, liability weighting for demographic assumptions and fully generational versions of mortality tables are becoming more common today than they were in the past. Economic assumptions are being heavily affected by the current low interest rate/ low inflation rate environment, leading many plans to reduce their investment return assumption.

Reasonable actuarial assumptions are very important for a plan's well-being. Out-of-date assumptions are of questionable validity and can potentially do great harm to a plan, causing decisions about the future to be based on out-of-date expectations. If your plan has not had an experience study recently, or if you are concerned about the validity of the assumptions, discuss them with your actuary. It matters.

[1]Typically, the inflation portion and the real portion of the return do not add to the total, especially when inflation is high. As an example, in the first row, the formula for the real portion is 1.081/1.016=1.064 or 6.4% real return.

[2]https://www.nasra.org/publicfundsurvey

About the Author

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The author thanks James Anderson, David Kausch and Mary Ann Vitale for their review and helpful comments.

About GRS

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APPENDIX 3

SAMPLE AUDIT REPORT

Sample Public Employees' Retirement System

Actuarial Audit Report

June 30, 2019

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March 12, 2020

Investment Board
Sample Public Employees' Retirement System
City, State

Dear Board Members:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this report of an Audit of the June 30, 2019 Actuarial Valuation of the Sample Public Employees' Retirement System (SPERS). We are grateful to SPERS Staff for their cooperation throughout the Audit process. In addition, we wish to thank the retained actuary for their assistance with this project.

The Actuarial Audit has several related objectives:

- Review assumptions and methods for compliance with Professional Standards, State Law, and Board Regulations,
- Verify the demographic data through independent collection and processing,
- Express an actuarial opinion regarding the reasonableness and/or accuracy of valuation results based upon an independent full replication of the retained actuary's work product,
- Review certain administrative factors for reasonableness and accuracy, and
- Assess the reasonableness of projections made in the retained actuary's valuation simulation model.

The Audit was performed under the supervision of Consultant 1 and Consultant 2 (the authors). In our opinion, the retained actuary's work provides a reasonable assessment of the financial position of SPERS. We are pleased to report that we have found no substantial errors or omissions in the retained actuary's work.

Throughout this report, the reader will note items where the authors see things differently than the retained actuary. Indeed, our mission is to point out such items. In interpreting our recommendations and suggestions, the investment board should be aware that while we are pointing out sources of difference, we agree with the retained actuary on the vast majority of items reviewed.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

The undersigned actuaries are independent of the plan sponsor.

Consultant 1 and Consultant 2 are members of the American Academy of Actuaries (MAAA), and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,

Consultant 1, FSA, EA, FCA, MAAA

Consultant 2, FSA, EA, FCA, MAAA

Table of Contents

SECTION I

INTRODUCTION

Introduction

The Sample Public Employees' Retirement System (SPERS) issued a Request for Proposal (RFP) for an audit of the June 30, 2019 Actuarial Valuation of SPERS performed by the retained actuary. Gabriel, Roeder, Smith & Company (GRS) responded to the RFP and was awarded the work. The work commenced on December 12, 2019.

An actuarial audit involves a review of the retained actuary's work by an independent actuarial firm. The purpose of this audit was to provide an evaluation sufficient to allow the authors of this report to express an actuarial opinion regarding the reasonableness and/or accuracy of valuation results, actuarial assumptions, and actuarial methods in accordance with generally recognized and accepted actuarial principles and practices.

The scope of service for this audit was the following:

1. Analyze the appropriateness of the actuarial assumptions.
2. Review the actuarial assumptions and methodology for compliance with generally recognized and accepted actuarial principles and practices which are consistent with Actuarial Standards of Practice, the Code of Professional Conduct, Qualifications Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries and GASB Statement No. 67.
3. Evaluate the data used for performance of the valuations including SPERS' production of data used in the actuarial calculations, the degree to which data is sufficient to support the conclusions of the valuation and the use and appropriateness of any assumptions made regarding the data.
4. Conduct a replication of the 2019 valuation results using the same data, methods and assumptions used by the retained actuary.
5. Evaluate the test results and reconcile any significant discrepancies between the findings, assumptions, methodology, rates and adjustments of the auditing firm and the retained actuary.
6. Assess whether the valuation appropriately reflects information pursuant to actuarial professional standards.
7. Assess the information provided by the actuarial consulting firm to the System for the System's required reporting standards under GASB.
8. Review optional form factors used by the System for reasonableness and accuracy.
9. Assess the reasonableness of the 30-year projections made in the valuation simulation model provided to SPERS by its actuary. The model projects contribution rates (actuarial rates and funding policy rates), funded ratios and liabilities under alternative scenarios of future investment returns, four discount rates and two inflation assumptions.

In connection with the audit, we requested and received the following items:

1. The participant data files that were provided to the retained actuary for the June 30, 2019 annual actuarial valuation.
2. A file layout containing the description and location of data items in the participant data files.
3. Several statements of recent retiree benefit calculations completed between July 1, 2018 and June 30, 2019.

4. The financial information that was provided to the retained actuary for June 30, 2019 actuarial valuation purposes.
5. A selection of printouts from the actuarial simulation model.
6. A Microsoft Excel workbook containing optional forms of benefit factors.
7. A description of the assumptions underlying the option factors (Interest Rate, Dividend assumption if any, mortality table, gender mix, etc.).
8. The interest rate credited to member accounts for refund purposes.
9. A document describing the SPERS Funding Policy.
10. Information regarding SPERS Current Target Asset Allocation if different from the April 1, 2019 Investment Policy and Goal Statement on the website.
11. A description of any benefit changes that have occurred since the audit of the June 30, 2014 valuation.
12. The most recent dividend certification letter from the retained actuary.
13. A copy of the most recent Asset Liability Study that has been performed for SPERS.
14. The final "groomed" data files that were used by the retained actuary for the June 30, 2019 annual actuarial valuation.
15. An itemized listing and description of data items relating to the data files in the above.
16. An Excel workbook containing a complete listing of the actuarial assumptions used for actuarial valuation and option factor purposes.

We also downloaded information from the SPERS Website, including actuarial valuation reports and GASB accounting reports and valuation PowerPoint presentations.

In order to perform this audit, we used our proprietary actuarial valuation software that is 100% independent of the commercial software that the retained actuary's firm uses.

Users of this report should bear in mind that an actuarial valuation involves a large number of intricate calculations and many individual judgments regarding rather arcane items along the way. Two independently written valuation programs will never agree. For actuarial audit purposes, we generally like to see principal valuation results within 1% to 2% for retired and deferred vested members, and within 5% for active members. For active members, larger differences may be seen for some valuation results, particularly if the level of service for the active test case is relatively small. In the audit, we concentrate on those differences that we believe are important and do not pursue differences that we believe are the result of minor judgment items.

The narrative in this report includes both recommendations and suggestions regarding the retained actuary's work. We have classified as *recommendations* those items which in our judgement have the potential of resulting in a meaningful improvement in the valuation process. Our *suggestions* in the body of the report are much more minor items that may result in minor improvements in clarity for the non-expert user or technical compliance with actuarial standards. It is unlikely that the many suggestions would affect end results in any material way.

Although we would perform certain aspects of the actuarial valuation differently than the retained actuary, and would probably arrive at slightly different assumptions and results, we have identified no significant exceptions to the work that we reviewed.

SECTION II

REVIEW OF DATA ELEMENTS

Review of Data Used for Actuarial Valuations

GRS evaluated the data which was used to perform the June 30, 2019 Actuarial Valuation. The data was independently collected from both SPERS and the retained actuary. As is typical with the actuarial valuation process, the retained actuary may "groom" the data into necessary formats for mathematical calculations and make certain adjustments to account for missing or incomplete data. As part of this Audit, GRS compared the SPERS data with the "groomed" retained actuary data to confirm there were no unexpected or unusual changes in data elements.

From SPERS, GRS received three data files: active/inactive member data (labeled "Available Money Member"), retiree member data (labeled "Retired Member (In-Pay)") and termination member data (labeled "Paid Out Member"). From the retained actuary, GRS received similar data split between active members, in-pay (retired) members, inactive vested and inactive non-vested members. As expected, GRS did not receive a file from the retained actuary similar to the "Paid Out Member" file received from SPERS because this information is not material for measuring future liabilities to the System.

After review of the data, we found that the data supplied by SPERS was sufficient to perform the actuarial valuation. The data adjustments GRS observed within the retained actuary's data files were minimal and not unusual for a data set as large as the SPERS data. Actuaries commonly adjust data to account for missing or incomplete dates of birth, benefit amounts, etc.

GRS also reviewed the data for compliance with ASOP 23. ASOP 23 provides guidance to actuaries when selecting, reviewing and performing actuarial analyses based upon data. In our judgment, the retained actuary's use of the data meets the requirements of ASOP 23.

While the data supplied was sufficient for performing the actuarial valuation, improvements could be made which would better model the updated benefit design after the July 1, 2012 SPERS Pension Reform. The following page discusses our observations on the data.

Active and Inactive Member Data Observations

GRS analyzed the following data fields for reasonableness, in addition to comparing to the retained actuary's supplied data:

- Dates of birth
- Years of active service (quarters worked)
- Gender
- Annual salary (reported by quarter)
- Average high 3 wages (Final Average Salary)
- Member & employer contributions (with interest)
- Membership status within SPERS

There were no significant differences between the two files.

- SPERS data includes a current 3-year Final Average Salary in addition to the current salary. We recommend an additional data field be reported that includes a member's current highest 5-year average salary. Such a field can help improve the estimation of benefits for Regular membership. There can be cases where the current pay is not a good estimator of final average compensation. The current highest 3-year average salary field is still needed and applicable for Special Services members.
- Effective with the July 1, 2012 SPERS Pension Reform, the calculation for Regular membership retirement benefits are based upon an average salary that is the greater of a member's highest 3-year average salary as of June 30, 2012 or highest 5-year average salary over their career. However, the data does not contain a "snapshot" of the highest 3-year average salary as of June 30, 2012. As we get further away from June 30, 2012, it becomes less important, but we think the addition of such a snapshot would still have merit.
- Years of service are currently reported based upon whether it was earned in Regular membership, Sheriff Deputy membership, or Protection Service membership. Effective with the July 1, 2012 SPERS Pension Reform, service earned on or before June 30, 2012 is treated different than service earned after July 1, 2012. The Early-Retirement Reduction for service before July 1, 2012 receives a 3% reduction for each year a member is to receive benefits before normal retirement age. The reduction for service on or after July 1, 2012 is 6%. We understand that the retained actuary maintains a record of the service as of June 30, 2012 in its database. We recommend, however, that SPERS provide the service earned prior to July 1, 2012 for each of the three valuation groups as part of the data that it submits to the actuary each year.

Retiree Member Data Observations

GRS analyzed the following data fields for reasonableness, in addition to comparing to the retained actuary's supplied data:

- Member and Beneficiary Dates of Birth
- Member and Beneficiary Genders
- Pension Plan and Type Elected
- Pension Benefits and Additional Ancillary Benefits (if any)

There were no significant differences between the two files.

GRS believes the data provided was sufficient for the required calculations and has no recommendations for changes to the retiree data supplied.

SECTION III

REVIEW OF EXPERIENCE STUDIES, ACTUARIAL ASSUMPTIONS AND OPTION FACTORS

Experience Studies, Actuarial Assumptions and Option Factors

In this section of the report, we present our analysis of the Economic and Demographic Assumptions Studies prepared by the retained actuary (dated March 24, 2017 and June 28, 2018 respectively). These studies are the basis (i.e., rationale) for the actuarial assumptions that are used for annual actuarial valuation purposes. We present our assessment on the appropriateness of the actuarial assumptions and whether they comply with the following:

(1) Actuarial Standards of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*;
(2) ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*; and
(3) Governmental Accounting Standards Board (GASB) Statement No. 67.

In addition, we present our analysis of the optional form factors that the retained actuary developed. We reviewed the factors for reasonableness and accuracy.

As the retained actuary correctly articulates in their studies, the actuarial assumptions setting process is a combination of art and science. An actuary's professional judgment is a key component in the assumption setting process. Different actuarial consulting firms, and different actuaries within the same firm, may have significantly different thoughts on how some assumptions should be developed.

Economic Assumptions

Generally, economic and demographic assumptions are reviewed together periodically (e.g., every four years for SPERS) in an Experience Study. The most recently completed Experience Study was scheduled to occur after completion of the June 30, 2017 annual actuarial valuation. At the request of the Investment Board, a review of the economic assumptions occurred after completion of the June 30, 2016 valuation in a report dated March 24, 2017. Actuarial assumptions are required to be reasonable at each and every valuation date. It is our experience that with the decline in forward-looking capital market assumptions over the past decade and the decline in inflationary expectations in the 2000s, economic assumptions for many public pension plans are generally at the upper end of the range that we would consider to be reasonable. Additionally, we do believe there are times that assumptions (in particular the investment return assumption) need to be reviewed prior to the next scheduled Experience Study. Therefore, we commend the Investment Board for requesting a review of the economic assumptions at that time.

Economic assumptions that the retained actuary reviewed include the following:

(1) Price inflation
(2) Investment return (generally used as the discount rate for public plan valuations)
(3) Interest on member accounts
(4) Wage growth (i.e., the across-the-board portion of salary increases)
(5) Payroll growth

Even though ASOP No. 27 considers the merit and seniority portion of active member pay increases an economic assumption, the retained actuary reviewed that assumption in their Demographic Assumptions Study. This is not an uncommon practice in the public sector. However, we would suggest that the retained actuary treat this as an economic assumption in future Experience Studies.

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by ASOP No. 27. The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions.

ASOP No. 27 (applicable to valuation dates on or after September 30, 2014) defines a reasonable economic assumption as an assumption that has the following characteristics:

(a) It is appropriate for the purpose of the measurement;
(b) It reflects the actuary's professional judgment;
(c) It considers historical and current economic data that is relevant as of the valuation date;
(d) It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
(e) It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed under Section 3.5.1, or when alternative assumptions are used for the assessment of risk.

In selecting economic assumptions, the actuary relies on many different experts (e.g., investment consultants) for data and analysis. However, as required by ASOP No. 27, "When the actuary is responsible for selecting or giving advice on selecting economic assumptions within the scope of this standard, the actuary may incorporate the views of experts but the selection or advice should reflect the actuary's professional judgment."

Price Inflation

Price inflation underlies both the wage inflation and investment return assumptions. In making their recommendation for the price inflation assumption, the retained actuary considered the following sources:

(1) Past experience
(2) Forecasts of inflation
    a. Based upon a comparison of Treasury yields and Treasury Inflation Protected Securities (TIPS)
    b. From SPERS' investment consultant
(3) Social Security projections
(4) Peer system comparison

Sources of data that the authors generally consider in the analysis of the price inflation assumption include:

(1) Inflation expectations of various Federal Reserve Banks (e.g., Cleveland, St. Louis)
(2) Philadelphia Federal Reserve quarterly survey of Society of Professional Forecasters
(3) Comparison of Treasury yields and Treasury Inflation Protected Securities (TIPS)
(4) Future expectations of the plan's investment consultant and other investment consultants that GRS monitors

Presented below are forward-looking price inflation forecasts that GRS monitors to assist in developing the price inflation assumption:

Forward-Looking Price Inflation Forecasts[a]	
Congressional Budget Office[b]	
5-Year Annual Average	2.46%
10-Year Annual Average	2.38%
Federal Reserve Bank of Philadelphia[c]	
5-Year Annual Average	2.20%
10-Year Annual Average	2.20%
Federal Reserve Bank of Cleveland[d]	
10-Year Expectation	1.71%
20-Year Expectation	1.93%
30-Year Expectation	2.09%
Federal Reserve Bank of St. Louis[e]	
10-Year Breakeven Inflation	1.61%
20-Year Breakeven Inflation	1.81%
30-Year Breakeven Inflation	1.78%
U.S. Department of the Treasury[f]	
10-Year Breakeven Inflation	1.65%
20-Year Breakeven Inflation	1.78%
30-Year Breakeven Inflation	1.87%
50-Year Breakeven Inflation	1.95%
100-Year Breakeven Inflation	2.00%
Social Security Trustees[g]	
Ultimate Intermediate Assumption	2.60%

[a] Version 2019-12-31 by Gabriel, Roeder, Smith & Company. Revised 2020-02-26.

[b] *The Budget and Economic Outlook: 2020 to 2030*, Release Date: January 2020, Consumer Price Index (CPI-U), Percentage Change from Fourth Quarter to Fourth Quarter, 5-Year Annual Average (2020 - 2024), 10-Year Annual Average (2020 - 2029).

[c] *Survey of Professional Forecasters, Fourth Quarter 2019,* Release Date: November 15, 2019, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2019 - 2023), 10-Year Annual Average (2019 - 2028).

[d] Inflation Expectations, Model output date: December 1, 2019.

[e] The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: December 1, 2020.

[f] *The Treasury Breakeven Inflation (TBI) Curve*, Monthly Average Rates, December 2019.

[g] *The 2019 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds*, April 25, 2019, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2021 and later.

Because GRS is a benefits consulting firm and does not develop or maintain its own capital market expectations, we monitor forward-looking expectations developed by several major investment consulting firms. For the investment consultants that provided capital market assumptions over roughly a 10-year horizon (14 firms), the average forward-looking price inflation assumption is 2.18%. For the investment consultants that provided capital market assumptions over a 20 to 30-year horizon (6 firms), the average forward-looking price inflation assumption is 2.44%.

With respect to the sources of data that the retained actuary used in its analysis, we have some concerns. While the Public Plans Database has many good features, it is not a credible source of information for the price inflation assumptions that public plans use in their actuarial valuations. We have found numerous instances in which a price inflation assumption that we use for a client is not correctly captured in the Database. (After a quick review of the Database, we could find situations where even the retained actuary's price inflation assumption for a particular client was incorrect.) Sometimes our wage inflation assumption has been included in the Database as though it were a price inflation assumption. In other circumstances, it is not clear where the information has come from. Therefore, we would suggest that the retained actuary not use the Public Plans Database as a source for data on price inflation assumptions.

Although historical data can be useful for context, historical data is of limited value in setting forward looking economic assumptions because historical averages are heavily dependent on the period selected. For example, depending upon the historical period selected, the high inflationary periods of the 1970s and early 1980s can significantly affect the results, have some effect, or may have no effect at all. We are not aware of any forward-looking inflation forecast that is expecting the high inflationary periods of the 1970s and early 1980s to be repeated and we would be reluctant to base retirement system funding on an assumption that such may happen.

It appears that the retained actuary's recommended price inflation assumption of 2.60% is heavily influenced by the fact that it is used in the Social Security projections. While this is a source of data that GRS monitors, and has been used as rationale by the authors in the past to choose a price inflation assumption, we are less inclined to use this as rationale going forward. This is due to at least a couple of reasons: (1) the fact that the rationale included with the Social Security Trustees report as to why this is the Trustees' best estimate relies on historical data and (2) it appears to be almost an outlier to the other sources of data that we monitor.

The authors find that the retained actuary's recommended price inflation assumption of 2.60% is at the upper end of the range that they would consider to be reasonable, based upon information available at this time. (As mentioned above, different actuaries even within the same firm can have different views on this matter). Given the data that we have included in the section and the SPERS' investment consultant's forward-looking price inflation assumptions of 1.95% (10 years) and 2.33% (30 years), our preferred assumption would be in the area of 2.25%. Although we believe that the 2.60% assumption is reasonable for use in the 2019 valuation, we recommend that the Board consider lowering the price inflation assumption from its current level. Doing so will reduce the chances that the assumption may become unreasonable prior to the next experience study. If that were to happen, the actuary would have to issue a qualified report or change the assumption. (Recall that actuarial assumptions must be reasonable in every valuation, not just in the one immediately following an experience study.)

Investment Return

The investment return assumption is the actuarial assumption that has the largest effect on actuarial valuation results. As more of the actuarial accrued liabilities are related to non-active members, the nominal (as opposed to real) investment return assumption becomes a more prominent factor. Since one of most public plans' fundamental financial objectives is the receipt of level contributions over time, the discount rate assumption is set equal to the investment return assumption. In making their recommendation for the investment return assumption, the retained actuary considered the following sources:

(1) Future expectations of the plan's investment consultant
(2) Future expectations of other investment consultants that participated in the 2016 Edition of the Horizon Actuarial Services Survey of Capital Market Assumptions (Horizon Survey)

Sources of data that the authors generally consider in the analysis of the price inflation assumption include:

(1) Future expectations of the plan's investment consultant
(2) Future expectations of other investment consultants that GRS monitors

We concur with the retained actuary that "the most appropriate analysis to consider in setting the investment return assumption is to model the expected returns given the System's target asset allocation and forward-looking capital market assumptions." For the investment consultants that GRS monitors, 14 firms provided capital market assumptions over roughly a 10-year horizon and 6 investment consultants provided capital market assumptions over a 20 to 30-year horizon.

We recognize that there is no "right" answer in deciding which time horizon to use in establishing the investment return assumption. Some will argue that since public plans are long-term investors, that 20 to 30-year horizons are more appropriate to use than 10-year horizons for setting the investment return assumption. The retained actuary makes this case in the Economic Assumptions Study. While the authors do not believe that longer-term horizons should be ignored, we tend to lean towards using the 10-year horizon expectations for at least the following reasons:

(1) While it is true that public plans are long-term investors, most public plans have significant liability commitments coming due in the next 10 to 15 years
(2) In many instances, we have seen rationale from investment consultants that indicate that their longer-term capital market assumptions assume a resumption of long-term equilibrium relationships between asset classes (i.e., reversion to the mean)
(3) Many investment consulting firms consider 10-year assumptions to be "long-term" (page 4 from the 2016 Horizon Survey)
(4) In many instances, it is difficult to rationalize the differences between the 10-year and 20-year capital market assumptions. For example, from the 2016 Horizon Survey, the asset class "US Corporate Bonds – Core" has a 10-year geometric return expectation of 3.41% and a 20-year geometric return expectation of 4.58%. To produce a 20-year expectation of 4.58%, that means that years 11 through 20 have to produce a 10-year return of 5.76% (235 basis points more than the previous 10 years). One would have to ask, "What is expected to be that much different between the second 10 years and the first 10 years?"

(5) A public employee retirement system that fails to meet its return assumptions for a ten-year period is likely to come under severe pressure to reduce benefits, increase contributions, or both with the effective end result being that promises that were made are not kept.

We also note that the retained actuary's recommended investment return assumption is net of administrative expenses. That is, the gross investment return assumption is actually 7.05% with 0.05% netted off for administrative expenses. While this has been common practice in the public sector prior to the issuance of GASB Statement No. 67, we believe that this structure of the investment return assumption does not comply with GASB Statement No. 67. We suggest that the retained actuary make an explicit load in the normal cost to account for administrative expenses and not include a provision for administrative expenses in the investment return assumption.

Using GRS' proprietary Capital Market Assumptions Modeler (CMAM), we determined the expected 10-year return resulting from SPERS target asset allocation (results are based upon the authors' preferred price inflation assumption of 2.25% and no netting off for administrative expenses):

Investment Consultant	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of Exceeding 7.00%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	3.81%	4.61%	5.42%	22.88%
2	4.60%	5.46%	6.33%	32.79%
3	4.70%	5.59%	6.50%	34.70%
4	5.00%	5.69%	6.38%	31.50%
5	5.35%	6.10%	6.87%	38.33%
6	5.30%	6.21%	7.12%	41.25%
7	5.37%	6.24%	7.12%	41.34%
8	5.44%	6.28%	7.12%	41.41%
9	5.50%	6.34%	7.20%	42.28%
10	5.40%	6.35%	7.31%	43.15%
11	5.95%	6.81%	7.67%	47.71%
12	6.10%	6.92%	7.75%	49.05%
13	6.44%	7.18%	7.92%	52.41%
14	6.39%	7.25%	8.11%	52.89%
Average	**5.38%**	**6.22%**	**7.06%**	**40.83%**

We note that the 50th percentile result of 6.22% compares very favorably to the 10-year returns presented on page 19 of the retained actuary's Study. We also note that there is only about a 40% probability of achieving the assumed rate of 7.0% over the next 10 years. Using the longer-term horizon capital market assumptions (i.e., 20 to 30-years) produced a 50th percentile result of 6.95%. Without going back and attempting to reproduce what would have been the case in 2017, we think it is possible that those probabilities would have been higher at the time the assumptions were originally set.

Based upon our analysis, the authors would consider the retained actuary's recommended investment return assumption of 7.00% to be at the upper end of the range that they would consider to be reasonable for the 2019 valuation. Although we believe that this assumption is reasonable at this time, we recommend that the Board consider lowering the investment return assumption from its current level. Doing so will reduce the chances that the assumption may become unreasonable prior to the next experience study. If that were to happen, the actuary would have to issue a qualified report or change the assumption. (Recall that actuarial assumptions must be reasonable in every valuation, not just in the one immediately following an experience study.)

Interest on Member Accounts

We agree with the retained actuary that this is a minor assumption that has a very small impact on the actuarial valuations results. We believe that the assumption of 3.50% is reasonable based upon the adopted 2.60% price inflation assumption. If the Board decides to lower the price inflation assumption, they may wish to lower this assumption as well for consistency.

Wage Growth

We believe that the wage growth assumption of 3.25% is reasonable for the 2019 valuation, although slightly on the high side. Even with a price inflation assumption of 2.25%, we think a wage growth assumption of 3.25% could still be considered reasonable. However, we would be more comfortable with a wage growth assumption between 2.75% or 3.00%.

Payroll Growth

We agree with the retained actuary that the payroll growth assumption should not exceed the wage growth assumption. Therefore, given the wage growth assumption of 3.25%, we think the payroll growth assumption of 3.25% is reasonable.

Demographic Assumptions

In general, we believe the assumptions developed in the Demographic Assumptions Study comply with applicable ASOPs. We generally concur with the retained actuary's philosophy in the demographic assumption setting process: (1) don't overreact, (2) anticipate trends and (3) simplify. However, we noted certain instances where it appeared that certain trends that appear to be reemerging from previous Experience Studies are being reflected perhaps too slowly. An example of this is the disability assumption. Page 31 of the Experience Study indicated that actual disabilities were significantly less than that assumed over the Experience Study period. However, only minor changes were made to the recommended disability rates.

We commend the retained actuary for performing demographic analyses both on a head count and liability-weighted basis and generally giving the liability-weighted experience more credibility than the head count weighted results.

We suggest that the retained actuary include additional disclosure of any credibility procedures used in the demographic assumption setting process as required by ASOP No. 25, Credibility Procedures.

Actuarial Methods

We concur with the decision to retain the Entry Age Actuarial Cost Method. We believe the asset valuation method satisfies the requirements of ASOP No. 44, Selection and Use of Asset Valuation Methods for Pension Valuations. With respect to the amortization policy, we suggest continued discussion of the pros and cons of establishing fixed periods over which changes in the unfunded accrued liability (UAL) are amortized resulting from assumption or benefit changes. We understand that the Board has decided to defer the establishment of fixed periods for these items, however we think it may be in the Board's interest to establish the periods before they are actually needed.

Mortality

Given that generational mortality is being used for actuarial valuation purposes, we would have expected to see the proposed actual to expected (A/E) ratios very close to 100% for all groups. We note that the proposed School Females and Other Females A/E ratios of 94% and 96% respectively. Additionally, the retained actuary performs significant adjustments to the proposed RP-2014 tables (through age setbacks, set forwards, or % increases or decreases in certain rates). However, the retained actuary has not disclosed any credibility analysis that would justify this level of adjustment to the tables.

We suggest that in future Experience Studies the retained actuary provide justification (i.e., a credibility analysis) for the adjustments made to the published mortality tables.

Option Factors

As a result of the adoption of a new investment return assumption and post-retirement mortality tables, the retained actuary developed new option factors, or more precisely, factors (e.g., annuities, costs of insurance) from which option factors can be derived. SPERS provided these factors to us and the retained actuary provided us the retiree and beneficiary mortality tables upon which the factors were based.

The mortality tables used to produce the factors were a blend of ten (5 different valuation groups x 2 sexes) different post-retirement mortality tables used for actuarial valuation purposes. Mortality improvement was reflected in the factors by including mortality improvement to calendar year 2035. We were able to replicate the provided mortality rates to a high degree of accuracy. However, we noted that there was a significant change in the mortality rates between the ages of 50 and 49. It appears that for post-retirement mortality purposes, the retained actuary is using the RP-2014 Employee mortality tables for ages below 50. We replicated the retained actuary's factors for a sample combination of ages (age 60 for the retiree and beneficiary; 120 months of payment for Opt 2). Presented below are the results of our analysis. Based upon that analysis, we can confirm that the retained actuary's development of the factors is correct within reasonable bounds.

	Factors Upon Which Optional Forms of Payment are Determined								
	Opt 1	Opt 2	Opt 3	Opt 4-25	Opt 4-50	Opt 4-75	Opt 4-100	Opt 5	Opt 6
Retained Actuary	1.4874	142.4127	139.8618	143.2803	146.6989	150.1175	153.5361	142.1550	124.9331
GRS	1.4923	142.7204	139.8618	143.2804	146.6989	150.1175	153.5361	142.1550	124.9330

	Bridge Factors to age 62					
	Opt 3	Opt 4-25	Opt 4-50	Opt 4-75	Opt 4-100	Opt 5
Retained Actuary	0.1593	0.1557	0.1523	0.1490	0.1458	0.1575
GRS	0.1593	0.1557	0.1523	0.1490	0.1458	0.1575

SECTION IV

REVIEW OF ANNUAL VALUATION REPORT

We believe that the 2019 valuation report is thorough, generally understandable, and the content is appropriate for the intended users. We note that the retained actuary made several changes to the report based on our suggestions in the 2014 actuarial audit. A few of our recommended changes from the last audit were not made and are repeated here. We also include some new observations based on our current views of the Actuarial Standards of Practice (ASOPs) and trends in the actuarial community. The ASOPs change frequently. There is a new ASOP in force (ASOP No. 51, Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions) since the last actuarial audit and three of the pension ASOPs are currently under revision. As much as possible, we have restricted our comments about compliance with the ASOPs to the versions in effect as of the valuation date.

Retained Actuary's Cover Letter

1. As mentioned in our 2014 actuarial audit, the retained actuary includes the following sentence in the cover letter:

   > "The Investment Board has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in Appendix C."

   In accordance with ASOP No. 41, Actuarial Communications, and ASOP No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions, we suggest that the retained actuary include the statutory reference that gives the Investment Board the authority to adopt the actuarial assumptions for valuation purposes.

2. The third paragraph of the cover letter refers to assumptions which, "in combination offer [the retained actuaries'] best estimate of anticipated experience affecting the System." The term "best estimate" is not defined or used in the Actuarial Standards of Practice. The ASOPs require assumptions selected by the actuary to be reasonable, but not necessarily best estimates. Best estimate assumptions have specific significance for accounting purposes that may or may not be consistent with the retained actuaries' use of the term. We also observe that in paragraph 4, the retained actuaries state that, "No one set of assumptions is uniquely correct." Which seems somewhat at odds with the assumptions being the best estimate. We suggest that the retained actuary either define the term "best estimate" in the context of the report or refrain from using the term.

3. The fourth paragraph of the cover letter refers to future "financial soundness". ("Sound financing" is also used twice in Appendix C in the discussion of the actuarial cost method.) While the term "financial soundness" is not referred to in the ASOPs, we observe that ASOP No. 1, Introductory Actuarial Standard of Practice, Section 2.3, *Actuarial Soundness*, states:

   > "the phrase 'actuarial soundness' has different meanings in different contexts and might be dictated or imposed by an outside entity. In rendering actuarial services, if the actuary identifies the process or result as 'actuarially sound,' the actuary should define the meaning of 'actuarially sound' in that context."

   We suggest that the retained actuary define the term "financial soundness" in the context used in the report or refrain from using the term.

Retained Actuary's Section I – Executive Summary

1. As mentioned in our 2014 actuarial audit, we find the Executive Summary to be a little long to be compatible with the usual idea of an Executive Summary. Perhaps it could be retitled. The discussion itself is very good, but reads more like the full results of the valuation as opposed to a brief summary.

2. Page 1 includes a discussion about the change in Required Contribution Rates as well as a table summarizing the development of the current Required Contribution Rate. The discussion refers to the Contribution Rate Funding Policy in Appendix D, however it is in Appendix E. We agree with the interpretation of the policy supporting the reduction in the employer rates for Sheriffs & Deputies and Protection Occupations and leaving the employer rate for Regular members unchanged.

   We note that the employee contribution rates for Sheriffs & Deputies and Protection Occupations also decreased and there is no discussion to that effect. The discussion in this section and in the Appendix E summary of the Contribution Rate Funding Policy is silent on employee contribution rates. The allocation between employer and employee shares of the Required Contribution only appears to be discussed within the plan provisions of each group in Appendix D. Based on that information, we agree with the calculations of the new employee rates.

   In our view, since the Board will in effect be changing the employee contribution rates as a result of the June 30, 2019 actuarial valuation, this information merits highlighting. For the benefit of those readers not familiar with the process, we suggest that the actuary discuss the impact on employee contribution rates in the Executive Summary.

3. Page 2 includes a discussion about changes in membership, however, as discussed in our 2014 audit report we are unable to find the actual reported payroll anywhere in the retained actuary's report. The table on page 15 discloses projected payroll for the upcoming fiscal year of $8,382 million as opposed to the actual payroll. The total salary data in the retained actuary's groomed data file was $7,917 million. The total payroll shown in Section VI, Risk Considerations, was $8,151 million. If we use the actuary's assumed payroll growth of 3.25% per year, we do not match the actuary's projected payroll using either available 2019 figure. We recommend that the retained actuary disclose the actual payroll that SPERS reported in the data that it submitted and clarify the projection methodology.

4. Page 6 includes a discussion of the growth of the UAL over the past few years. However, the discussion does not include any mention of the future expected increase in UAL as a result of actuarial amortization payments being less than the nominal interest on the UAL (referred to in the actuarial community as "negative amortization"). Exhibit 16 on page 42 shows an amortization schedule for Regular Members which indicates that if all assumptions are met, the UAL is expected to increase in nominal dollars each year for the next three years and not decline to its present level until the fiscal year ending June 30, 2027. ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, Section 4.1 m. requires the actuary to disclose:

   > "a qualitative description of the implications of the contribution allocation procedure or plan sponsor's funding policy on future expected plan contributions and funded status in accordance with section 3.14.2. The actuary should disclose the significant characteristics

of the contribution allocation procedure or plan sponsor's funding policy, and the significant assumptions used in the assessment"

There has been significant attention to negative amortization in the actuarial community over the last ten or so years. We consider negative amortization to be an important implication of the actuarial amortization schedule which warrants highlighting in the Executive Summary. We suggest that the actuary highlight the negative amortization inherent in the amortization policy and disclose their view of its implications.

5. Page 9 shows a history of the amortization period for the UAL with the 2019 amortization period being 22 years. There is discussion about the Actuarial Contribution Rate and the Required Contribution Rate. The description in the chart legend says it is based on the "statutory contribution rate," which we presume to mean the Required Contribution Rate. We have verified that the implied amortization period based on the Required Contribution Rate for Regular Members is 22.1 years for the 2021 fiscal year contribution. The corresponding periods for the other two groups are 2.4 years for Sheriffs & Deputies and 0.6 years for Protection.

   We also note that the remaining amortization periods resulting from the Actuarial Contribution Rates are greater than the figures in the chart. The remaining amortization period based on the Actuarial Contribution Rate is 24.1 years for Regular, infinite for Sheriffs & Deputies, and 6.9 years for Protection. We include some additional discussion on the actuarially determined amortizations for Sheriffs & Deputies later in this report.

Retained Actuary's Section II – System Assets

We find this section to be well presented and we have no comments.

Retained Actuary's Section III – System Liabilities

1. There is a description on page 27 of the transfer of assets each year for the employees whose membership group changed since the prior valuation. The procedure describes transfers based on the funded portion of the liability being transferred out of a particular group. Based on this methodology, one would reasonably expect that the funded percent for a group would not change after a transfer out (the assets and liabilities transferred out have the same funded status as the group as a whole). Transfers into a group may change the funded status since the receiving group may have a different funded status from the sending group. In general, the principles appear to describe a reasonable procedure for linking plan funding with transfers between groups.

   On pages 21 and 22, the net asset transfers between groups add up to zero. The bottom of page 27 shows the counts of transfers between groups and a summary of the impact on UAL for the three groups. The sum of the impact of the three UAL transfers is not zero. The description concludes with, "[t]he asset values after the transfers and the liabilities for the employees reside in their current membership group and are used to prepare the final valuation results." We expect that this is a result of the fact that the liability for a transferred member in a new group may be different than the liability for the same individual in the old group due to different assumptions and benefit provisions. Given that the Protection group has the highest funded percent and the Regular group has the lowest funded percent, it is reasonable to expect that the transfers this year would leave Regular and Sheriffs & Deputies better off and Protection worse off, as is the case.

We suggest that the retained actuary could disclose more information about the liability for the members transferring (before and after) to give a better understanding of the total non-zero impact on the UAL.

2. Page 30 shows the development of the aggregate actuarial gain or loss for the year. The total normal cost for the year is shown as $825 million as of the beginning of the year. The implied total normal cost from page 37 of the 2018 valuation report is $896 million, roughly $71 million higher. The actual payroll in 2019 was lower than expected, so it is reasonable to expect that the actual normal cost will be lower than expected. However, if we apply the total normal cost rates to the implied payroll for 2019 (based on the actual 2019 contributions), we get total normal cost of $879 million, $54 million higher than reported. There appears to be a disconnect. Another way of viewing this is that the expected UAL based on the 2018 report was $6,858 million, but it was only $6,839 in the 2019 gain/loss development. If contributions were lower than expected as a result of lower actual payroll, then the expected UAL normally would be higher than projected in the previous year, not lower.

   One possible reason is that the normal cost shown in this year's report is a closed-group normal cost (i.e., it does not reflect expected new entrants). If that is the case, it is not entirely consistent with the funding of the plan as a percent of payroll throughout the year. Another possibility is the timing of interest on the normal cost, but again this does not appear to explain the difference.

   We suggest that the actuary clarify the normal cost development in the gain/loss schedule, perhaps by showing the normal cost by membership group with corresponding payroll and normal cost rates and a discussion of interest timing.

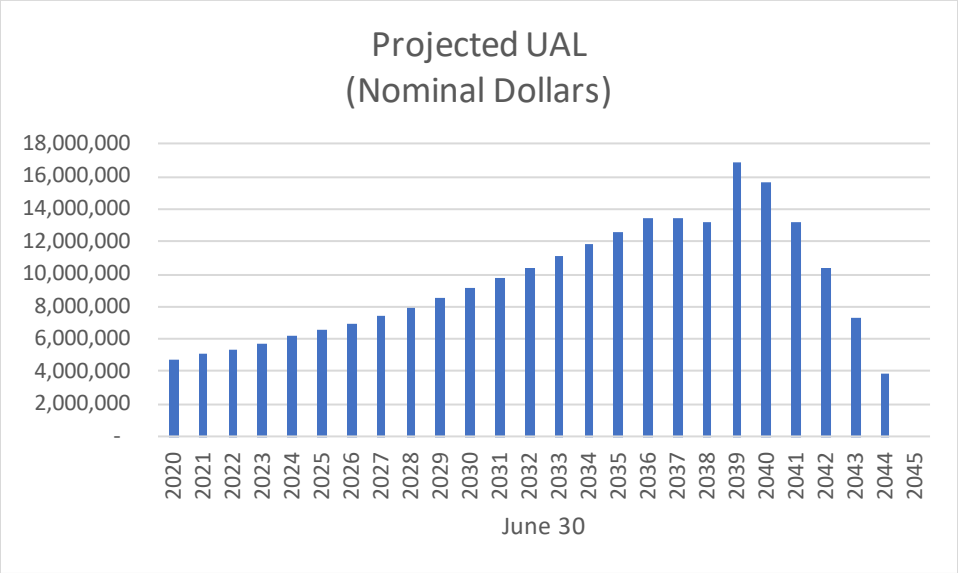
Retained Actuary's Section IV – System Contributions

1. Page 37 shows the roll forward of the UAL to July 1, 2020 for each of the three plans and in total. As mentioned above, we are unable to match the projected payroll figures. The remaining calculations are internally consistent.

2. Pages 38, 39, and 40 show the amortization schedules for the three plans. We were able to confirm that each amortization layer prior to 2019 was amortized using the expected payment from the Actuarial Contribution Rates determined in the 2018 valuation. The new gain/loss layer is effectively a balancing item so that the projected UAL ties to the calculation on page 37. In effect, this means that any additional contributions from the Required Contribution Rate exceeding the Actuarial Contribution Rate during the year are reflected in the 2019 gain/loss layer. As long as contributions exceed the actuarially determined amount and the amortization period for a new gain/loss layer is greater than the period for the initial UAL layer, we would expect that the net UAL contribution will be lower than it otherwise would if the excess contributions were applied to all outstanding layers. This will increase the risk that the net UAL payment will result in negative amortization. It may even be possible for the UAL to be positive and the net payment in the first year to become negative. Once the period for the initial UAL falls below the 20-year period for a new gain/loss layer, the situation would reverse.

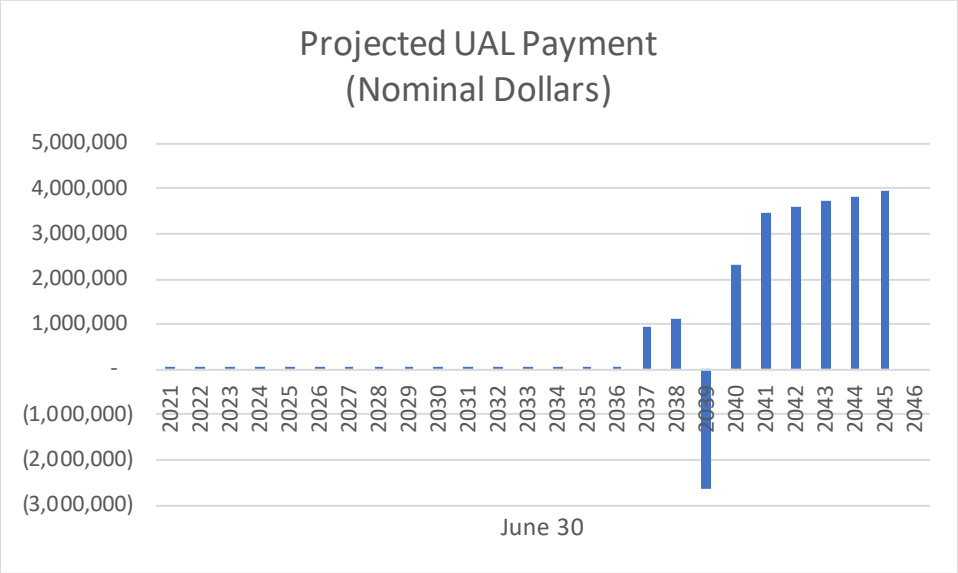
3. Page 39 shows the amortization schedule for Sheriffs & Deputies. The net projection UAL as of July 1, 2020 is $4,743,401 and the net annual payment is $14,848 which equates to 0.01% of payroll. We match these calculations; however due to the offsetting amortization layers the resulting net payment of $14,848 is very low and results in an infinite amortization period. Said another way, the UAL for this group is expected to grow faster than payroll. Page 49 shows an amortization schedule for the Regular Membership, but there is no similar schedule for Sheriffs & Deputies. Our analysis of the current amortization schedule projects that the UAL would more than triple by 2039 under this schedule as shown in the following graph.

Sheriffs & Deputies



The corresponding dollar contributions exhibit significant volatility as the layers get paid off beginning in 16 years.

Sheriffs & Deputies



We note that the Sheriffs & Deputies UAL is extremely small in comparison to the whole System. Moreover, since the Required Contribution Rate exceeds the Actuarial Contribution Rate, it is not unlikely that this group's funded percent will exceed 100% in the next few years which would wipe out all the layers under the Contribution Rate Funding Policy thus eliminating this future volatility. However, that is not a given.

The Conference of Consulting Actuaries' White Paper on Actuarial Funding Policies and Practices for Public Pension Plans (CCA White Paper) suggests combining layers to avoid the "tail volatility" exhibited in this type of amortization schedule. Perhaps more importantly, although in this situation the amortization period from the Required Contribution Rate is 2.4 years since the contribution margin is wide, it may be possible for a situation to occur wherein the amortization period from both the Required Contribution Rate and the Actuarial Contribution Rate is infinite.

We suggest that the actuary consider reviewing the Funding Rate Contribution Policy with SPERS for managing tail volatility and unusually long net amortization periods.

4. Page 42 shows the amortization schedule for Regular Membership assuming all actuarial assumptions are met and all current amortization layers are applied. We were able to match the calculations and have the following observations.

    a. The schedule clearly shows negative amortization with the maximum expected UAL of $6,547 occurring in the fiscal year ending June 30, 2024. We suggest that this could be emphasized with a footnote since the general reader may not scrutinize the table in detail.
    b. The amortization schedule as shown assumed contributions will be made at the Actuarial Contribution Rate, not the Required Contribution Rate. While this is reasonable, we suggest that the disclosure could be clarified to state that the projected contributions shown are determined based on the Actuarial Contribution Rates. Otherwise, a general reader could infer that "all assumptions being met" includes the assumption that contributions are at the statutory Required Contribution Rate.
    c. The amortization schedule shows the UAL being paid off in 25 years, consistent with the longest amortization period remaining in the current schedule. However, this is inconsistent with the 22 years remaining quoted in the Executive Summary. We believe that this difference is attributable to the difference between the Actuarial Contribution Rate and the Required Contribution Rate and suggest that this could be clarified with a footnote.

Retained Actuary's Section V – Historical Funding and Other Information

1. Page 48 shows the schedule of contributions and the percent of the Actuarial Contribution Rate (ACR) contributed each year. For the year ending June 30, 2019, the dollar amounts shown match the actual contributions made and the percents are shown as 100% of the ACR for each plan. However, our understanding is that the actual contributions were made at the Required Contribution Rates which all exceed the ACR. We would have expected to see dollar calculations of the ACR that are lower than the actual contributions made and percents of ACR in excess of 100% in the 2019 row of this schedule.

Retained Actuary's Section VI – Risk Considerations

This is a new section since the prior actuarial audit. The risk discussion and exhibits are generally consistent with the guidance in ASOP No. 51. We provide a few specific comments below.

1. The plan maturity metrics are a relatively new addition to actuarial practice. ASOP No. 51 requires disclosure of the history of plan maturity metrics that are appropriate in the actuaries' professional opinion. The ASOP does not specify the length of history to be provided and the retained actuary provided schedules that go back before the implementation of the ASOP. We

believe this is useful information that informs the reader of the general trend of these metrics over time. We commend the retained actuaries for including the additional history.

2. Some of these risk metrics, such as the asset volatility ratio, may be difficult for the general reader to assess. Page 56 shows both the history of the asset volatility ratio and an estimated impact on the ACR for a return 10% lower than assumed. We believe that this type of comparison helps the general reader assess the magnitude of the impact of these risk metrics and commend the retained actuary for including this schedule. This schedule could be enhanced by using the standard deviation of the expected portfolio return as opposed to 10%, or by giving the probability of returns being 10% lower than assumed in a given year. The disclosure points out that the impact of asset smoothing is not reflected, but it does not indicate that the estimated impact is based on an amortization of the asset loss which appears to be 20 years, consistent with the gain/loss amortization period under policy. This could be clarified.

3. Page 57 shows the negative net cash flows as a percent of assets. We agree that negative net cash flows may pose a risk and they are suggested as a disclosure in ASOP No. 51. However, we think it is important to point out that one purpose of prefunding retirement benefits is so that a portion of investment return pays plan benefits – this is the same as having a negative net cash flow. Fully funded plans, for example, would be expected to have negative cash flow. They are sensitive to investment volatility not because of the negative cash flow *per se*, but rather because such plans typically would have a high ratio of assets to payroll. The retained actuaries' discussion begins with a statement that plans with negative net cash flows will experience increased sensitivity to investment volatility. It is not entirely clear that this is the case. The order in which high and low rates of return are realized may affect the sensitivity differently for plans with positive and negative net cash flows. The discussion goes on to state that a negative net cash flow of more than 5% causes significant concern without explanation as to why this is a significant threshold. For example, a fully funded retiree only plan may anticipate a negative net cash flow of greater than 5% which may not be a significant risk.

Retained Actuary's Appendices

1. Pages B-6 and B-9 discuss the Favorable Experience Dividend (FED) established under State Code Section 97B.49F(2). There is no description of how assets would be transferred into the FED Reserve. The actuarial assumptions on page C-4 state that there is no cost-of-living adjustment assumed to be granted to future retirees.

   The application of the statute is not entirely clear, but appears to indicate that transfers into the FED Reserve (and consequently additional benefits payable to retirees) would be possible if not required when the System is over 100% funded. Given that the estimated period to reach 100% funded is 22 years and that the Required Contribution Rate anticipates a margin above the Actuarial Contribution Rate, it is reasonable to expect that transfers into and corresponding benefit payments out of the FED Reserve could be made within the lifetime of some (possibly many) of the current active members.

   According to ASOP No. 4, Section 3.5.3 a., this feature may be considered a plan provision which is difficult to measure which may need to be reflected in the valuation. We suggest that the actuary clarify their rationale for not reflecting this plan provision in the valuation.

2. Pages C-5 and C-6 disclose the retained actuaries' mortality assumptions as variants to RP-2014 with MP-2017 improvement scale. The report does not indicate what mortality rates were used in cases where the published tables have no rates (for example, the published tables do not have retiree mortality rates below age 50 yet there are retirees or beneficiaries in the data below that age). The disclosure does not indicate whether MP-2017 applies with a base year of 2014 or 2006 with revisions to the base table as recommended by the Society of Actuaries. In addition, certain setbacks and increases in rates were described, but it was not clear whether those applied to the base mortality rates, the mortality improvement rates, or both. We presume it was the base mortality rates only.

3. Page C-11 discusses the amortization policy adopted in 2013. The policy is generally consistent with the CCA White Paper. The period for plan amendments is not specified but is referred to as "demographically appropriate" at the selection of the Investment Board. Moreover, the amortization layers are eliminated if the funded percent exceeds 100%. This could create a situation, particularly for Sheriffs & Deputies or Protection Occupations, where an appropriate funding period is set for a plan amendment increase, a subsequent gain eliminates all layers, and a subsequent loss results in a new amortization of 20 years regardless of the period originally selected for the plan amendment.

4. Page E-4 describes the Contribution Rate Funding Policy which outlines the adoption of the total employer and employee contribution rates. The portion of the total rate that is allocated to the employees depends on the plan provisions for each group and is disclosed with the plan provisions in Appendix D. However, given that the Board adopts the final contribution rates, we suggest it would be a helpful clarification for this section to discuss the allocations between employer and employees for each group.

GASB No. 67 Report

1. The retained actuaries' 2019 GASB Statement No. 67 report does not contain an exhibit supporting the discount rate, but we understand that it is provided as a separate exhibit. We find this unusual, but see no particular problem with it.

2. Page 22 states that the assumed rate of investment return is 7.00%, net of expenses. This is consistent with the assumption used for funding purposes. Technically, GASB Statement No. 67 requires the discount rate used to be net of investment expenses only. In that case, we would expect the discount rate to be slightly less than the assumed rate of return due to different treatment of administrative expenses. Since the administrative expenses appear to be small as a percent of assets (roughly 0.05%), this would likely not have a material impact on the valuation. However, we suggest that the retained actuary address this discrepancy.

December 5, 2019 Valuation PowerPoint Presentation

In addition to reviewing the valuation report, we also reviewed the December 5, 2019 presentation of the valuation to the Board. In general, we felt the overall presentation was a fair representation of the valuation. We have the following observations:

1. Under ASOP No. 41, Actuarial Communications, this presentation may be considered part of the valuation communication. Section 4.1.3 j. of ASOP No. 41 requires the actuary to identify any documents comprising the report. In our opinion, this would be satisfied if the retained actuaries incorporated the valuation report by specific reference in the presentation itself.

2. Slide 30 shows a graph of retiree liability as a percent of payroll which is not included in the valuation report. We suggest the actuary include it in the full actuarial report, if it is not already in the risk report (a review of which was not part of this engagement).

SECTION V

REPLICATION VALUATION

Replication of June 30, 2019 Valuation Results

Introduction

The goal of a replication audit is to verify that the main valuation results can be independently duplicated to within reasonable tolerances. While valuation systems will tend to produce different results, the differences should generally be minor unless there is an actual error in either the retained actuary's or the auditing actuary's work. Replication of results within 2%-5% depending on the metric being compared are generally viewed as a successful replication.

The below table summarizes tolerances that were used in performing this actuarial audit.

Category	Active & Inactive Member Tolerance	Retired Member Tolerance	Aggregate Tolerance
Present Value of Future Benefits	2.0%	2.0%	2.0%
Actuarial Accrued Liability	5.0%	2.0%	2.0%
Normal Cost	5.0%	N/A	5.0%
Computed Contribution Rate	N/A	N/A	5.0%

The above tolerances were applied at the division level (i.e., Regular Members, Sheriffs and Deputies and Protection Occupation). When applicable (e.g., present value of future benefits), active and inactive in the table above is meant to represent the total for the non-retired population. The computed contribution rate tolerance was applied to the total required contribution rate. Tolerances are applied with professional judgement considering the complexity of the benefits being valued, the limitations of the data, the complexity of the assumptions being applied and the materiality of any observed difference.

It is not uncommon for the differences in actuarial accrued liabilities and normal costs to be in opposite directions (the auditing actuary's accrued liabilities are greater, but the normal costs are lower or vice-versa). This can happen due to minor differences in the way valuation systems allocate the present value of benefits between the past and the future. Because of this, the tolerance range on accrued liabilities is larger than on the present value of benefits.

The following page provides an overview of the principal valuation results.

Principal Valuation Results

SYSTEM MEMBERSHIP - TOTAL	Retained Actuary	GRS	+/- Diff	% Diff
Active Membership				
Number of Members	172,272	172,272	-	-
Projected Payroll for Upcoming Fiscal Year[1]	$8,382M	$8,416M	+$34M	+0.4%
Average Salary	$48,658	$48,853	+$195	+0.4%
Average Age	45.2	45.1	-0.1	-0.2%
Average Years of Service	11.2	11.1	-0.1	-0.9%
Inactive & Retiree Membership				
Number not In Pay Status[2]	71,110	71,116	+6	+0.0%
Number of Retirees/Beneficiaries	123,513	123,513	-	-
Average Annual Benefit	$17,433	$17,411	-$22	-0.1%

ASSETS AND LIABILITIES - TOTAL	Retained Actuary	GRS	+/- Diff	% Diff
Net Assets				
Market Value of Assets (MVA)	$34,011M	$34,011M	-	-
Actuarial Value of Assets (AVA)	$33,324M	$33,324M	-	-
Present Value of Future Benefits				
Retired Members	$21,506M	$21,472M	-$34M	-0.2%
Inactive Members	$945M	$921M	-$24M	-2.5%
Active Members	$25,302M	$25,196M	-$106M	-0.4%
Total Liability	$47,753M	$47,589M	-$164M	-0.3%
Actuarial Accrued Liability	$39,801M	$39,992M	+$191M	+0.5%
Unfunded Actuarial Accrued Liability	$6,477M	$6,668M	+$191M	
Funded Ratio				
AVA / AAL	83.73%	83.33%	-0.40%	
MVA / AAL	85.45%	85.04%	-0.41%	

SYSTEM CONTRIBUTIONS - BY GROUP FOR FISCAL YEAR 2021	Retained Actuary	GRS	+/- Diff
Required Contribution Rate, Regular Members	15.73%	15.73%	-
Employer Contribution Rate	9.44%	9.44%	-0.00%
Employee Contribution Rate	6.29%	6.29%	+0.00%
Total Actuarial Contribution Rate	15.44%	15.39%	-0.05%
Shortfall/(Margin)	-0.29%	-0.34%	-0.05%
Required Contribution Rate, Sheriffs and Deputi	18.52%	18.52%	-
Employer Contribution Rate	9.26%	9.26%	-
Employee Contribution Rate	9.26%	9.26%	-
Total Actuarial Contribution Rate	16.88%	18.06%	+1.18%
Shortfall/(Margin)	-1.64%	-0.46%	+1.18%
Required Contribution Rate, Protection Occupat	16.02%	16.49%	+0.47%
Employer Contribution Rate	9.61%	9.89%	+0.28%
Employee Contribution Rate	6.41%	6.60%	+0.19%
Total Actuarial Contribution Rate	15.35%	16.49%	+1.14%
Shortfall/(Margin)	-0.67%	0.00%	+0.67%

[1] *GRS estimated annualized payroll for the upcoming fiscal year by increasing the June 30, 2019 GASB 67 reported Covered Payroll by 3.25%.*

[2] *GRS excluded Inactive Retired Reemployed records in the counts*

Principal Valuation Results (Discussion)

In aggregate, GRS replicated the retained actuary's results to within acceptable tolerances.

Present Value of Future Benefits (PVFB)

GRS replicated the June 30, 2019 Actuarial Valuation total PVFB to within $164 million out of $47.8 billion (or a 0.3% difference). As is typically expected, accuracy was higher for retired members (0.2% difference in PVFB) compared to active and inactive members (0.4% and 2.5% differences respectively).

Actuarial Accrued Liability (AAL) & Unfunded Actuarial Accrued Liability (UAAL)

The GRS Actuarial Accrued Liability in total was within 0.5% of the retained actuary's figure. Taking the Actuarial Accrued Liability and subtracting off System assets gives Unfunded Actuarial Accrued Liability. Since this measure is the net difference between two large values, there is no tolerance test as a percentage. In dollars, GRS matched the UAAL calculation to within $191 million out of $6.5 billion.

Computed Contribution Rates

For Regular Membership, the computed total Actuarial Contribution Rate was similar to the retained actuary, 15.39% versus 15.44%. For the Special Services groups, GRS computed Actuarial Contribution Rates that were higher than the retained actuary's figure. This was a result of Present Value of Future Benefits being estimated higher for Special Services than compared to the results for the Regular membership.

Membership Data by Group

Below is a summary of the Active & Retired Membership Data reported by the retained actuary in the June 30, 2019 Valuation report compared with our study of the data received from SPERS.

GRS replicated the retained actuary's reported demographic data almost perfectly. The minor discrepancies are likely due to rounding.

ACTIVE MEMBERSHIP BY GROUP	Retained Actuary	GRS	+/- Diff	% Diff
Regular Membership				
Number of Members	163,317	163,317	-	-
Average Age	45.4	45.4	-	-
Average Years of Service	11.2	11.1	-0.1	-0.9%
Sheriffs & Deputies				
Number of Members	1,664	1,664	-	-
Average Age	40.7	40.7	-	-
Average Years of Service	14.2	14.1	-0.1	-0.7%
Protection Occupations				
Number of Members	7,291	7,291	-	-
Average Age	41.0	41.0	-	-
Average Years of Service	10.5	10.4	-0.1	-1.0%

RETIRED MEMBERSHIP BY GROUP	Retained Actuary	GRS	+/- Diff	% Diff
Regular Membership				
Number of Members	119,297	119,297	-	-
Average Annual Benefit	$17,046	$17,046	-	-
Sheriffs & Deputies				
Number of Members	1,039	1,039	-	-
Average Annual Benefit	$33,371	$33,371	-	-
Protection Occupations				
Number of Members	3,177	3,177	-	-
Average Annual Benefit	$25,892	$25,892	-	-

Present Value of Future Benefits

Regular Membership				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
Active Members				
Retirement Benefits	$21,514	$21,398	-$116	-0.5%
Death Benefits	262	343	81	+31.1%
Termination Benefits	1,131	1,047	-84	-7.4%
Disability Benefits	452	442	-10	-2.3%
Total	$23,359	$23,230	-$129	-0.6%
Inactive Members				
Vested Members	769	745	-24	-3.1%
Nonvested Members	112	112	0	+0.2%
Retired Members and Beneficiaries	20,277	20,225	-52	-0.3%
Total Present Value of Future Benefits	**$44,517**	**$44,312**	**-$204**	**-0.5%**

Sheriffs & Deputies				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
Active Members				
Retirement Benefits	$523.1	$525.3	$2.2	+0.4%
Death Benefits	$7.1	$9.2	$2.1	+29.3%
Termination Benefits	$22.8	$20.8	-$2.0	-8.6%
Disability Benefits	$16.2	$16.2	$0.0	+0.3%
Total	$569.2	$571.5	$2.4	+0.4%
Inactive Members				
Vested Members	$11.4	$11.1	-$0.3	-2.3%
Nonvested Members	$0.3	$0.3	$0.0	+0.1%
Retired Members and Beneficiaries	$366.4	$374.3	$7.9	+2.2%
Total Present Value of Future Benefits	**$947.3**	**$957.3**	**$10.1**	**+1.1%**

Protection Occupation				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
Active Members				
Retirement Benefits	$1,167.9	$1,190.4	$22.5	+1.9%
Death Benefits	22.7	26.7	4.0	+17.7%
Termination Benefits	133.1	126.7	-6.4	-4.8%
Disability Benefits	50.0	50.6	0.6	+1.2%
Total	$1,373.7	$1,394.4	$20.7	+1.5%
Inactive Members				
Vested Members	50.1	49.6	-0.5	-1.0%
Nonvested Members	2.7	2.8	0.2	+6.4%
Retired Members and Beneficiaries	862.7	872.8	10.1	+1.2%
Total Present Value of Future Benefits	**$2,289.2**	**$2,319.6**	**$30.5**	**+1.3%**

Grand Total				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
Active Members				
Retirement Benefits	$23,205	$23,114	-$91	-0.4%
Death Benefits	291	379	88	+30.0%
Termination Benefits	1,287	1,195	-92	-7.2%
Disability Benefits	518	509	-10	-1.9%
Total	$25,302	$25,196	-$106	-0.4%
Inactive Members				
Vested Members	831	806	-25	-3.0%
Nonvested Members	115	115	0	+0.3%
Retired Members and Beneficiaries	21,506	21,472	-34	-0.2%
Total Present Value of Future Benefits	**$47,753**	**$47,589**	**-$164**	**-0.3%**

Present Value of Future Benefits (Discussion)

While the Present Value of Future Benefits in total matched the retained actuary's value to within 0.3%, the individual group by group breakdown resulted in more variance. We still believe the results to be within reasonable tolerances.

Special Services (Sheriffs & Deputies and Protection Occupation)

The total Present Value of Future Benefits for the Special Services groups were higher than the retained actuary in average by 1% to 2%. While this is within our acceptable tolerances, the difference was higher than that observed for the Regular Membership group.

As previously mentioned, it is not unusual for differences in results to occur as a result of different applications of the same assumptions by Actuaries. Differing calculations, such as application of the System's complex hybrid service formula can lead to varying results.

Active Member Liabilities by Decrement

Results when broken down by individual decrement (i.e., by retirement, death, termination and disability benefits) experienced more variance than when observed in total.

We believe this occurred as a result of differing methods of decrement application from actuary to actuary. There is no one right answer for application of actuarial assumptions. For example, GRS classifies a non-vested active member death as a termination benefit, meanwhile the retained actuary could be classifying this as a death benefit. Another potential source of differences is that the retained actuary applies decrement assumptions in a method that is referred to as "competing rates" (i.e., decrements within the same tested year impact one another). The GRS methodology for applying decrements assumes rates within a given tested year operate independently of each other. This difference in application can lead to liabilities being categorized differently. Since the differences by decrement type between the retained actuary and GRS offset one another and in aggregate are close, we do not believe this is a cause for concern and believe the computed Present Value of Future Benefits as of June 30, 2019 to be reasonable.

Development of Unfunded Actuarial Accrued Liability

Regular Membership				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
1. Present Value of Future Benefits	$44,517	$44,312	-$204	-0.5%
2. Present Value of Future Normal Costs	7,192	6,858	-334	-4.6%
3. Actuarial Accrued Liability (1) - (2)	$37,324	$37,454	$130	+0.3%
4. Actuarial Value of Assets	$30,860	$30,860	$0	+0.0%
5. Unfunded Actuarial Accrued Liability (3) - (4)	$6,464	$6,594	$130	
6. Funded Ratio (4) / (3)	82.68%	82.39%	-0.29%	

Sheriffs & Deputies				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
1. Present Value of Future Benefits	$947.3	$957.3	$10.1	+1.1%
2. Present Value of Future Normal Costs	$216.5	$211.3	-$5.2	-2.4%
3. Actuarial Accrued Liability (1) - (2)	$730.8	$746.1	$15.3	+2.1%
4. Actuarial Value of Assets	$723.8	$723.8	$0.0	+0.0%
5. Unfunded Actuarial Accrued Liability (3) - (4)	$7.0	$22.3	$15.3	
6. Funded Ratio (4) / (3)	99.04%	97.01%	-2.03%	

Protection Occupation				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
1. Present Value of Future Benefits	$2,289.2	$2,319.6	$30.5	+1.3%
2. Present Value of Future Normal Costs	$542.8	$527.8	-$15.0	-2.8%
3. Actuarial Accrued Liability (1) - (2)	$1,746.4	$1,791.8	$45.4	+2.6%
4. Actuarial Value of Assets	$1,740.2	$1,740.2	$0.0	+0.0%
5. Unfunded Actuarial Accrued Liability (3) - (4)	$6.1	$51.6	$45.4	
6. Funded Ratio (4) / (3)	99.65%	97.12%	-2.53%	

Grand Total				
($'s in Millions)	Retained Actuary	GRS	+/- Diff	% Diff
1. Present Value of Future Benefits	$47,753	$47,589	-$164	-0.3%
2. Present Value of Future Normal Costs	7,952	7,597	-354	-4.5%
3. Actuarial Accrued Liability (1) - (2)	$39,801	$39,992	$191	+0.5%
4. Actuarial Value of Assets	$33,324	$33,324	$0	+0.0%
5. Unfunded Actuarial Accrued Liability (3) - (4)	$6,477	$6,668	$191	
6. Funded Ratio (4) / (3)	83.73%	83.33%	-0.40%	

Development of Unfunded Actuarial Accrued Liability (Discussion)

The next step after computing the Present Value of Future Benefits is to compute the split between the Actuarial Accrued Liabilities and the Present Value of Future Normal Costs (i.e., Normal Cost for short when referring to the cost of active members for one year).

Present Value of Future Normal Cost

The GRS computation of the Present Value of Future Normal Costs was on average 3% to 5% lower than that of the retained actuary. This is a result of differing methodologies in timing of Normal Cost computations. Because contributions are typically paid continuously throughout the year, GRS considers normal costs to be received mid-year and computes its present value accordingly (i.e., with an adjustment for mid-year timing). The retained actuary calculates the present value of future normal cost as though normal cost is received annually on the first day of the year rather than mid-year. Therefore, the retained actuary's Present Value of Future Normal Costs is expected to be a 1/2 years' worth of interest higher ($1.07^{0.5} - 1 = 3.4\%$) than the GRS value. With this adjustment, the retained actuary and GRS results would be closer.

Actuarial Accrued Liability

Since the Actuarial Accrued Liability is the difference between Present Value of Future Benefits and the Present Value of Future Normal Cost, the opposite impact is observed. GRS estimates of the Actuarial Accrued Liabilities were slightly higher than the retained actuary calculation as a result. The estimates are still within the 5% tolerance range for active member liabilities.

Funded Ratio

GRS matched the retained actuary's computation of the System's funded ratio to within 1% for Regular Membership. For Sheriffs & Deputies and Protection Occupation the GRS Funded Ratio was 2% to 3% lower primarily as a result of the higher present value of future benefit estimates for these groups.

Analysis of Contribution Rates

Regular Membership	Retained Actuary	GRS	+/- Diff
1. Normal Cost Rate	10.51%	10.30%	-0.21%
2. UAL Contribution Rate for FY 2021	4.93%	5.09%	+0.16%
3. Funded Ratio as of June 30, 2019	82.7%	82.4%	-0.3%
Funded Ratio as of June 30, 2018	81.3%	81.3%	-
Funded Ratio as of June 30, 2017	80.4%	80.4%	-
4. UAL Contribution Rate Applicable for FY 2021	4.93%	5.09%	+0.16%
5. Actuarial Contribution Rate for FY 2021 (1) + (4)	15.44%	15.39%	-0.05%
6. Required Contribution Rate for FY 2020	15.73%	15.73%	-
7. Required Contribution Rate for FY 2021	15.73%	15.73%	-
Employer Contribution Rate	9.44%	9.44%	-
Employee Contribution Rate	6.29%	6.29%	-

Sheriffs & Deputies Analysis of Contribution Rates	Retained Actuary	GRS	+/- Diff
1. Normal Cost Rate	16.87%	17.11%	+0.24%
2. UAL Contribution Rate for FY 2021	0.01%	0.95%	+0.94%
3. Funded Ratio as of June 30, 2019	99.0%	97.0%	-1.99%
Funded Ratio as of June 30, 2018	97.9%	97.9%	-
Funded Ratio as of June 30, 2017	93.0%	93.0%	-
4. UAL Contribution Rate Applicable for FY 2021	0.01%	0.95%	+0.94%
5. Actuarial Contribution Rate for FY 2021 (1) + (4)	16.88%	18.06%	+1.18%
6. Required Contribution Rate for FY 2020	19.02%	19.02%	-
7. Required Contribution Rate for FY 2021	18.52%	18.52%	-
Employer Contribution Rate	9.26%	9.26%	-
Employee Contribution Rate	9.26%	9.26%	-

Protection Occupation Analysis of Contribution Rates	Retained Actuary	GRS	+/- Diff
1. Normal Cost Rate	15.28%	15.53%	+0.25%
2. UAL Contribution Rate for FY 2021	0.07%	0.96%	+0.89%
3. Funded Ratio as of June 30, 2019	99.6%	97.1%	-2.48%
Funded Ratio as of June 30, 2018	98.5%	98.5%	-
Funded Ratio as of June 30, 2017	97.8%	97.8%	-
4. UAL Contribution Rate Applicable for FY 2021	0.07%	0.96%	+0.89%
5. Actuarial Contribution Rate for FY 2021 (1) + (4)	15.35%	16.49%	+1.14%
6. Required Contribution Rate for FY 2020	16.52%	16.52%	-
7. Required Contribution Rate for FY 2021	16.02%	16.49%	+0.47%
Employer Contribution Rate	9.61%	9.89%	+0.28%
Employee Contribution Rate	6.41%	6.60%	+0.19%

Analysis of Contribution Rates (Discussion)

The replication of employee and employer contribution rates was based upon the Actuarial Accrued Liabilities and Normal Costs computed by GRS. Therefore, the results are expected to differ from those of the retained actuary.

Regular Membership Contribution Rate

For Regular Membership, the GRS computation of normal cost was 21 basis points lower than the retained actuary's figure. This difference was offset by a higher UAL Contribution by 16 basis points. In aggregate, GRS replicated the retained actuary's Actuarial Contribution Rate for Fiscal Year 2021 to within 5 basis points (15.39% versus 15.44%). Since both of these rates are within 50 basis points of the Required Contribution Rate for Fiscal Year 2020, the SPERS Funding Policy keeps the Required Contribution Rate unchanged for Fiscal Year 2021.

Sheriffs & Deputies Contribution Rate

For Sheriffs & Deputies, the GRS computation of Normal Costs and UAL Contributions was 1.18% higher than the retained actuary's value (18.06% versus 16.88%). This was primarily a result of the higher estimates for Present Value of Future Benefits. Since both the retained actuary's and GRS' Actuarial contribution Rates were more than 50 basis points lower than the Required Contribution Rate for Fiscal Year 2020, the computed Required Contribution Rates for Fiscal Year 2021 were 50 basis points lower than the prior year.

Protection Occupation

For Protection Occupations, the GRS computation of Normal Costs and UAL Contributions was 1.14% higher than the retained actuary (16.49% versus 15.35%). Like Sheriffs & Deputies, this was primarily a result of the higher estimates for Present Value of Future Benefits. Since the GRS estimate of the Actuarial Contribution Rate for Fiscal Year 2021 was higher than the Required Contribution Rate for Fiscal Year 2020, the Required Contribution Rate for Fiscal Year 2021 was set equal to the Actuarial Contribution Rate.

Contribution Rate Funding Policy

An additional review was conducted to confirm the retained actuary's computation of the contribution rates was consistent with the SPERS Funding Policy. We believe the methodology applied for computation of the Fiscal Year 2021 Required Contribution Rates were consistent with the SPERS Funding Policy Guidelines.

SECTION VI

EVALUATION OF JUNE 30, 2019 TEST CASE RESULTS

Case Studies

To evaluate the reasonableness and/or accuracy of valuation results in accordance with generally recognized and accepted actuarial principles, we requested individual valuation results for 10 active test cases (6 Regular Membership, 2 Sheriffs and Deputies and 2 Protection Occupation), 20 retired test cases (15 Regular Membership, 2 Sheriffs and Deputies and 3 Protection Occupation) and 5 inactive test cases (3 Regular Membership, 1 Sheriffs and Deputies and 1 Protection Occupation).

Results between GRS and the retained actuary were generally within expected boundaries, especially for the retired test cases and active test cases with higher amounts of service credit. A small number of active test cases had larger differences than anticipated. We attributed the differences primarily to rounding methods for fractional ages and services.

Page VI-2 shows a summary of the results for the individual test cases by valuation group. Based upon the results shown on this page, we have validated the accuracy of the valuation results to a reasonable degree as presented in the June 30, 2019 actuarial valuation report.

Summary of Individual Test Case Results

A. Active Members

	PVFB			EAAL			EANC %		
	Ret. Actuary	GRS	% Diff	Ret. Actuary	GRS	% Diff	Ret. Actuary	GRS	Diff
Regular Membership	$ 1,619,498	$ 1,640,495	1.3 %	$ 1,311,571	$ 1,330,725	1.5 %	10.83%	9.65%	1.18 %
Sheriffs and Deputies	$ 736,287	$ 732,255	(0.5)%	$ 505,170	$ 507,797	0.5 %	17.31%	17.50%	(0.19)%
Protection Occupation	$ 821,627	$ 824,263	0.3 %	$ 648,157	$ 644,916	(0.5)%	10.55%	10.97%	(0.42)%
Total Active Test Cases	**$ 3,177,412**	**$ 3,197,013**	**0.6 %**	**$ 2,464,898**	**$ 2,483,438**	**0.8 %**	**12.23%**	**11.46%**	**0.78 %**

B. Retired Members

	PVFB		
	Ret. Actuary	GRS	% Diff
Regular Membership	$ 4,596,417	$ 4,583,280	(0.3)%
Sheriffs and Deputies	752,049	744,385	(1.0)%
Protection Occupation	1,016,295	1,013,470	(0.3)%
Total Retiree Test Cases	**$ 6,364,760**	**$ 6,341,135**	**(0.4)%**

C. Inactive Non-Retired Members

	PVFB		
	Ret. Actuary	GRS	% Diff
Regular Membership	$ 390,222	$ 362,441	(7.1)%
Sheriffs and Deputies	27,156	26,575	(2.1)%
Protection Occupation	474,795	471,679	(0.7)%
Total Inactive Test Cases	**$ 892,173**	**$ 860,695**	**(3.5)%**

Active Test Cases – Regular Membership

	Age	Service	Annualized Salary	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 1								
	32.04	2.50	$ 59,474	F	PVFB	$ 134,284	$ 126,810	(5.6)%
					EAAL	$ 20,324	14,696	(27.7)%
					EANC	10.7%	11.4%	(0.7)%
					PVFS	$ 1,064,319	983,063	(7.6)%
Test Case 2								
	64.96	3.00	$ 45,772	M	PVFB	$ 43,469	$ 43,886	1.0 %
					EAAL	$ 22,549	24,275	7.7 %
					EANC	17.3%	15.7%	1.5 %
					PVFS	$ 121,187	124,730	2.9 %
Test Case 3								
	40.63	13.75	$ 42,489	M	PVFB	$ 125,762	$ 124,127	(1.3)%
					EAAL	$ 76,528	75,285	(1.6)%
					EANC	9.0%	9.0%	0.0 %
					PVFS	$ 544,433	541,443	(0.5)%
Test Case 4								
	57.88	35.75	$ 160,989	F	PVFB	$ 1,043,932	$ 1,061,990	1.7 %
					EAAL	$ 1,000,626	1,017,196	1.7 %
					EANC	8.6%	8.9%	(0.3)%
					PVFS	$ 505,041	505,464	0.1 %
Test Case 5								
	42.46	22.00	$ 63,806	M	PVFB	$ 225,269	$ 235,610	4.6 %
					EAAL	$ 172,290	179,748	4.3 %
					EANC	6.8%	7.5%	(0.7)%
					PVFS	$ 775,382	744,072	(4.0)%
Test Case 6								
	26.13	8.25	$ 29,324	F	PVFB	$ 46,783	$ 48,072	2.8 %
					EAAL	$ 19,254	19,525	1.4 %
					EANC	6.6%	6.9%	(0.4)%
					PVFS	$ 419,648	410,903	(2.1)%

Active Test Cases – Sheriffs and Deputies

	Age	Service	Annualized Salary	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 7								
	28.04	3.25	$ 57,074	M	PVFB	$ 216,594	$ 210,523	(2.8)%
					EAAL	$ 28,214	29,507	4.6 %
					EANC	16.9%	17.5%	(0.6)%
					PVFS	$ 1,113,308	1,034,683	(7.1)%
Test Case 8								
	58.71	31.72	$ 74,410	F	PVFB	$ 519,692	$ 521,732	0.4 %
					EAAL	$ 476,956	478,290	0.3 %
					EANC	17.6%	17.5%	0.1 %
					PVFS	$ 242,479	248,310	2.4 %

Active Test Cases – Protection Occupation

	Age	Service	Annualized Salary	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 9								
	27.38	4.06	$ 48,416	F	PVFB	$ 111,402	$ 112,150	0.7 %
					EAAL	$ 27,409	24,063	(12.2)%
					EANC	11.4%	12.7%	(1.3)%
					PVFS	$ 735,846	694,443	(5.6)%
Test Case 10								
	50.54	30.00	$ 122,370	M	PVFB	$ 710,225	$ 712,113	0.3 %
					EAAL	$ 620,748	620,853	0.0 %
					EANC	10.1%	10.3%	(0.2)%
					PVFS	$ 882,920	886,336	0.4 %

Retired Test Cases – Regular Membership

	Member Age	Member Gender	Beneficiary Age	Beneficiary Gender	Option Elected at Retirement	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 1	53.42	M	48.34	F	Active Member Death Benefit	PVFB	111,103	110,009	(1.0)%
Test Case 2	62.75	F	NA	NA	Opt 5 10 Yr Certain	PVFB	590,768	590,781	0.0 %
Test Case 3	63.47	F	45.02	M	Opt 5 10 Yr Certain	PVFB	25,078	24,048	(4.1)%
Test Case 4	59.22	F	NA	NA	Opt 2 w/ Decreasing Lump Sum	PVFB	369,516	367,188	(0.6)%
Test Case 5	64.80	M	NA	NA	Opt 2 w/ Decreasing Lump Sum	PVFB	155,828	155,707	(0.1)%
Test Case 6	59.94	M	NA	NA	Opt 1 w/ Fixed Lump-Sum Benefit	PVFB	523,402	522,795	(0.1)%
Test Case 7	76.43	F	NA	NA	Opt 1 w/ Fixed Lump-Sum Benefit	PVFB	76,867	77,620	1.0 %
Test Case 8	59.25	M	NA	NA	Opt 3 Single Life	PVFB	1,546,355	1,539,151	(0.5)%
Test Case 9	69.85	M	59.70	F	Opt 4 100% J&S	PVFB	259,659	259,932	0.1 %
Test Case 10	80.47	F	82.68		Opt 4 25% J&S	PVFB	27,207	27,463	0.9 %

Retired Test Cases – Regular Membership (Concluded)

	Member Age	Member Gender	Beneficiary Age	Beneficiary Gender	Option Elected at Retirement	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 11	67.04	F	69.02	M	Opt 6 50% J&S w/ pop-Up	PVFB	474,509	473,750	(0.2)%
Test Case 12	70.08	M	68.48	F	Opt 6 75% J&S w/ pop-Up	PVFB	209,523	209,111	(0.2)%
Test Case 13	56.92	F	51.26	M	Opt 6 100% J&S w/ pop-Up	PVFB	89,352	89,033	(0.4)%
Test Case 14	86.89	M	NA	NA	Opt 2 w/ Decreasing Lump Sum	PVFB	65,632	65,334	(0.5)%
Test Case 15	61.00	M	NA	NA	Opt 2 w/ Decreasing Lump Sum	PVFB	71,616	71,358	(0.4)%

Retired Test Cases – Sheriffs and Deputies

Retired Test Cases - Sheriffs and Deputies (Special Services 1)									
	Member Age	Member Gender	Beneficiary Age	Beneficiary Gender	Option Elected	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 16	66.32	M	NA	NA	Opt 1 w/ Fixed Lump-Sum Benefit	PVFB	605,809	598,614	(1.2)%
Test Case 17	66.27	F	61.64	M	Opt 4 100% J&S	PVFB	146,240	145,771	(0.3)%

Retired Test Cases – Protection Occupation

	Member Age	Member Gender	Beneficiary Age	Beneficiary Gender	Option Elected	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 18	64.12	M	NA	NA	Opt 1 w/ Fixed Lump-Sum Benefit	PVFB	284,136	282,377	(0.6)%
Test Case 19	58.87	M	43.74	F	Opt 7 Level Pmt Opt 4 (50% J&S)	PVFB	504,865	504,993	0.0 %
Test Case 20	54.92	M	NA	NA	Opt 3 Single Life	PVFB	227,294	226,100	(0.5)%

Inactive Non-Retired Test Cases – Regular Membership

	Age	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 1	29.89	F	PVFB	$ 16,931	16,943	0.1 %
Test Case 2	52.15	M	PVFB	$ 91,857	89,843	(2.2)%
Test Case 3	61.46	F	PVFB	$ 281,434	255,655	(9.2)%

Inactive Non-Retired Test Cases – Sheriffs and Deputies

	Age	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 4	46.08	M	PVFB	$ 27,156	26,575	(2.1)%

Inactive Non-Retired Test Cases – Protection Occupation

	Age	Gender	Valuation Result	Retained Actuary	GRS	% Diff
Test Case 5	53.46	M	PVFB	$ 474,795	471,679	(0.7)%

SECTION VII

SIMULATION MODEL

Analysis of Simulation Model

GRS Received screenshots and PDF outputs of the 30-year Simulation model from SPERS. The model gives the user the ability to adjust various assumptions and methods to observe the projected valuation results under differing assumptions.

Some of the assumptions which can be adjusted include:

- Asset valuation method – actuarial vs market value basis
- Required Contribution Rate change limit year over year
- Investment return assumption
- Wage growth assumption (based on underlying price inflation assumption)

Outputs include:

- Funded/Unfunded Actuarial Accrued Liabilities and/or surplus (if any)
- Assumed rate of market value investment return and the resulting actuarial rate of return
- Cash flows – benefit payouts & total contributions
- Market/Actuarial Value of Assets and funded ratio
- Actuarial and required contribution rates

GRS received "baseline" results based on valuation assumptions being exactly realized for the Regular, Sheriffs & Deputies, and Protection Occupation groups. Review of the baseline models resulted in the following observations:

- Results for Year 2019 were consistent with June 30, 2019 Valuation results as expected.
- Projected payroll the first year after the valuation appears to be noticeably lower than projected payroll disclosed in the valuation report.
- Projecting forward, accrued liabilities and payroll in the 30-year projection are growing at an average rate of around 2.50% per year. We would normally expect that by the end of the projection period, most actuarial values would be growing fairly close to the assumed rate of wage growth (3.25%). Growth rates different from wage inflation for an initial period are not unusual as a result of changing workforce demographics or in the case of SPERS, changes in benefit design for new retirees. It is possible that if the tool results were extended beyond 30 years, the expected 3.25% growth rates would be realized. However, since the tool only shows 30 years, we were not able to verify that.
- For all three groups (Regular membership, Sheriffs & Deputies, and Protection Occupation), when the System achieves 100% Funding, it appears the amortization layers are automatically collapsed in accordance with the SPERS Funding Policy. While the application of this method is correct, some form of indicator in the projection output could benefit the end users understanding that this is the cause for a sudden decrease in the Actuarial Contribution Rate.

For the Regular membership group, GRS requested results based upon the following input parameters:

- 6% Market rate of investment return for all future calendar years with no change in the assumed rate.
- 6% Market rate of investment return for all future calendar years. Change the assumed rate of investment return to 6% and assumed wage growth 2.65%.

- Same as above but change the asset valuation method to market value.

The observations under these alternate assumptions were similar to those of the baseline results:

- The liability and payroll growth rates tend to lag 50 to 100 basis points lower than the assumed wage growth assumption.
- To the extent that the model is using assumptions that differ from the user inputs, best practice would be to disclose these assumptions in the projection's output. Such as, if it is being assumed that long term wage growth of the System is set to price inflation, this should be disclosed. Currently, the model includes the following disclosure which would lead the average reader to believing the tool is using the defined valuation assumptions:
  "The investment return and salary scale assumptions used in the funding valuations and ultimately adopted by the Board upon the advice of the actuary, typically provided in the experience study."
- The simulation model does not display each of the user inputted assumptions in the output. The assumed and actual investment returns are currently the only assumptions displayed. We suggest that the model should display any assumption that is made that differs from the valuation assumption. For example, the wage inflation, actuarial vs market value asset basis, and maximum required contribution rate change assumptions made in the model could also be displayed.

The results of the model appeared reasonable with the exception of the ultimate growth rates of payroll and other financial values. One of the checks we applied to the tool is that in a base simulation using valuation assumptions, financial items (benefit payments, liabilities, payroll, etc.) should be growing at a rate close to the assumed rate of payroll growth in the valuation by the end of the projection period. We did not see that happen, although that may have been because the projection period (30 years) is too short for the growth rates to approach the payroll growth rate. This suggests a potential disjoint between the techniques used to develop the simulation model and the methods and assumptions used in the valuations. We recommend that the retained actuary confirm that the Simulation Model is performing in a manner consistent with the valuation assumptions in the base (i.e., all assumptions equal to valuation assumptions) case. In particular, we recommend that the retained actuary perform an internal test that extends the operation of the tool to 50 or more years in order to verify that at the end of the period, financial values are growing at a rate at or close to the wage growth rate.

SECTION VIII

SUMMARY OF RECOMMENDATIONS

Summary of Recommendations

The principal results of this audit are:

- The actuarial assumptions are reasonable;
- The actuarial work is mathematically correct; and
- The actuarial report fairly presents the actuarial condition of the Retirement System.

However, two actuaries will never agree completely on all of the ingredients that go into an actuarial valuation. Also, different actuaries can draw different conclusions from the same set of facts, because they have been exposed to different experiences. This section of the report summarizes all of the recommendations made in this audit. Page numbers refer to the page in this report where the issue is discussed in depth, or the recommendation was originally made.

This section summarizes the recommendations we have made throughout the report. We have classified as *recommendations* those items which in our judgement have the potential of resulting in a meaningful improvement in the valuation process. Our *suggestions* in the body of the report are much more minor items that may result in minor improvements in clarity for the non-expert user or technical compliance with actuarial standards. It is unlikely that the many suggestions would affect end results in any material way.

Recommendations Regarding Data

Page II-2: SPERS data includes a current 3-year Final Average Salary in addition to the current salary. We recommend an additional data field be reported that includes a member's current highest 5-year average salary. Such a field can help improve the estimation of benefits for Regular membership. There can be cases where the current pay is not a good estimator of final average compensation. The current highest 3-year average salary field is still needed and applicable for Special Services members.

Page II-2: Years of service are currently reported based upon whether it was earned in Regular membership, Sheriff Deputy membership, or Protection Service membership. Effective with the July 1, 2012 SPERS Pension Reform, service earned on or before June 30, 2012 is treated different than service earned after July 1, 2012. The Early-Retirement Reduction for service before July 1, 2012 receives a 3% reduction for each year a member is to receive benefits before normal retirement age. The reduction for service on or after July 1, 2012 is 6%. We understand that the retained actuary maintains a record of the service as of June 30, 2012 in its database. We recommend, however, that SPERS provide the service earned prior to July 1, 2012 for each of the three valuation groups as part of the data that it submits to the actuary each year.

Recommendations Regarding the Experience Study, Assumptions, and Methods

Page III-4: The authors find that the retained actuary's recommended price inflation assumption of 2.60% is at the upper end of the range that they would consider to be reasonable, based upon information available at this time. (As mentioned above, different actuaries even within the same firm can have different views on this matter). Given the data that we have included in the section and the SPERS' investment consultant's forward-looking price inflation assumptions of 1.95% (10 years) and 2.33% (30 years), our preferred assumption would be in the area of 2.25%. Although we believe that this assumption is reasonable for use in the 2019 valuation, we recommend that the Board consider lowering

the price inflation assumption from its current level. Doing so will reduce the chances that the assumption may become unreasonable prior to the next experience study. If that were to happen, the actuary would have to issue a qualified report or change the assumption. (Recall that actuarial assumptions must be reasonable in every valuation, not just in the one immediately following an experience study.)

Page III-7: Based upon our analysis, the authors would consider the retained actuary's recommended investment return assumption of 7.00% to be at the upper end of the range that they would consider to be reasonable for the 2019 valuation. Although we believe that this assumption is reasonable at this time, we recommend that the Board consider lowering the investment return assumption from its current level. Doing so will reduce the chances that the assumption may become unreasonable prior to the next experience study. If that were to happen, the actuary would have to issue a qualified report or change the assumption. (Recall that actuarial assumptions must be reasonable in every valuation, not just in the one immediately following an experience study.)

Recommendations Regarding the Actuarial Valuation Reports

Page IV-2: Page 2 includes a discussion about changes in membership, however, as discussed in our 2014 audit report we are unable to find the actual reported payroll anywhere in the retained actuary's report. The table on page 15 discloses projected payroll for the upcoming fiscal year of $8,382 million as opposed to the actual payroll. The total salary data in the retained actuary's groomed data file was $7,917 million. The total payroll shown in Section VI, Risk Considerations, was $8,151 million. If we use the actuary's assumed payroll growth of 3.25% per year, we do not match the actuary's projected payroll using either available 2019 figure. We recommend that the retained actuary disclose the actual payroll that SPERS reported in the data that it submitted and clarify the projection methodology.

Recommendations Regarding the Simulation Model

Page VII-2: The results of the model appeared reasonable with the exception of the ultimate growth rates of payroll and other financial values. One of the checks we applied to the tool is that in a base simulation using valuation assumptions, financial items (benefit payments, liabilities, payroll, etc.) should be growing at a rate close to the assumed rate of payroll growth in the valuation by the end of the projection period. We did not see that happen, although that may have been because the projection period (30 years) is too short for the growth rates to approach the payroll growth rate. This suggests a potential disjoint between the techniques used to develop the simulation model and the methods and assumptions used in the valuations. We recommend that the retained actuary confirm that the Simulation Model is performing in a manner consistent with the valuation assumptions in the base (i.e., all assumptions equal to valuation assumptions) case. In particular, we recommend that the retained actuary perform an internal test that extends the operation of the tool to 50 or more years in order to verify that at the end of the period, financial values are growing at a rate at or close to the wage growth rate.

SECTION IX

FORMAL OPINION AND CONCLUDING REMARKS

Formal Opinion and Concluding Remarks

The auditing actuarial firm, Gabriel, Roeder, Smith & Company, is independent of the retained actuarial firm, the retained actuary. The auditing firm employed its proprietary actuarial software for this actuarial audit. The auditing firm's software is completely independent of the retained actuary's software. The auditing actuaries are not aware of any conflict of interest that would impair the objectivity of this work.

In the opinion of the auditing actuaries, the work of the retained actuaries reasonably represents the financial position of the Retirement System based upon the assumptions and methods employed. In particular:

- The actuarial assumptions and methods are reasonable and comply with generally accepted actuarial principles, State Law, and Board Regulations.
- With a few exceptions, the retained actuary is processing the data correctly.
- The retained actuary's actuarial valuation results, including accrued liability, normal cost, and expected contributions are correct to within acceptable tolerances.
- The retained actuary's actuarial valuation results in accordance with GASB Statement No. 67 are correct to within acceptable tolerances.

In our judgement, the probability of meeting or exceeding the actuarial assumed rate of return over time (at least over the next ten years) is approximately 40%. Therefore, although we agree that the economic assumptions are reasonable, we consider them to be on the aggressive side. This is not unusual in the public sector today, but we believe it is important that policy makers are aware of that fact.

We have presented many suggestions for areas where we believe the actuarial work product can be improved. Of course, the retained actuary has access to information and a long history of experience with SPERS that we do not have. We understand that the retained actuary may agree with some of our recommendations, while rejecting others. We ask that the retained actuary and the Board consider our recommendations carefully. We hope that SPERS and the retained actuary find these suggestions useful.

We appreciate the opportunity to work on this assignment.