Actuarial Audit of the Kentucky State-Administered Retirement Systems As of June 30, 2021

Prepared for: Public Pension Oversight Board

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February 20, 2023

Senator Jimmy Higdon, Co-Chair
Representative James Tipton, Co-Chair
Public Pension Oversight Board
702 Capitol Avenue, Annex Room 170
Frankfort, KY 40601

Re: Actuarial Audit of June 30, 2021 Actuarial Valuations

Dear Co-Chairs Higdon and Tipton:

We are pleased to present the enclosed report summarizing our findings and recommendations resulting from our independent Level 1 full-scope audit of the actuarial work performed by the System Actuaries for the fiscal year 2021 actuarial valuation and most recent experience study for the following state-administered Kentucky Retirement Systems (KYSRS):

- Kentucky Employees Retirement System (KERS)
  - Includes hazardous (KERSHZ) and non-hazardous plans (KERSNHZ)
- State Police Retirement System (SPRS)
- County Employees Retirement System (CERS)
  - Includes hazardous (CERSHZ) and non-hazardous plans (CERSNHZ)
- Teachers' Retirement System (TRS)
- Judicial Form Retirement System (JFRS)
  - Includes Legislators' Retirement Plan (LRP) and Judicial Retirement Plan (JRP)

As indicated above, for purposes of this report we will use KYSRS to refer to all of the retirement systems listed above and included in this audit, and we will use the abbreviations shown above for each system/plan. We also note that the Kentucky Public Pension Authority (KPPA) administers the KERS, CERS, and SPRS funds on behalf of

the KRS and CERS Boards, and the Judicial Form Retirement System (JFRS) oversees the JRP and LRP. We will use these abbreviations throughout this report.

This report presents an executive summary followed by separate sections discussing in detail our findings, analyses and recommendations. While some issues are discussed at greater length than others, this report is intended to provide a complete and independent third party review of each retirement system under KYSRS and its operations from an actuarial perspective. All comments and recommendations are intended to be constructive. Our purpose was to identify areas of possible improvement in the system, its operation and/or the actuarial procedures.

We would like to thank the staffs of the Public Pension Oversight Board (PPOB), Kentucky Public Pension Authority (KPPA), Teachers' Retirement System (TRS), Judicial Form Retirement System (JFRS), as well as the actuaries for each of the retirement systems (GRS, CavMac, and USI, respectively) for their cooperation. Their prompt and courteous responses to our questions and requests for information were of valuable assistance to us and greatly appreciated.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by the staff of each retirement system and each system's actuary. This information includes, but is not limited to, statutory provisions, employee data, and financial information. Since the audit results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised. The audit results were developed using models intended for actuarial valuations that use standard actuarial techniques.

A valuation report is only an estimate of the Plan's financial condition as of a single date. It can neither predict the Plan's future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of Plan benefits, only the timing of Plan contributions. Future actuarial measurements may differ significantly from the current measurements presented in this analysis due to actual plan experience deviating from the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as potential additional contribution requirements due to changes in each System's funded status), and changes in plan provisions, actuarial assumptions, and applicable law. An assessment of the potential range and cost effect of such differences is beyond the scope of this analysis.

Milliman's work product was prepared exclusively for the PPOB for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning the operations of each retirement system, and the uses of the data provided, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultants who worked on this assignment are retirement actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Actuarial Standards of Practice promulgated by the Actuarial Standards Board and the applicable Code of Professional Conduct, amplifying Opinions, and supporting Recommendations of the American Academy of Actuaries.

We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

The signing actuaries are independent of the PPOB. We are not aware of any relationship that would impair the objectivity of our work.

We look forward to having the opportunity to present this report and respond to questions regarding our review and recommendations.

Respectfully submitted,

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Executive Summary and Recommendations

This report summarizes the results of an actuarial review of the state-administered Kentucky Retirement Systems, "KYSRS". This review covered the most recent experience studies and the June 30, 2021 actuarial valuations for the following retirement systems:

- Kentucky Employees Retirement System (KERS)
  - Includes hazardous (KERSHZ) and non-hazardous plans (KERSNHZ)
- State Police Retirement System (SPRS)
- County Employees Retirement System (CERS)
  - Includes hazardous (CERSHZ) and non-hazardous plans (CERSNHZ)
- Teachers' Retirement System (TRS)
- Judicial Form Retirement System (JFRS)
  - Includes Legislators' Retirement Plan (LRP) and Judicial Retirement Plan (JRP)

As indicated above, for purposes of this report we will use KYSRS to refer to all of the retirement systems included in this audit, and we will use the abbreviations shown above for each system/plan. We also note that the Kentucky Public Pension Authority (KPPA) administers the KERS, CERS, and SPRS funds on behalf of the KRS and CERS Boards and we will use this abbreviation when discussing these three systems in tandem throughout this report.

The actuaries for each of the systems are Gabriel, Roeder, Smith & Company ("GRS") for KPPA, Cavanaugh Macdonald Consulting, LLC ("CavMac") for TRS and Findley, A Division of USI ("USI") for JFRS.

The purpose of this report is to provide the results of our Level 1 full-scope audit of the actuarial work performed by the System Actuaries for each of the retirement systems noted above. This audit includes a full replication of the June 30, 2021 actuarial valuations and specifically includes a review of:

- the reasonableness and accuracy of the fiscal year 2021 actuarial valuations, most recent experience studies, and employer contribution rate recommendations
- the data, assumptions and methods for appropriateness, internal consistency, and compliance with actuarial standards of practice
- the reasonableness and accuracy of the actuary's calculation and assignment of the prorated dollar amount of the actuarially accrued liability contribution for each of the non-hazardous employers in KERS, as required under Kentucky Revised Statute.

Overall Assessment

Our overall assessment as a result of our review of the actuarial work for KYSRS is that all major actuarial functions are being appropriately addressed across all retirement

systems. The actuaries (GRS, CavMac and USI) have employed generally accepted actuarial practices and principles in studying plan experience, selecting assumptions, determining liabilities and employer contribution rates, and presenting the results of their work.

Review of Another Actuary's Work

In systems as large and complex as those in KYSRS, there are many operational aspects that have a bearing on the actuarial analysis of the plans. The reader should recognize that many of the issues that we reviewed and which we will discuss in this report are subject to opinion and professional preference. No two actuaries (or actuarial firms) are likely to use precisely the same methods and assumptions (and, therefore, arrive at precisely the same conclusions) when presented with the exact same problem and set of historical facts. Notably, our review included an actuarial audit of the actuarial work performed by three different actuarial firms. In completing our review, we have attempted to focus on those aspects of the systems and its actuarial functions that could be meaningfully improved or where an alternative approach might be beneficial. In presenting our findings in this report, we have tried to limit discussion of aspects which reflect our professional preferences but which would have minimal effect on the results and conclusions presented by the actuaries.

By its nature, a review of another professional's work product will tend to focus on those aspects where the reviewer believes some modification in current procedures would be desirable. Hence, a report such as this will devote the majority of the presentation to commentary that, even though intended to be constructive, may give the reader the impression that only problems were found. ***Therefore, we would like to state clearly up front that we found the actuarial procedures and practices to be of a high quality and in compliance with all major aspects of the applicable actuarial standards.*** While we will discuss several areas where we believe some modifications in current data collection procedures, valuation procedures, actuarial assumptions or methods would be beneficial, that discussion should be considered within the context of an overall favorable report concerning the work performed by GRS, CavMac, and USI.

Actuarial Valuation Model

KYSRS is a complex set of five retirement systems, consisting of eight pension programs, with varying contribution rates, accrual rates, retirement eligibility provisions, early retirement reductions, actuarial equivalent factors, and optional forms of benefits that members may elect upon retirement. Furthermore, there are separate models for retirement benefits and insurance benefits.

It is important to note that an actuarial valuation is based on a model that estimates benefits expected to be paid in the future. The determination of the liabilities and contributions is then based on those projections. During this modeling, some estimates or approximations may be made by the actuary due to immateriality, inadequate data, or

complexity. The use of such estimates or approximations is generally accepted within the actuarial profession.

A purpose of this audit is to review the valuation model to determine if the results are reasonable and that the assumptions, estimates and approximations are appropriate. We recommend consideration of certain changes in the model that will, in our opinion, improve the "accuracy" of the model. However, overall, we believe that the June 30, 2021 actuarial valuation reports are reasonable and appropriate for the intended uses of those reports.

Audit Conclusions

Set forth below is a summary of the conclusions of the audit split into the various components considered in our review. In each subsection, we have provided commentary including any recommended changes we have or items that we suggest should be considered in the future.

The following are our most significant suggestions and comments along with the page number reference to the discussion in the executive summary:

1. This audit includes a level 1 actuarial audit where we performed a parallel valuation. As our results do not deviate significantly from those calculated in the valuations, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of each system based on the assumptions and methods. Please refer to page 17.

2. We recommend consideration be given to promoting a consistent framework in setting certain assumptions to be used in the upcoming actuarial valuations across the systems. Assumptions suggested for consideration include the inflation assumption, investment return assumption, hybrid interest crediting assumption, mortality improvement assumption and healthcare trend and aging factors for valuing pre-65 health benefits provided by the KEHP. Please refer to page 11.

   We received feedback from KPPA on this recommendation:

   "The funded statuses, risk tolerances, liquidity needs, member and retiree demographics, and asset allocations vary by system. Therefore, the assumptions need to be unique to each system."

   We received feedback from TRS on this recommendation:

   "TRS takes exception to the report's broad recommendation for uniform actuarial assumptions across all Kentucky plans. The recommendation is inconsistent with the norm throughout the nation and many of the report's other determinations,

particularly the findings on the accuracy of TRS's valuation results and methodologies. Teachers, who are Kentucky's only large group of participants in state retirement plans not in Social Security, have myriad differences from other state workers. This includes demographics – 70% of TRS's membership is female with longer life expectancies compared to the general workforce. Asset allocations are an outgrowth of those demographics. Additionally, the circumstances and design of each retirement plan – including funded ratio, risk tolerance, investment returns and asset allocation – makes tailored assumptions the norm. A one-size fits all approach would appear to increase risk for Kentucky taxpayers, including the annuitants of TRS.

To clarify, we are suggesting a similar framework be applied to each group reflecting their unique characteristics that will most likely result in different assumptions selected among the systems. For example, inflation is a key assumption that currently differs for all three systems although each system is subject to the same economic environment producing the inflation.

We do note the complexity of attempting to establish such a framework that would be beneficial to all parties.

3. We recommend a modification to how the assumed interest crediting rate is set for the hybrid plan to reflect the impact of the 4% minimum on expected credits. Based on our estimates, this could result in an increase in the assumed interest crediting rate by as much as 1.5%. Please refer to pages 12 - 14.

   We received feedback from KPPA on this recommendation:

   "GRS will review the hybrid interest crediting rate assumption while they perform the next experience study. They agree that the 4% minimum interest crediting rate could result in an interest crediting rate that is higher than an annual return. However, since the interest crediting rate is based on a five-year average of the System's annual return, they believe this difference will be muted."

   We note that our analysis reflected the five-year averaging period for determining the interest crediting rate and look forward to seeing the analysis completed by each of the actuaries.

4. We suggest that consideration be given to reducing the inflation assumption and investment return assumption for JFRS. Please refer to page 12.

5. We suggest a review of the impact that the 3-High provision has on SPRS benefit amounts at retirement to determine if a load should be added to the actuarial valuation to account for this provision. Please refer to pages 6.

6. During our review and in discussion with the actuary for KPPA, there was one item that was not valued accurately in the 2021 valuations: non-hazardous benefits for retiree records with both hazardous and non-hazardous portions were excluded from KERS and CERS non-hazardous valuations. We believe this item had less than a 2% impact on the plans' liabilities and was corrected in the recently released 2022 valuations. Please refer to page 5.

7. During our review and in discussion with the actuary for JFRS, there was one item that was not valued accurately in the 2021 valuations: a mortality table was incorrectly applied in the JFRS valuations. We believe this item had less than a 2% impact and was corrected in the recently released 2022 valuations. Please refer to page 18.

Our comments should be viewed in the context of an overall favorable review of the actuarial work.

Section I – Data Validity

We performed tests on both the raw data supplied by the staffs of each system and the processed data used by each actuary in the actuarial valuations. As part of our review, we reviewed eighty-six (86) individual benefit calculations across all of the systems reflecting members who retired in the year before or year after the valuation date allowing us to review the raw data for consistency with information used in the actual benefit calculation. Based on this review, we feel the individual member data used is appropriate and complete, but offer the following comments based on our review. Please refer to the subsection below as well as *Section I – Data Validity* of this audit report for more details.

KPPA

Our comments on the review of KPPA data are as follows:

- **Non-Hazardous Retiree Benefits:** The retiree benefits reported in the actuarial valuation reports for KERS and CERS non-hazardous retirees excluded the non-hazardous portion if the retiree record had both a hazardous and non-hazardous benefit. It is our understanding that this issue was corrected in the 2022 valuation.

- **Hazardous Portion - Actives**: For active members with both hazardous and non-hazardous service, GRS includes the entire liability in the plan where the member is currently accruing service. Upon retirement, the liability is then allocated to each plan. We recommend that GRS and KPPA discuss this situation to determine if a prorated portion of the liability should be allocated to each plan while the employee is an active member.

- **Hazardous Portion - Retirees**: For retiree records with both a hazardous benefit and non-hazardous benefit, KPPA provides the percentage associated with each

portion, but the percentage is based on accrued service rather than the actual benefit. We suggest KPPA review the possibility of providing the actual benefit accrued in each plan on the data.

- **Final Compensation:** In our review of the final average compensation used in the benefit calculations, we noticed that Tier 1 members may time their retirement to maximize the impact of compensation earned in their last fiscal year of employment on their retirement benefit amount. This appeared to have the impact of increasing a member's final average compensation over that projected using the salary data provided for the actuarial valuation. We believe it would have a greater impact on members subject to the 3-High provision than the 5-High provision, and it seemed to have the greatest impact on SPRS. For six SPRS calculations we reviewed, we estimate the approximate increase in the final average compensation ranged from 3% to 13%. We recommend a review be completed by GRS and KPPA to determine if a load should be incorporated into the actuarial valuations.

TRS

Our comments on the review of TRS data are as follows:

- **Reciprocity with KPPA**: Reciprocity service with KPPA can impact the applicable benefit multiplier and the compensation used in the development of the final average compensation. In our review of the benefit calculations, we found three of the seven records reviewed contained reciprocity service. We suggest that CavMac and TRS review the prevalence of members with KPPA reciprocity service to determine if an assumption should be incorporated into the actuarial valuation.

- **Popup Percentage:** For retirees that elect a joint and survivor annuity, the member's benefit increases or "pops up" if the beneficiary pre-deceases them. CavMac estimates the amount of the popup, but we suggest that TRS provide the single life annuity amount on the data if possible.

JFRS

Our comments on the review of JFRS data are as follows:

- **Contribution Account Balance**: We recommend that JFRS provide member contribution account balances for retirees such that it can be valued as a potential death benefit for unmarried members.

- **Benefit information Reported in Actuarial Valuation:** We recommend USI review the benefits reported in the valuation as we believe that benefits noted for LRP retirees and traditional plan terminated vested members were twice the amount included in the valuation and that the cash balance account for hybrid

members was treated as if it was an annual benefit paid to traditional plan members. We believe this only impacts the reporting of benefits in the valuation report and that the benefits were correctly valued in the valuation.

Section II – Actuarial Valuation Methods and Procedures

In this section, we provide our comments on our review of the various actuarial valuation methods and procedures used in determining the contribution rates. Our review consisted of compliance with actuarial standards of practice and guidance within the actuarial community, specifically a white paper titled *Actuarial Funding Policies and Practices for Public Pension Plans* issued by the Conference of Consulting Actuaries.

Actuarial Value of Assets

We have reviewed the calculations of the funding value of assets used in the June 30, 2021 actuarial valuations. We found the calculations to be accurate and the methodology to be appropriate and in compliance with actuarial standards of practice.

Actuarial Cost Method

We have reviewed the version of the Entry Age Normal cost method employed by each of the actuarial firms and have found the methodology to be appropriate and in compliance with actuarial standards of practice.

Funding Policy

A system's funding policy sets the parameters for the actuary to determine the actuarially determined contribution rate. One of the primary features of a funding policy is how the unfunded actuarial accrued liability, if any, is paid down over time. Employer contribution requirements are established in Kentucky Revised Statute for each of the systems plus TRS incorporates a Board funding policy that produces an additional rate to be contributed.

<u>KPPA</u>

Our comments on the review of the policies in place for KPPA are as follows:

- **Amortization Period:** Beginning with the 2021 fiscal year, the amortization period in the funding policy was updated to the following:
    - Use of a 30-year closed period to amortize the unfunded liability as of June 30, 2019.
    - Use of a 20-year closed period to amortize new sources of unfunded liability (consisting of benefit changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).

We suggest consideration be given to establishing a minimum total amortization payment calculated based on the current unfunded liability and the greater of the remaining fresh start amortization period and 20 years. This would prevent subsequent actuarial gains from lengthening the effective amortization period in any one actuarial valuation. In addition, we recommend that GRS note the effective amortization period and specify the adjustments made in determining the new amortization layer for the year.

- **HB 8 Allocation:** HB 8 modified how the unfunded liability portion of the contribution rate is allocated to KERS Non-Hazardous employers from a percent of payroll to their portion of the actuarial accrued liability as of July 1, 2019 to help prevent employers from reducing their future contribution towards the unfunded liability through payroll reductions. We confirmed the calculations used by GRS and note the following items:

    - For the issue noted above regarding retiree records who are receiving both non-hazardous and hazardous benefits that the non-hazardous benefits were not being valued, we estimated that this increased KERS non-hazardous liabilities by approximately 1.8%. This may impact some employers more than others such that it would increase their allocation. Determining any adjustment to the allocation percentage is outside the scope of this audit.

    - Due to a different projected payroll used for insurance benefits, the dollar amount of the allocated amortization was higher than the amount noted in the valuation report by approximately $801,000. GRS notes that the difference in payroll is due to members receiving pension benefits from multiple systems but would only receive insurance from one system. However, the insurance unfunded liability contribution rate was applied to the projected payroll for retirement benefits causing the slight difference.

TRS

Our comments on the review of the policies in place for TRS are as follows:

- **Amortization Period:** Established by Board policy, beginning with the 2014 fiscal year, the amortization period in the funding policy was updated to the following:

    - Use of a 30-year closed period to amortize the unfunded liability as of June 30, 2014.
    - Use of a 20-year closed period to amortize new sources of unfunded liability (consisting of benefit changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).

As of the June 30, 2021 valuation, the remaining amortization period on the 2014 fresh start base is 23 years, which is in line with actuarial guidance (CCA White Paper model practices for transition periods) where the contribution rates are calculated on an actuarial basis. In the 2021 valuation, the amortization payment is slightly less than interest on the unfunded liability meaning that negative amortization continues to occur. Although, we would expect that any negative amortization would not occur for much longer, assuming the full actuarially determined contribution rate is made.

- **Special Appropriation:** Since the Board policy produces contribution rates in excess of the statutory employer rates, CavMac determines an additional employer contribution rate. This additional rate was reduced by a special 2.38% of payroll appropriation made by the State. In our opinion, it was not clear in the valuation report that this rate was intended to be fully offset against the employer contribution, as opposed to accelerating a reduction in the unfunded liability. TRS confirmed that CavMac's treatment of this additional special appropriation was applied in accordance with the Board's policy. We suggest clarification be added to the valuation report.

- **Additional Employer Contribution Rate:** Per TRS Board Policy, employers are not currently contributing the full additional contribution rate of 23.05%. The amount in excess of 14.48% of payroll is being phased-in over a 5-year period. We suggest that the report incorporate more information regarding the phase-in and note the full actuarially determined contribution rate in accordance with the Board policy. We also recommend that CavMac comment on the impact on future contribution rates of phasing in this impact, in accordance with revised actuarial standards of practice that will become effective in 2023.

JFRS

Our comments on the review of the policies in place for JFRS are as follows:

- **Amortization Period:** While this audit focuses on the 2021 actuarial valuation, beginning with the 2023 fiscal year, the amortization period in the funding policy will be updated to the following:

    - Use of a 20-year closed period to amortize the unfunded liability as of June 30, 2023.
    - Use of a 20-year closed period to amortize new sources of unfunded liability (consisting of benefit changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).

  The use of a 20-year amortization period replaced the prior amortization methodology which equaled interest plus 1% of the unfunded liability or 7.5% of

the unfunded liability in total. The prior funding policy effectively resulted in an open amortization period of 27 years. We believe the changes to the amortization period to 20 years for unfunded liabilities are consistent with model practices contained in the CCA White Paper.

- **Biennium Valuations:** A funding valuation is performed every other year to establish the contribution requirements for the following two fiscal years. To determine these subsequent contribution requirements, USI increases the required contribution with interest by one year to account for the lag and then by two years. As this method does not take into account changes in the normal cost from the traditional tier to the hybrid tier, we suggest that USI consider performing a one-year projection of the normal cost in determining the contribution amount for the second year.

Section III – Actuarial Assumptions

We have reviewed the actuarial assumptions used in the June 30, 2021 valuations for retirement and insurance benefits for each of the systems as recommended in the following three experience studies:

- For KPPA, GRS 2018 Actuarial Experience Study for the period ending June 30, 2018 dated April 18, 2019.
- For TRS, CavMac 2020 Experience Investigation prepared as of June 30, 2020 dated September 28, 2021.
- For JFRS, USI 2020 Pension Plan Experience Study dated October 23, 2020.

We found the assumptions to be in compliance with actuarial standards of practice. Although we generally agreed with the appropriateness of these assumptions, we believe that the hybrid interest crediting rate assumption should be studied, with strong consideration for increasing the assumption.

In some instances, we suggest additional disclosure for the assumption be noted in the experience study and/or valuation report. For these comments, please refer to *Section IV – Actuarial Valuation Report*.

<u>Consistency in Certain Key Actuarial Assumptions</u>

Below we provide a summary of our comments specific to each system on the actuarial assumptions used, but in this section, we recommend consideration be given to promoting a consistent framework in setting certain assumptions to be used in the upcoming actuarial valuations to promote consistency across the systems. These assumptions would consist of:

- Inflation assumption
- Investment return assumption
- Interest crediting assumption for the Hybrid plan
- Mortality improvement assumption
- Healthcare trend rates and aging factors for pre-65 insurance benefits provided through the Kentucky Employees' Health Plan (KEHP)

While we believe each individual actuary and system have made decisions that are reasonable and in conformance with actuarial standards, there are differences among the systems that when compared to each other, and viewed in aggregate, may not necessarily be consistent from a broader Kentucky perspective. We identified the above assumptions that would make sense to us to have a consistent assumption applied.

While there are states that are similar to Kentucky where the assumptions for each plan are established independently, there are also states that set certain assumptions consistently across systems or plans.

- Minnesota's Legislative Commission on Pensions and Retirement was established to study pension and retirement topics, to make recommendations furthering sound pension policy for the State's public pension plans and to arrange for review and replication of the annual actuarial work, including the experience studies. All experience studies are conducted in the same year across the systems.

- Florida sets assumptions and methods each year at its annual Assumption Conference. However, the Florida Retirement System is a single system that contains seven membership classes.

- State of Washington has a Pension Funding Council that sets assumptions and methods for all but one of the retirements systems based on recommendations by the Office of the State Actuary. The law enforcement officers and firefighters (LEOFF) Plan 2 Board sets the assumptions for that plan.

The following provides further discussion on these assumptions:

- **Inflation and Investment Return Assumption:** We performed an independent analysis using Milliman capital market assumptions as of June 30, 2021. Please note that our analysis is used to determine the reasonableness of the current assumptions. Our analysis shows the following:

    - For KERS Non-Hazardous and SPRS retirement, our analysis shows an expected median real return of 2.8%, which is slightly lower than the current assumption of 2.95%. We based our analysis on 10-year expected returns due to the current funded status of these plans.

- For KERS Hazardous and all KERS insurance plans, our analysis shows a 20-year expected median real return of 4.15%, which is a bit higher than the current assumption of 3.95%.
- For CERS retirement and insurance plans, our analysis shows a 20-year expected median real return of 4.05%, which is a bit higher than the current assumption of 3.95%.
- For TRS, our analysis shows a 30-year expected median real return of 4.3%, which is very similar to the TRS' investment consultant's analysis of 4.4%, which is a bit lower than the current assumption of 4.6%.
- For JFRS, our analysis shows a 30-year expected median real return of 3.15%, which is a bit lower than the current assumption of 3.5%.

Our analysis focused on the assumption in relation to the time of the experience study and used in the June 30, 2021 valuation. However, driven by increasing fixed income yields and lower price-to-earnings ratios, capital market assumptions have increased significantly as of June 30, 2022, as compared to a year ago. Based on Milliman's capital market assumptions as of June 30, 2022, the 20-year long-term expected returns for the systems increased by approximately 60 basis points (0.6%) from Milliman's 2021 20-year expected return.

We estimate that reflecting the June 30, 2022 economic environment would increase the expected returns above the current assumptions of 5.25% and 6.25% used for KPPA and to slightly above the current 7.1% assumption for TRS. Therefore, we suggest no changes to the assumptions at this time for KPPA or TRS.

For JFRS, our analysis suggests that a reduction in the investment return assumption and the inflation assumption should be considered. The inflation assumption used for JFRS is 3% whereas it is 2.3% for KPPA and 2.5% for TRS. Milliman's capital market assumptions would suggest a long-term inflation assumption in the range of 2.3% - 2.5%.

- **Hybrid Interest Crediting Rate Assumption:** The hybrid cash balance accounts are credited with interest equal to a minimum of 4% plus an amount equal to 75% of the average geometric return over the past five years in excess of 4%. If the geometric return over the past five years is less than 4%, the accounts are credited with 4%. Each actuary is setting the interest crediting assuming that the excess return equals the investment return assumption less 4%. The investment return assumptions are based on a distribution of returns that typically reflect a 50% chance of achieving that return or higher. Without any minimum interest crediting rate, this chance would be offset by the 50% chance that returns are below the expected return. However, for the interest crediting rate, the low end of the distribution of possible outcomes is limited due to the application of the 4% minimum interest crediting rate. This results in a greater chance the average interest crediting rate would exceed an assumption strictly based on the

investment return assumption, even if the long-term investment return assumption is achieved. Not reflecting the value of the minimum interest credit risks understating the measured liabilities.

We performed two independent analyses, a historical and a forward-looking analysis, to estimate the average interest crediting rate. We based our analysis on long-term 30-year returns as the hybrid account only applies to members recently hired and thus average returns would reflect a longer time horizon for these particular members. The following table shows the results of our analysis.

Hybrid Plan Assumed Interest Crediting Rate			
	KERS NHz / SPRS	KERS Hz / CERS	JFRS
75% of Assumed Excess Return over 4%	0.9375%	1.6875%	1.875%
Historical Analysis of 75% of Excess Return over 4%	1.5%	2.9%	2.8%
Forward Looking Analysis of 75% of Excess Return over 4%	2.4%	3.0%	2.3%
Assumed Interest Crediting Rate used in Valuation	4.9375%	5.6875%	5.875%
Assumed Interest Crediting Rate based on Historical Analysis	5.5%	6.9%	6.8%
Assumed Interest Crediting Rate based on Forward Looking Analysis	6.4%	7%	6.3%

We recommend that KPPA and JFRS complete a similar analysis on the interest crediting rate to determine an applicable assumption that should be used and be reflected in the next valuation. We believe this could have a material impact on the liabilities for the hybrid plan.

- **Mortality Improvement:** Each of the actuaries use different methods for projecting mortality improvement.
    - For KPPA, GRS uses the Society of Actuaries (SOA) MP-2014 ultimate table and does not use the 15-year select table produced by the SOA.

- For TRS, CavMac uses 75% of the SOA MP-2020 scale, including the select and ultimate scales.
- For JFRS, USI uses 100% of the SOA MP-2020 scale, including the select and ultimate scales.

While we find each assumption selected reasonable for each system, they are different from each other in how they forecast mortality improvement. Since these are all employees of the Commonwealth of Kentucky, and its municipalities and other governmental agencies, we would not expect rates of mortality improvement to differ for each group. Therefore, we recommend a consistent assumption be applied.

- **Healthcare trend rates and aging factors:** Each of the actuaries use different models and methods for developing healthcare trend rates and whether aging factors should apply or not apply in valuing projected premiums to be paid by the systems. We performed an independent analysis using the Getzen model developed by the SOA. Based on our review, liabilities may be lower or higher depending on the system or whether it is for benefits provided prior to or subsequent to becoming eligible for Medicare. While Milliman would utilize different trend factors than the System Actuaries did, we believe the assumptions selected by the System Actuaries are reasonable and in compliance with actuarial standards.

  We do recommend that a consistent trend model, such as the Getzen model, be used to set the healthcare trend assumptions for all the plans. We would anticipate the same trend be used for the pre-Medicare benefits across the systems as early retirees all participate in KEHP and thus, projected increases in healthcare costs should be the same. We believe this same philosophy would apply to whether to use aging factors or not for pre-65 benefits.

KPPA

The following represent additional comments related specifically to the plans administered by KPPA:

- **Mortality:** GRS constructed their own tables based on KPPA experience for post-retirement healthy mortality experience for all plans combined rather than basing it on recent tables published by the SOA, specifically the Pub-2010 tables. We offer the following comments:

  - Since the liabilities and costs for each plan under KPPA are developed independently, we are unsure why this one particular assumption comprises of all groups rather than the demographics of each specific group. We suggest that KPPA determine if this assumption should be determined separately or in a combined fashion. We suggest combining KERS and

CERS non-hazardous members together and the KERS and CERS hazardous plus SPRS together.

- Recent analysis by the SOA has indicated that the mortality experience among contingent survivors is higher than retirees or spouses of alive retirees. The experience for contingent beneficiaries was included in GRS' analysis of the postretirement mortality assumption. We suggest that this experience be studied separately in the next experience study.

- For insurance benefits, we suggest that the mortality table used be weighted based on count whereas for retirement benefits, it would be weighted based on amount.

- **Retirement Rates:** In the next experience study, we suggest that GRS review rates of retirement by tier within each group and clarify any adjustments made to rates based on the experience study data, and provide appropriate justification and rationale for the assumptions.

- **Disability Rates:** In the next experience study, we suggest that certain situations be excluded in the development of the rates of disability and in their application within the valuation model, such as:

  - Members with less than 5 years of service who are not eligible for disability benefits.

  - Members who have accrued a certain number of years of service, such as 27 years for Tier 1 non-hazardous or 20 years for Tier 1 SPRS, a disability benefit would not be payable, and the retirement benefit would be payable.

TRS

The following represent additional comments related specifically to TRS:

- **Mortality:** CavMac used the PubT-2010 tables for teachers, with customization to TRS retiree experience. We offer the following comments:

  - We suggest that a healthy post-retirement mortality table be used for beneficiaries while the retiree is alive and use the contingent mortality table only upon death of the retiree.

  - For insurance benefits, we suggest that the headcount-weighted versions of the mortality table be used.

- **Withdrawal Rates:** We suggest consideration be given to whether the rates should vary by each year of service so that there are no significant jumps in the assumption from one service grouping to the next.

- **Retirement:** We suggest the following considerations for the next experience study:

    - Potentially reflecting the impact service may have on rates of retirement, especially since the different benefit percentages apply at different service levels.
    - Establishing separate rates of retirement for members hired on or after July 1, 2008 to account for differences in retirement eligibility and benefit. A similar adjustment may be needed for a new tier of benefits for employees hired on or after January 1, 2022.

JFRS

The following represent additional comments related specifically to JFRS:

- **Salary Increase Assumption:** The salary increase assumption stated in the valuation report was 1% for three years and 3.5% thereafter. USI did not note the specific years the 1% assumption would apply to. We found that it applied to four years from the valuation date plus it was applied retroactively for purposes of determining benefits under the Entry Age Normal cost method. We suggest more clarity be provided in the use of this assumption.

- **Non-Legislative Salary Load for LRP:** USI loads the liability associated with active and inactive members by 40% to account for the expected liability associated with the possibility of significantly higher benefits provided by LRP due to salaries earned with other state employment. While we believe the analysis and subsequent recommendation completed by USI is reasonable, a load of 40% has a material impact on the valuation, so additional review may be appropriate. If available, we suggest JFRS submit to KPPA and TRS a list of current terminated members who have not commenced to receive updated salary information. This information could then be provided to the actuary and an estimated benefit for specific members could be incorporated into the valuation.

- **Insurance Valuation:** USI performs the insurance valuation on a contract basis, meaning that the coverage is valued over the retiree's lifetime and does not consider the dependent's independent lifetime. The cost of the coverage does include the value of dependent coverage if one is currently covered or assumed to be covered in the future. While actuarial standards do not require the actuary to value coverage on an individual basis versus a contract basis, we do find it unusual

to use a contract basis and recommend that USI consider modifying its approach to an individual basis.

Section IV – Actuarial Valuation Report

In this section, we provide commentary on the applicable actuarial standards of practice as well as the summary of plan provisions and actuarial assumptions contained in the reports. While we note some items for improvement or additional disclosure, we find that the System Actuaries are meeting the applicable actuarial standards.

Section V – Parallel Valuations

Based on the data and actuarial assumptions provided by each actuary, we were able to successfully replicate the retirement and insurance valuations as of June 30, 2021 for each of the systems and plans. Although actuaries are well versed in the standard actuarial cost methods available, there are differences in interpretation and implementation from firm to firm such that no two actuarial valuation software programs perform calculations exactly the same way. Even if the firms use the same actuarial software, differences in programming and techniques can also result in differences. As shown below, the results of our parallel valuation for each system are similar. Overall, the values produced by the System Actuaries are reasonable and comply with relevant actuarial standards.

The following comments represent comments regarding the benefits valued and our parallel valuation.

<u>KPPA</u>

- **Non-Hazardous Retiree Benefits:** The retiree benefits reported in the actuarial valuation reports for KERS and CERS non-hazardous retirees excluded benefits payable to certain retiree records. These retiree records had both a hazardous and non-hazardous benefit, but only the hazardous benefit was included in the hazardous valuations. We estimated that correcting this issue would increase the liability for KERS Non-Hazardous and CERS Non-Hazardous by 1.8% and 1.4%, respectively. It is our understanding that this issue was corrected in the 2022 valuation.

- **Accumulated Contributions:** For members who elect the maximum single life annuity, a beneficiary may be entitled to a death benefit equal to the accumulated contribution balance less the amount of payments received in retirement. Based on the information in the KPPA data, we estimated that the average period for which a death benefit would be applicable ranged from 32 months to 36 months (from 2.7 years to 3 years) for members who retired during the past year by dividing the balance at retirement by the applicable retirement benefit for CERS, KERS and SPRS. We suggest that GRS incorporate an assumption for this provision.

TRS

- **Accumulated Contributions:** For members who elect the maximum single life annuity, a beneficiary may be entitled to a death benefit equal to the accumulated contribution balance less the amount of payments received in retirement. Based on the information in the TRS data, we estimated that the average period for which a death benefit would be applicable is 49 months (4.1 years) by dividing the balance at retirement by the applicable retirement benefit. We suggest that CavMac incorporate an assumption for this provision.

JFRS

- **Mortality Table Application:** In performing the audit, USI indicated that they incorrectly applied a mortality table in developing the liabilities for the traditional plan. USI stated the impact on the actuarial accrued liability for the traditional plan for JRP and LRP was an overstatement of 1.557% and 1.75%, respectively. It is our understanding that this issue was corrected in the 2022 GASB valuation.

- **Excluded Members from Insurance Valuation:** In performing the audit, USI indicated that 5 inactive members and 1 retiree were excluded from the LRP valuation that should have been included.

- **Accumulated Contributions:** For members who elect the maximum single life annuity, a beneficiary may be entitled to a death benefit equal to the accumulated contribution balance less the amount of payments received in retirement. We suggest that USI incorporate an assumption for this provision.

Section I – Data Validity

Background

The member data used by the actuary is one of the basic foundations of an actuarial valuation. It forms the basis for actuarially projecting the benefits provided to members by the various systems of KYSRS. Thus, an important step in an actuarial audit is reviewing the validity of the member data.

As part of our review process, we performed independent edits on the raw data and then compared our results with the valuation data used by each system's actuary. We found our results to be consistent. Our results did not match exactly in some cases; however, this is understandable since the retained actuary typically has more extensive data-editing procedures. Overall, each key data component matched within an acceptable level, and we believe the individual member data used by each system's actuary was appropriate for valuation purposes.

Valuation Data Review

A summary of the data in aggregate is shown in the following exhibits. Note that the various statistics displayed in the following exhibits may not be consistent between systems as the statistics displayed align with the information as shown in the respective valuation reports prepared by the different actuarial firms.

We have the following comments:

- Retiree benefits for KERS and CERS retirees do not match the values included in the valuation report as the numbers reported exclude the non-hazardous portion of benefits for retirees who are receiving benefits where a portion is due to hazardous service and a portion is due to non-hazardous service. The non-hazardous portion of the benefits for these members were excluded from the valuation. Please refer to our discussion in Section V for the impact on the valuation liabilities.

- For LRP, the benefits reported in the valuation for retirees and traditional terminated vested members are twice the amount included in the valuation. We believe this is only a reporting issue and the correct benefit was valued in determining plan liabilities.

- For LRP and JRP, the cash balance account for vested members is included with the benefits for traditional plan members as if both benefits were paid annually. This impacts the average benefits reported for vested members. We suggest that these members be separated for purposes of reporting data statistics.

Comparison of June 30, 2021 Membership Data
KERS

	GRS	Milliman's Review of Valuation Data	Ratio of Milliman /GRS
Total retirees			
Number	52,426	52,426	100.00%
Total annual benefits ($1,000's)	$1,043,237	$1,068,511	102.42%
Average annual benefit	$19,899	$20,381	102.42%
Average age	69.5	69.5	100.00%
Service retirees			
Number	44,907	44,907	100.00%
Total annual benefits ($1,000's)	$935,283	$957,135	102.34%
Average annual benefit	$20,827	$21,314	102.34%
Average age	69.6	69.6	100.00%
Disabled retirees			
Number	1,931	1,931	100.00%
Total annual benefits ($1,000's)	$25,043	$25,616	102.29%
Average annual benefit	$12,969	$13,266	102.29%
Average age	66.0	66.0	100.00%
Beneficiaries			
Number	5,588	5,588	100.00%
Total annual benefits ($1,000's)	$82,911	$85,760	103.44%
Average annual benefit	$14,837	$15,347	103.44%
Average age	70.1	70.1	100.00%
Active members			
Total number	34,013	34,013	100.00%
Average age	45.4	45.4	100.00%
Average service	11.2	11.2	100.00%
Total salary ($1,000's)	$1,512,165	$1,512,165	100.00%
Average salary	$44,458	$44,458	100.00%
Vested inactive members			
Number	33,853	33,853	100.00%
Total annual benefits ($1,000's)	$93,181	$93,182	100.00%
Average annual deferred benefit	$2,753	$2,753	100.00%
Nonvested inactive members			
Number	28,349	28,349	100.00%

Comparison of June 30, 2021 Membership Data
CERS

	GRS	Milliman's Review of Valuation Data	Ratio of Milliman /GRS
Total retirees			
Number	78,064	78,064	100.00%
Total annual benefits ($1,000's)	$1,080,438	$1,108,669	102.61%
Average annual benefit	$13,840	$14,202	102.61%
Average age	69.3	69.3	100.00%
Service retirees			
Number	66,069	66,069	100.00%
Total annual benefits ($1,000's)	$944,293	$968,693	102.58%
Average annual benefit	$14,293	$14,662	102.58%
Average age	69.8	69.8	100.00%
Disabled retirees			
Number	4,549	4,549	100.00%
Total annual benefits ($1,000's)	$55,924	$57,230	102.33%
Average annual benefit	$12,294	$12,581	102.33%
Average age	65.3	65.3	100.00%
Beneficiaries			
Number	7,446	7,446	100.00%
Total annual benefits ($1,000's)	$80,221	$82,746	103.15%
Average annual benefit	$10,774	$11,113	103.14%
Average age	66.8	66.8	100.00%
Active members			
Total Members	86,540	86,540	100.00%
Average age	46.9	46.9	100.00%
Average service	9.5	9.5	100.00%
Total salary ($1,000's)	$3,107,090	$3,107,090	100.00%
Average salary	$35,904	$35,904	100.00%
Vested inactive members			
Number	52,534	52,534	100.00%
Total annual deferred benefits	$91,309	$91,309	100.00%
Average annual deferred benefit	$1,738	$1,738	100.00%
Nonvested inactive members			
Number	52,099	52,099	100.00%

Comparison of June 30, 2021 Membership Data
State Police

	GRS	Milliman's Review of Valuation Data	Ratio of Milliman /GRS
Total retirees			
Number	1,673	1,673	100.00%
Total annual benefits ($1,000's)	$62,700	$62,700	100.00%
Average annual benefit	$37,478	$37,478	100.00%
Average age	63.9	63.9	100.00%
Service retirees			
Number	1,375	1,375	100.00%
Total annual benefits ($1,000's)	$54,771	$54,771	100.00%
Average annual benefit	$39,833	$39,834	100.00%
Average age	63.5	63.5	100.00%
Disabled retirees			
Number	54	54	100.00%
Total annual benefits ($1,000's)	$913	$913	100.00%
Average annual benefit	$16,907	$16,907	100.00%
Average age	57.0	57.0	100.00%
Beneficiaries			
Number	244	244	100.00%
Total annual benefits ($1,000's)	$7,016	$7,016	100.00%
Average annual benefit	$28,754	$28,754	100.00%
Average age	67.4	67.4	100.00%
Active members			
Total Members	775	775	100.00%
Average age	37.7	37.7	100.00%
Average service	11.1	11.1	100.00%
Total salary ($1,000's)	$45,338	$45,338	100.00%
Average salary	$58,501	$58,501	100.00%
Vested inactive members			
Number	313	313	100.00%
Total annual benefits ($1,000's)	$1,134	$1,134	100.00%
Average annual benefit	$3,623	$3,623	100.00%
Nonvested inactive members			
Number	321	321	100.00%

Comparison of June 30, 2021 Membership Data
Teachers

	CavMac	Milliman	Ratio of Milliman / CavMac
Total retirees			
Total number	57,465	57,493	100.05%
Annual benefits ($1,000's)	$2,265,323	$2,266,073	100.03%
Average age	70.7	70.7	100.00%
Service retirees			
Total number	50,129	50,132	100.01%
Annual benefits ($1,000's)	$2,061,901	$2,062,003	100.00%
Disability retirees			
Total number	2,831	2,831	100.00%
Annual benefits ($1,000's)	$88,783	$88,783	100.00%
Beneficiaries			
Total number	4,505	4,530	100.55%
Annual benefits ($1,000's)	$114,639	$115,287	100.57%
Total active members			
Total number	69,256	69,260	100.01%
Average age	43.4	43.4	100.00%
Average service	11.7	11.7	100.00%
Total salary	$3,784,400	$3,784,722	100.01%
Average salary	$54,644	$54,645	100.00%
University			
Total number	3,047	3,048	100.03%
Total salary	$191,462	$191,520	100.03%
Average salary	$62,836	$62,835	100.00%
Non-University			
Total number	66,209	66,212	100.00%
Total salary	$3,592,938	$3,593,202	100.01%
Average salary	$54,267	$54,268	100.00%
Inactive members			
Vested	10,538	10,539	99.99%
Nonvested	50,697	50,696	100.00%

Comparison of June 30, 2021 Membership Data
Legislators

	USI	Milliman	Ratio of Milliman / USI
Retirees & Beneficiaries			
Total number	245	245	100.00%
Total annual benefits ($1,000's)	$10,317	$5,159	50.00%
Average benefit	$42,110	$21,055	50.00%
Terminated Vested			
Vested (Traditional)	39	39	100.00%
Total annual benefits ($1,000's)	$1,025	$513	50.00%
Average benefit	$21,817	$13,146	60.26%
Vested (Hybrid)	8	8	100.00%
Hybrid Account ($1,000's)	$63	$63	100.00%
Total Active Members			
Total number	101	101	100.00%
Average age	56.3	55.8	99.11%
Average service	9.9	8.7	87.88%
Total salary ($1,000's)	$4,201	$4,201	100.00%
Average salary	$41,597	$41,597	100.00%

Judicial

	USI	Milliman	Ratio of Milliman / USI
Retirees & Beneficiaries			
Total number	356	356	100.00%
Total annual benefits ($1,000's)	$49,034,016	$49,592,216	101.14%
Average benefit	$137,736	$139,304	101.14%
Terminated Vested			
Vested (Traditional)	12	12	100.00%
Total annual benefits ($1,000's)	$812,180	$406,089	50.00%
Average benefit	$58,013	$33,841	58.33%
Vested (Hybrid)	2	2	100.00%
Hybrid Account ($1,000's)	$58	$58	100.00%
Total Active Members			
Total number	231	231	100.00%
Average age	57.4	57.4	100.00%
Average service	15.1	14.7	97.35%
Total salary ($1,000's)	$29,537	$29,603	100.22%
Average salary	$127,864	$128,150	100.22%

Benefit Calculation Review

Our data review process included an extra layer of data verification by comparing valuation data and benefit calculation data. The purpose of the valuation is to determine the liability for benefits to be paid in the future. Therefore, verifying the consistency between the data used for valuation purposes and the data used for benefit calculation purposes is a critical and integral component of the audit process.

To perform this task, we requested the data that each system provided to their actuary for the June 30, 2021 valuation and additional information from each system regarding members who retired after June 30, 2021. After reviewing this data, we then requested individual benefit calculations from each system that were randomly selected to encompass all employee categories and the majority of the benefits members can receive from the systems. In total, we requested eighty-six (86) benefit calculations across all systems. These benefit calculations included service retirement benefits, disability benefits, survivor benefits, and lump sum options in the systems. Forty-one (41) of the requested calculations were for members whose benefits commenced subsequent to June 30, 2021 (they were reported as active members on the valuation date) and forty-five (45) of the requested calculations were for members whose benefits commenced prior to June 30, 2021 (they were reported as retired members on the valuation date). This information was the basis for our review. The following table details the number of calculations reviewed for each system.

System	Commenced Subsequent to June 30, 2021	Commenced Prior to June 30, 2021	Total
KERS	10	13	23
CERS	12	10	22
SPRS	6	5	11
KPPA Subtotal	28	28	56
TRS	7	8	15
JRP	4	4	8
LRP	2	5	7
JFRS Subtotal	6	9	15
Grand Total	41	45	86

The purpose of reviewing actual benefit calculations is two-fold. First, we reviewed the benefit calculations for reasonableness, consistency and compliance with applicable member handbooks and summary plan descriptions. Second, we reviewed the data used in the benefit calculations for consistency with the valuation data provided to the plan actuary for the June 30, 2021 valuation.

Benefit Calculation Review – Retiree Data

The following table describes the items reviewed for members who were reported with the retiree data in the June 30, 2021 actuarial valuation.

	Benefit Calculation Review: Retiree Data	Milliman
1.	Benefits were generally computed accurately in the calculation based on the information contained in the calculation and were reasonable and consistent with the Summary Plan Descriptions	✓
2.	Basic data information (date of birth, gender, date of commencement) was provided accurately in the retiree data to the actuary (see discussion on date of retirement for JFRS)	✓
3.	Benefit amounts (maximum allowance, current benefit, social security benefits) were provided accurately in the retiree data (see discussion on initial benefits for KPPA)	✓
4.	Form of payment information was provided accurately	✓
5.	Information on beneficiaries (spouse date of birth, joint annuitant percentage, payee type) was provided accurately (see discussion on popup joint and survivor benefits for TRS)	✓
6.	For KERS and CERS, portion of benefit attributed to hazardous and non-hazardous (see discussion on hazardous percentage for KPPA)	✓
7.	For survivors, benefit and other information was provided accurately	✓
8.	For members receiving a disability benefit from TRS, the benefit amount and date the entitlement period ceases were provided accurately (see discussion on disability below for TRS)	X
9.	Service credit, final average compensation and employee contribution balance were consistent with amounts computed in the benefit calculation (see discussion on date of hire for TRS and contribution account balance for JFRS)	✓
10.	Employee type (hazardous, non-hazardous for KERS and CERS) was provided accurately	✓

In our experience, this degree of matching indicates that high quality retiree data is being provided to the actuary by each System.

However, we did identify the following items in our review related to the retiree data. Some of these may be record keeping items with no impact on the calculation of benefits or liability and some of them may be considered to have an immaterial effect on the calculation of liability. Nevertheless, we have included all items that we identified for each system to review and determine if any actions should be taken.

KPPA

1) **Initial Benefits:** We did notice a few items in our review where the data provided to the actuary did not exactly match the final benefit calculation provided to us due to adjustments made after the data was submitted to the actuary for the valuation. For example, there were situations where additional service was included, changes in compensation due to the application of the pension spike cap or due to qualifying for disability since the initial calculation occurred. These types of issues are fairly common among retirement systems.

   Recommendation: One suggestion we have been providing to clients is for them to provide an indicator on the data whether the information in the data reflects an estimated calculation or final calculation. Based on our review, we do not believe there is a significant lag in completing calculations. The actuary can then determine if it is appropriate to adjust the liability for those with estimated benefits.

2) **Hazardous Portion**: Some members have accrued both hazardous and non-hazardous service during their career. Each benefit is calculated separately with the sum paid to the member. The total benefit is included in the data submitted to the actuary. In addition, percentages of the service accrued as hazardous and non-hazardous are provided and used by the actuary to split the benefit between the hazardous and non-hazardous groups. However, the percentage of service would not necessarily be the same as the percentage of the retirement benefit due to various other factors such as differences in final average compensation, benefit multiplier, early retirement factor, etc. Using the actual benefits accrued, we determined slightly different percentages due to these various factors.

   Recommendation: We suggest that KPPA review the possibility of providing the actual benefit accrued under each plan on the data.

TRS

1) **Pop-up Percentage**: When a member elects a joint and survivor benefit, they are entitled to receive an increase in their monthly benefit in the event that their contingent beneficiary pre-deceases them. CavMac estimates the pop-up percentage based on the retiree's date of retirement and various plan factors. We believe the approach used by CavMac is reasonable given the data provided,

although this estimate differs from the reciprocal of the option factor used in the benefit calculation.

Recommendation: We suggest that CavMac and TRS determine if the single life annuity amount (i.e., the pop-up amount) can be included in the data TRS submits to the actuary to reflect the actual value of this benefit feature without the need for use of an estimation technique.

2) **Disability:** When a member becomes disabled, the disability benefit is paid for an entitlement period, typically 5 years. During the period of disability, members are eligible for cost-of-living adjustments (COLA) and survivor benefits upon death. At the end of entitlement period, the benefit is re-determined based on actual service plus service during the entitlement period. The benefit calculation includes the benefit to be paid at the end of the entitlement period. However, this information is not included in the valuation data provided to the actuary.

   Recommendation: We suggest that the date the entitlement period ceases and the member's projected benefit at that date be included in the valuation data TRS submits to the actuary and incorporated into the valuation programming to more accurately value this benefit feature. Please note that we do not believe this impacts many records.

3) **Date of Hire**: For two members, the date of hire in the valuation data was not consistent with the date of hire in the benefit calculation as both of these members have reciprocity service with KPPA. Please see our discussion on KPPA reciprocity service in the active data section below.

<u>JFRS</u>

1) **Contribution Account Balance**: For an unmarried member, their beneficiary receives a refund of the remaining balance of accumulated employee contributions equal to the amount that exceeds the sum of the annuity payments made to the member in retirement. However, the employee contribution balance is currently not included on the data submitted to the actuary for current retirees, and therefore not reflected in the calculation of the retiree liability. In addition, we believe the liability associated with this refund provision for death after retirement, is not being reflected for future retirees.

   Recommendation: We suggest that JFRS includes a member's contribution account balance at date of retirement in the data submitted to the actuary so that USI can accurately value this provision. As discussed in Section II, we also suggest that USI value this provision for future retirees as well.

2) **Date of Retirement**: For one LRP member, date of retirement in the data is actually the date of termination rather than date of commencement.

   Recommendation: We suggest that JFRS provides both date of termination and date of commencement to USI.

Benefit Calculation Review – Active Data

The following table describes the items reviewed for members who were reported with the active data in the June 30, 2021 actuarial valuation and retired subsequent to the valuation date. Calculations reflected a cross-section of members from various participant groups.

	Benefit Calculation Review: Active Data	**Milliman**
1.	Benefits were generally computed accurately in the calculation based on the information contained in the calculation and were reasonable and consistent with the Summary Plan Descriptions	✓
2.	Basic data information (date of birth, gender, date of hire) was provided accurately in the active data to the actuary	✓
3.	Total service credit was generally consistent with the active data, including split of hazardous and non-hazardous service for KERS and CERS (see discussion on sick leave service for KPPA, on reciprocity for TRS and on date of hire / years of service for JFRS)	✓
4.	Annual salary and historical salary were generally consistent with the active data (see discussion on final compensation for KPPA and compensation for TRS)	✓
5.	Employee contribution balance was generally consistent with the active data	✓

In our experience, this degree of matching indicates that high quality active data is being provided to the actuary by the System.

However, we did identify the following items in our review related to the active data. Some of these may be record keeping items with no impact on the calculation of benefits or liability and some of them may be considered to have an immaterial effect on the calculation of liability. Nevertheless, we have included all items that we identified for each system to review and determine if any actions should be taken.

KPPA

1) **Sick Leave Service**: Tier 1 members may elect to convert unused accumulated sick leave to service upon retirement. We found that four of the five SPRS members we reviewed had converted unused sick leave to service ranging from

19 months to 38 months. Note that the fifth member had purchased 41 months of service. This issue was not prevalent for KERS or CERS.

Recommendation: We understand that employers contribute an additional amount for employees who convert unused sick leave service that is equal to the estimated actuarial value. Since there would be no expected cost impact to the system, we believe no further analysis is required.

2) **Final Compensation:** Final compensation for Tier 1 members is based on a member's five highest years of final compensation for non-hazardous members (5-High) and three highest years for hazardous members (3-High). However, partial years may be included as a full year for this purpose where the average is then determined based on actual months worked during the 3-High period. For example, a hazardous or SPRS member who terminates employment in August may receive compensation from July 1 to date of termination representing one month of service. This partial year would count as the third year in determining the average final compensation used in calculating the member's benefit. Based on the timing of compensation received during this partial year, there is a likelihood that it could be significantly higher than the member's typical monthly salary. The spiking prevention provision does not seem to apply in these situations. For the six SPRS calculations, the approximate percentage increase in the final average compensation for reflecting this partial year method ranged from 3% to 13% higher. This could materially increase a member's final average compensation over the value projected using the salary data provided for the actuarial valuation.

   Recommendation: We recommend a review be completed by GRS and KPPA to determine if a load should be incorporated into the actuarial valuations for SPRS, KERS and CERS to account for the potential impact of partial year compensation on the final average compensation for Tier 1 members. While it may impact non-hazardous members subject to the 5-High provision, it will have a lesser impact due to the additional years included in the final average period. Also, the 5-High and 3-High provision may not necessarily apply to all members, but it does appear that it would have the greatest impact on SPRS.

TRS

1) **Compensation**: For a few records, actual compensation used in the benefit calculation was lower than the amount reported in the active data due to Kentucky Revised Statute § 161.220(9)(b), a statute that limits the increases in salary for the three years preceding retirement to prevent compensation spiking.

   Recommendation: We suggest that TRS and CavMac review the impact of this provision to determine if an assumption would be appropriate for limiting the final salary calculation when members are assumed to retire.

2) **Reciprocity with KPPA**: It is our understanding that service with KPPA can impact a member's benefit in a couple of different ways:

   a. Reciprocity service may impact the applicable benefit multiplier
   b. Compensation earned with KPPA may be used in the development of final average salary

   Of the seven active records reviewed, three had reciprocity service with KPPA. In addition, there were an additional two retiree records that also had reciprocity service. It appears that the KPPA compensation and service used in the benefit calculation is not included in the valuation data. This can lead to large differences in expected benefit amounts due to using a higher benefit multiplier (for example 2.5% versus 1.5%) and for members with recent KPPA compensation that is greater than the compensation history in the valuation data.

   Recommendation: We suggest that CavMac and TRS review the prevalence of members with KPPA reciprocity service. If KPPA service and compensation information can be provided on the valuation data, we recommend it be incorporated into the valuation processing. If this information is unavailable, we suggest a further review to determine if an assumption should be incorporated into the actuarial valuation.

JFRS

1) **Date of Hire / Years of Service**: We found a few situations where the date of hire or years of service information was not necessarily consistent with that shown in the benefit calculation. For example:
   a. The date of hire for a LRP member was not specified in the benefit calculation but years of service was reasonable based on information in the valuation data.
   b. The date of hire for a JRP member in the valuation data reflected prior service but years of judicial service reported in the data did reflect the member's judicial date of hire.
   c. The date of hire for a JRP member in the valuation data was reported as the end of the month of hire rather than the actual day of hire.
   d. The total years of service for a JRP member in the valuation data did not reflect service years that was transferred from KPPA. However, since JFRS charges KPPA their portion of applicable costs, we do not believe there is any material issue.

   Recommendation: Although there were some inconsistencies in the reporting of date of hire and years of service, we do not believe any issue is material and thus, we are not recommending any changes at this time.

Valuation Data Review

In preparing an actuarial valuation, the actuary will review the "raw" data provided by the plan sponsor and will "edit" the data as needed to complete missing data and/or to remove discrepancies. We requested and received a copy of the edited data from each system's actuary. Based on our understanding of the data provided to the actuary, we reviewed the data procedures employed by GRS, CavMac, and USI to review the reasonableness of interpretations, estimates and adjustments made in the data editing process.

A general review of the valuation data should include the following:

General Annual Data Review

1.	Compare data with prior year's data to ensure all records from prior year are accounted for	✓
2.	Prepare data reconciliation from prior year to current year and identify status changes, such as new members, terminations, retirements, deaths, etc. during the year (see discussion on data reconciliation)	X
3.	Compare data reconciliation with prior year reconciliation to identify trends and anomalies	X
4.	Review data for unusual changes in compensation, benefits or other fields	✓
5.	Interpreting the data fields appropriately (see discussion on retiree data for KPPA)	✓
6.	Determine reasonable assumption for missing data fields (see discussion on Missing Data Fields for TRS)	✓

Overall, we found the procedures for each system's actuary to be reasonable and appropriate for the scope of the project and consistent with Actuarial Standard of Practice 23 – *Data Quality*. The following represent a few minor comments regarding the general data procedures employed by GRS, CavMac, and USI.

All Systems

1) **Data Reconciliation**: We understand that systems as complex as these systems require a significant amount of data editing and review to understand movement in membership from one year to the next. Identifying this movement in data is important in understanding the reason for actuarial gains and losses, understanding changes in status, continual review of actuarial assumptions, etc. Furthermore, it may be helpful in understanding when members transfer from hazardous to non-hazardous or vice versa.

Recommendation: We recommend each of the actuaries incorporate a data reconciliation for each plan in the valuation report detailing changes in status, transfers among groups, and members added who were not previously included in the census data.

KPPA

1) **Retiree Data**: We found certain situations where the applicable benefit payable to a retiree, surviving spouse or alternate payee may not have been completely clear based on codes provided with the data from KPPA. These situations included where the later pay benefit differed from the current pay benefit, but the benefit was not expected to change based on the form of payment selected, the later pay benefit was set to zero or some other benefit amount for certain records where the form selected was the Social Security leveling option, etc. After discussions with KPPA in conjunction with our review of the actuary data, we determined the actuary was correctly valuing the proper benefits in all situations we had inquired on.

   Recommendation: We understand that KPPA had made a change to their programming for one situation we noticed. We suggest that KPPA may provide additional notes on the correct benefits to value by form of payment to eliminate any possible confusion in the future.

TRS

1) **Missing Data Fields**: It is not uncommon for valuations of large plans (like TRS) to include an assumption for selected missing data fields based on the data received for all other members. To the extent the number of missing data fields are minimal, this is a reasonable approach. For those records missing or having an unreliable date of birth, it appears that CavMac used an average age for these members though this is not clear in the report.

   There are about 50 records on the 2021 valuation data who are missing gender but have statuses that are valued. It is unclear what assumption CavMac is making for these records.

   Recommendation: We suggest that CavMac disclose the assumptions for missing data fields in the valuation report.

Data Review – Retiree Data

For a system as complex as KYSRS, a significant part of the valuation is ensuring that the data provided to the actuary is accurate and provides all information necessary to value all the benefits that could be payable upon future contingent events. In the prior

section, our comments focused on data items verified against members' specific calculations. In this section, we provide commentary on the reasonableness of the total data files provided to the actuary.

The following table describes the items reviewed for members who were reported with the retiree data in the June 30, 2021 actuarial valuations.

	Valuation Data Review: Retiree Data	**Milliman**
1.	Member's status is reasonable and consistent with other data fields in file	✓
2.	Basic data information (date of birth, gender, date of commencement), including adjustments for missing data, was reasonable	✓
3.	Relationship between the current benefit and the later pay benefit is used appropriately for members electing a social security leveling option or the popup joint and survivor benefit	✓
4.	For members electing a joint and survivor benefit, the joint percentage and joint annuitant date of birth were reasonable	✓
5.	The member's accumulated contributions information is included on the data (see discussion)	X
6.	For TRS members receiving a disability benefit, information on when and how the benefit amount may change after the entitlement period ends is included (see discussion above)	X
7.	For beneficiaries receiving the survivor portion of the retirement benefit, the current benefit reflects the survivor percentage appropriately	✓
8.	Basic Healthcare data information (health plan information, Medicare eligibility, etc.) was reasonable (see discussion on health plan for JFRS)	✓
9.	Basic Healthcare dependent data information (dependent type, date of birth, health plan information, Medicare eligibility, etc.) was reasonable	✓

Based on our review, we believe that each actuary is correctly reflecting the data provided by each system into the actuarial valuation process, although we did identify the following item in our review.

<u>All Systems</u>

1) **Accumulated Contributions:** For members who elect the maximum single life annuity, a beneficiary may be entitled to a death benefit equal to the accumulated contribution balance less the amount of payments received in retirement. While KPPA and TRS are including this information and JFRS did not provide it, none of the actuaries are incorporating this information into the valuation.

   Based on the information in the KPPA data, we estimated that the average period for which a death benefit would be applicable ranged from 32 months to 36 months or from 2.7 years to 3 years for members who retired during the past year by

dividing the balance at retirement by the applicable retirement benefit for CERS, KERS and SPRS.

Based on the information in the TRS data, we estimated that the average period for which a death benefit would be applicable is 49 months or 4.1 years by dividing the balance at retirement by the applicable retirement benefit.

Recommendation: Based on this analysis, we recommend that each of the actuaries incorporate a value for this feature for current and future retirees.

Data Review – Active Data

The following table describes the items reviewed for members who were reported with the active data in the June 30, 2021 actuarial valuation.

	Valuation Data Review: Active Data	**Milliman**
1.	Basic data information (date of birth, gender), including adjustments for missing data, was reasonable	✓
2.	Service credit information provided was reasonable and included both hazardous and non-hazardous service information for KERS and CERS (see discussion on hazardous / non-hazardous service)	✓
3.	Employee contribution balance was generally consistent with service and compensation information (see discuss on member contributions for JFRS)	✓

Based on our review, we believe that each actuary is correctly reflecting the data provided by each system into the actuarial valuation process, although we did identify the following item in our review.

KERS and CERS

1) **Hazardous / Non-Hazardous Service**: Certain active members have accrued both hazardous and non-hazardous service. KPPA provides two records for these members, a current active record for where the member is currently accruing service and an inactive record indicating service accrued as a prior employee. GRS incorporates the total service in the valuation under the current active record. For example, if a current hazardous member with 15 years of service and 5 years of non-hazardous service, GRS values all 20 years as a hazardous member. Therefore, the entire liability is held under the member's current active status.

   Upon retirement, KPPA includes the portion of the benefit attributable to hazardous service and to non-hazardous service. This split is incorporated into the valuations. When the member does retire, this methodology results in a loss to the plan not holding any liability and a gain to the plan holding the entire liability.

Recommendation: We recommend that GRS and KPPA discuss this issue to determine if a prorated portion of the liability should be determined while the employee is an active member. Based on the service included in the valuation, we believe this would result in an increase in the liability held for KERS and CERS Hazardous as there is more hazardous service for non-hazardous members than non-hazardous service for hazardous members.

JFRS

1) **Member Contributions**: For hybrid members in the LRP and JRP Hybrid Plans, JFRS data files provided by USI do not specify the member's portion of their hybrid account balance. This information is included in the data submitted by JFRS. Please note that there are certain contingencies where only the member's portion of the hybrid balance would be paid, such as members who terminate with less than 5 years of service.

   Recommendation: While the estimated impact on the valuation liabilities is anticipated to be insignificant, we suggest that USI review its valuation procedures and include accordingly.

2) **Health Plan**: A member's health plan election determines the amount of premiums to be paid by JFRS for the upcoming year. This information is not submitted to the actuary on an individual basis. In valuing the insurance benefits, USI utilizes a weighted average of the group premium rates based on coverage tier based on information provided by JFRS in total.

   Recommendation: We believe applying average group information to develop average costs for retirees is reasonable, but suggest health plan election information, including dependent information, be included in the data submitted to the actuary.

Section II – Actuarial Valuation Methods and Procedures

In this section, we discuss the various actuarial methods used in the actuarial valuation to measure the plan's liabilities and funded status and calculate the contribution rates in accordance with statute and the board's funding policy.

Asset Valuation Method

An asset valuation method develops the actuarial value of assets, which is used to develop the unfunded liability for purposes of determining the statutory contribution rate. The asset valuation methods used by each system are identical. The method applies to both the retirement benefits and the insurance benefits.

The asset valuation method recognizes the difference between the actual investment income on the market value of assets and the expected investment income on the market value of assets based on the valuation interest rate over a period of five years. No corridor is applied to this value to compare the resulting actuarial value of assets to the market value. A corridor would limit how far the actuarial value of assets could deviate from the market value of assets. For example, if the actuarial value exceeds (or is below) the market value by 30%, a 20% corridor would limit this deviation such that a greater portion of prior losses (or gains) is recognized in the current year. While a corridor is a common practice, it is not required by Actuarial Standards of Practice for the asset valuation methods used in the KYSRS valuations.

Actuarial Standard of Practice 44 – *Selection and Use of Asset Valuation Methods for Pension Valuations (ASOP 44)* provides guidance to actuaries in selecting or evaluating asset valuation methods. ASOP 44 states that a method is reasonable if it produces values within a sufficiently narrow range around market value or if it recognizes differences from market value in a sufficiently short period.

One purpose of an asset valuation method is to assist in the determination of an actuarially determined contribution rate. Recognizing investment gains or losses over a period of time limits annual fluctuations in contribution rates to prevent large increases in one year followed by large decreases in the next year. Recognizing the importance of minimizing the impact of potentially volatile investment returns on the application of the statutory funding policy, we agree with the use of the asset valuation methods used in the valuations.

We find that the methods used are reasonable and consistent with the guidance provided in Actuarial Standard of Practice 44 – *Selection and Use of Asset Valuation Methods for Pension Valuations*.

We reviewed the numerical calculations of the development of the actuarial value of assets and found them to be accurate for each system.

Actuarial Cost Method

Both the pension and retiree healthcare valuations use the Entry Age Normal actuarial cost method to determine the cost of benefits accrued during the upcoming year (known as the normal cost) plus the value of benefits accrued for all years of past service (known as the accrued liability) as of the valuation date. This method is used by all the systems for all plan benefits.

The purpose of any cost method is to allocate the cost of future benefits to specific time periods. Most public plans follow one of a group of generally accepted funding methods, which allocate the cost over the members' working years. In this way, benefits are financed during the time in which services are provided.

The Entry Age Normal actuarial cost method is the most common cost method used by public plans. The 2022 Public Fund Survey from the National Association of State Retirement Administrators shows that about 90% of the retirement systems surveyed are using the Entry Age Normal cost method.

The focus of the Entry Age Normal cost method is the level allocation of costs over the member's working lifetime. For a public plan, in theory this means current taxpayers pay their fair share of the pensions of the public employees who are currently providing services. Current taxpayers are not expected to pay for services received by a past generation, nor are they expected to pay for the services that will be received by a future generation. The cost method does not anticipate increases or decreases in allocated costs.

We find that the actuarial cost method used in both the pension and retiree healthcare valuations is reasonable and consistent with the guidance provided in Actuarial Standard of Practice 4 – *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions* (ASOP 4) and Actuarial Standard of Practice 6 – *Measuring Retiree Group Benefits Obligations and Determining retiree Group Benefits Program Periodic Costs or Actuarially Determined Contributions.*

For GASB Statements Nos. 67, 68, 74 and 75, the Entry Age Normal actuarial cost method is the only permissible cost method for financial reporting purposes.

Funding Policy

A system's funding policy sets the parameters for the actuary to determine the actuarially determined contribution rate once the assets are developed in accordance with the asset valuation method and the liabilities are determined in accordance with the actuarial cost method. One of the primary features of a funding policy is how the unfunded actuarial accrued liability, if any, is paid down over time. ASOP 4 provides guidance to actuaries

in selecting or evaluating the various procedures used to determine actuarially determined contribution rate or amount.

In addition, there are publications within the actuarial community that also provide guidance on these items, particularly a white paper on public pension plan funding issued by the Conference of Consulting Actuaries.

Conference of Consulting Actuaries White Paper

The Conference of Consulting Actuaries (CCA) has issued a white paper titled *Actuarial Funding Policies and Practices for Public Pension Plans*. The white paper was composed by a group of public plan actuaries from the major consulting firms that work with public plans and was the result of an extensive series of meetings which lasted for over two years. The white paper was not meant as a replacement for the actuarial standards of practice. The white paper focuses on a Level Cost Allocation Model (LCAM) and provides detailed analysis for classifying each of the three major components of LCAM funding policies: (a) cost methods, (b) asset methods and (c) amortization methods. The classification system uses the following terms:

Categories under CCA Guidelines	
Model Practices	Those practices most consistent with the Level Cost Allocation Model (LCAM)
Acceptable Practices	Well established practices that typically do not require additional analysis to demonstrate their consistency with the LCAM.
Acceptable Practices with Conditions	May be acceptable in some circumstances either to reflect different policy objectives or on the basis of additional analysis.
Non-Recommended Practices	Systems using these practices should acknowledge the policy concerns identified by the CCA Guidelines or acknowledge they reflect different policy objectives.
Unacceptable Practices	No description provided by CCA, but the implication is that these should not be used.

As we evaluate the different funding policies for each system, we have used this CCA White Paper as a guide.

Contribution rates are set through a combination of statutory requirements and Board policies that vary by each system.

There will always be a competition between providing strong funding to the system and having reasonable contribution rates. We believe that the funding policies now in place for all the systems strikes a reasonable balance between the two objectives.

KPPA

For KERS and SPRS, employer contribution requirements are based on Kentucky Revised Statute § 61.565 and for CERS on § 78.635. The following are the principles for calculating the total actuarially determined employer contribution:

A. Use of the Entry Age Normal actuarial cost method
B. Use of a five-year asset smoothing method.
C. Use of a 30-year closed period to amortize the unfunded liability as of June 30, 2019.
D. Use of a 20-year closed period to amortize new sources of unfunded liability (consisting of benefit changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).
E. Separate contributions shall be determined for employers with employees participating in hazardous duty retirement coverage.
F. Employer contribution rates shall include separate rates to fund retirement benefits and insurance benefits.
G. All employers including the General Assembly, shall pay the full actuarially required contributions to KERS and SPRS. For CERS, each employer shall include in the budget sufficient funds to pay the employer contribution.
H. For CERS, the sum of the normal cost and actuarially accrued liability contributions for retirement and insurance benefits shall not increase by more than a factor of 1.12 over the prior year for contribution rates established until June 30, 2028.

For poorly funded plans, using a long amortization period such as 30 years may not be advisable as it can produce negative cash flow. Negative cash flow occurs when benefits paid out of the system exceed the contributions coming into the system. Negative cash flow is common among mature well-funded plans as contributions were made such that asset values can pay for benefits upon retirement. However, poorly funded plans with negative cash flow can result in continual decreases in asset values such that a plan could become insolvent. We do note that KERS Non-Hazardous and SPRS were cash flow positive during the year ending June 30, 2021.

A long amortization period also results in negative amortization, where the unfunded liability is projected to grow from year to year, meaning that the payment is less than the interest accrual. Negative amortization would not be applicable to those plans with a 0% payroll growth but would currently apply to CERS with a 2% payroll growth assumption. Establishing layers for subsequent changes in the unfunded liability over a 20-year period is consistent with the CCA White Paper but depending on how experience has unfolded

since the fresh start, negative amortization may still occur. In fact, if actuarial gains occur immediately, this can increase the effective amortization period beyond the fresh start period. For example, an actuarial gain that is amortized over 20 years combined with a fresh start base amortized over 30 years, can result in an effective amortization period of the unfunded liability exceeding 30 years. This is the issue in the 2021 actuarial valuations for each of the plans.

Recommendation: We suggest consideration be given to establishing a minimum total amortization payment calculated based on the current unfunded liability and the greater of the remaining fresh start amortization period and 20 years. This would prevent subsequent actuarial gains from lengthening the effective amortization period in any one actuarial valuation. In addition, we recommend that GRS note the effective amortization period.

Payment of the Full Actuarially Determined Contribution Rate

Specifying the payment of the full actuarially determined contribution rate into the funding policy is an important element that cannot be overlooked. One theme we have found among poorly funded retirement systems are that contributions have been less than the amount an actuary has calculated using sound funding policies. When this latest funding policy was adopted, there were significant increases in the contribution rates for many employers. The legislation allowed certain employers to continue to contribute for fiscal year 2020 and 2021 based on the prior funding policy. Beginning with fiscal year 2022, it is our understanding that all employers would be contributing the full actuarially determined contribution.

Determination of the Amortization Payment

When there is a lag between the date the unfunded liability is determined and the payment of the resulting contribution, actuaries use various techniques to account for the delay in determining the contribution. For KPPA, GRS uses the following methods:

- Increases the amortization base with one year of interest from the valuation date to the end of the year
- Adjusts the amortization base to account for payments during the year
- Adjusts the amortization base to account for expected payments in the current year that differ from the prior year due to changes in covered payroll
- Amortizes the resulting amortization over a period 1 year less than indicated

For example, the fresh start unfunded liability was determined as of July 1, 2019. This amount was brought forward with interest to June 30, 2020 and adjusted for payments received during the 2020 fiscal year, which were determined in a prior valuation. This resulting base was then amortized over 29 years, such that this fresh start unfunded liability is paid off by the 2049 fiscal year (30 years after July 1, 2019).

Once the fresh start base has been established, the payment amount is anticipated to be fixed in each future year. Subsequent adjustments are then all included in the new amortization base established for the year. This can produce an unexpected result in the current year a new base is established. For example, the new base established in the 2020 valuation had a balance of $153,145,000, but a payment of only $2,708,000. On the surface, this payment would not pay off this balance. However, due to the adjustments made to the 2019 fresh start liability, there was a $125,048,000 adjustment made to this balance. Applying interest adjustments appropriately yields a balance of $32,895,000 and the payment of $2,708,000 would pay this balance off over a 20-year period.

Due to certain employers contributing less than the full actuarially determined contribution rate in fiscal years 2020 and 2021, the adjustments are larger than would be expected in future years once all employers are contributing the full contribution requirement. We agree that the adjustments made are appropriate. However, the adjustments made are not disclosed in the valuation report. We recommend that GRS specify the adjustments in the amortization payments report exhibit such that another actuary could replicate the calculation based on the information contained in the report.

HB 8 Allocation for KERS Non-Hazardous

HB 8 modified the method for determining each employer's portion of the actuarially determined contribution for KERS Non-Hazardous, which is codified in Kentucky Revised Statute § 61.565(d). Previously, each employer was charged the applicable contribution rate on pensionable payroll. However, due to contribution rates that are a significant portion of payroll, which were caused by the very low funded status of the plan, many KERS Non-Hazardous employers attempted to reduce their pensionable payroll to limit the amount of contributions being made to the plan. As such, HB 8 separated the actuarial accrued liability component of the required contribution and allocated it based on each employer's portion of the actuarial accrued liability as of July 1, 2019. This should prevent employers from reducing their future contribution towards the unfunded liability through payroll reductions. Employers would continue to be assessed the normal cost rate as a percentage of pensionable compensation. We agree with many of the opinions that this methodology would help stabilize the contributions being made by employers into the plan as GRS stated in the Actuarial Analysis Summary of BR424 "we believe this legislation will result in an improved and sustainable funding policy for the KERS Non-Hazardous System."

As part of this audit, we reviewed the allocation of the amortization component of the actuarially determined contribution and the development of the required contribution for the 2021-2022 fiscal year based on the July 1, 2020 actuarial valuation. We confirmed the following:

- The actuarial accrued liability as of July 1, 2019 used in the allocation matched the sum of the retirement and insurance actuarial accrued liability noted in the 2019 actuarial valuation report. This amount is based on the employer code submitted to the actuary. Quasi-governmental agencies were able to appeal the employees allocated to them. Based on information provided by KPPA, some of these employees had separate contracts between the executive branch and the governmental agency where the member was provided to KPPA by the agency but should be allocated to the executive branch for purposes of the allocation.

  Please note that we found that retiree records who are receiving both non-hazardous and hazardous benefits that the non-hazardous benefits were not being valued. We estimated that this increased KERS non-hazardous liabilities by approximately 1.8%. This may impact some employers more than others such that it would increase their allocation. Determining any adjustment to the allocation percentage is outside the scope of this audit.

- The projected payroll for the 2021-2022 fiscal year was consistent with the amount for retirement purposes noted in the actuarial valuation report. Please note that GRS develops a different projected payroll in the actuarial valuation report for insurance purposes than retirement purposes. The determination of the amounts in the employer allocation file were based on retirement payroll. Since the dollar amount of the amortization component was based on the sum of the amortization rate for retirement and insurance benefits, multiplied by the retirement projected payroll, a higher amortization cost was developed in the allocation than determined in the 2020 valuation report. The following table compares the amounts developed in the valuation report versus those used in the employer allocation.

Amortization Cost for Fiscal Year 2021 - 2022 $ in thousands			
	Retirement	**Insurance**	**Total**
Projected Payroll	$1,387,761	$1,376,818	$1,387,761
Amortization Rate	67.42%	7.51%	74.93%
Amortization Amount (Valuation)	935,656	103,392	1,039,048
Allocated Amortization	Not Shown	Not Shown	1,039,849

The use of different payrolls is resulting in the amortization amount for the 2022 fiscal year used for employer allocation purposes to be higher than amounts

shown in the 2020 actuarial valuation report by $801 thousand (rounding differences may cause a difference as well). GRS notes that the difference in payroll is due to members receiving pension benefits from multiple systems but would only receive insurance from one system.

In the fiscal year 2023 allocation, the sum of the dollar amount of amortizations for retirement and insurance was used in the allocation so any payroll difference would not impact the allocation calculation.

- The allocation percentages used were adjusted properly by agencies that ceased participation or adjusted through the appeals process, such that the sum of the allocation percentages added to 100%. Any rounding adjustment was applied to the executive branch.

- The contribution rates were consistent with those reported in the July 1, 2020 actuarial valuation and applied to each employer properly.

Limiting Contribution Increases for CERS

To provide some budget stability to employers of CERS until June 30, 2028, there is a 12% limit on relative increases in the contribution rate from one year to the next. This would limit increases in the contribution rates from 26.79% to 30.00% for non-hazardous and from 49.59% to 55.54% for hazardous from the 2021 actuarial valuation to the 2022 actuarial valuation, respectively.

Kentucky Revised Statute § 61.670 requires the actuaries to perform a sensitivity analysis on the impact on contribution rates of varying the investment return assumption, payroll growth assumption and inflation assumption. As part of the analysis completed by GRS based on the June 30, 2021 valuations, the CERS limitation is not discussed although the impact of a 1% decrease in the interest rate assumption would increase the contribution rates to 34.95% and 64.47%, respectively. These calculated contribution rates exceed the 12% limitation. We suggest that GRS incorporate the potential impact of this limitation into future analyses.

<u>TRS</u>

For TRS, Kentucky Revised Statute § 161.540(1) and § 161.550(1) specify the minimum contribution rates that would apply for members and employers, respectively. To the extent that these rates are lower than the Board's funding policy, an additional rate is determined. Per Appendix 17 of the Board Governance Manual, the following are principles for calculating the total actuarially determined employer contribution:

A. Use of the Entry Age Normal actuarial cost method
B. Use of a five-year asset smoothing method.

C. Use of a 30-year closed period that began fiscal year 2014 to amortize the unfunded liability.
D. Use of a 20-year closed period to amortize new sources of unfunded liability (consisting of benefit changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).
E. Reach a minimum funded ratio of 100% within the closed period adopted by the Board.

In practice, the actuary maintains the base from 2014 and establishes new incremental bases for each subsequent year. The bases are amortized as a level percentage of payroll meaning that the dollar amount of each payment would increase each year at the payroll growth assumption but is expected to be level as a percentage of pay assuming actual payroll increases at the assumption each year.

As of the June 30, 2021 valuation, the remaining amortization period on the 2014 fresh start base is 23 years, which is in line with actuarial guidance (CCA White Paper model practices for transition periods) where the contribution rates are calculated on an actuarial basis. A long amortization period results in negative amortization, where the unfunded liability is projected to grow from year to year, meaning that the payment is less than the interest accrual. Establishing layers for subsequent changes in the unfunded liability over a 20-year period is consistent with the CCA White Paper but depending on how experience has unfolded since the fresh start, negative amortization may still occur. In the 2021 valuation, the amortization payment is slightly less than interest on the unfunded liability. Although, we would expect that any negative amortization would not occur for much longer, assuming the full actuarially determined contribution rate is made.

In accordance with the Board funding policy, the actuary calculates the unfunded liability amortization rate and the normal cost rate, including an administrative expense load, for the total actuarially determined contribution rate. The “Additional (contribution rate) to comply with Board Funding Policy” equals 23.05% and reflects the difference between the actuarially determined rate and the rates specified by statute and any appropriation made by the State.

Statutory Contribution Rates

The following chart specifies the statutory contribution rates for both the member and the employer.

Statutory Contribution Rates		
	Non-University	**University**
Member	9.105%	7.625%
Employer for Member Hired Prior to July 1, 2008	12.355%	10.875%
Employer for Member Hired July 1, 2008 and later	13.355%	*10.875%*

Please note that in the 2021 actuarial valuation report the University employer contributions for members hired July 1, 2008 and later is 11.875%, or 1% higher than noted in statute. TRS confirmed that the additional 1% contribution for University was in accordance with statute at the time of the July 1, 2021 actuarial valuation. The law changed regarding the contribution rate in 2021 with an implementation date of January 1, 2022.

The weighted-average total of member and employer statutory contribution rates using valuation salaries is 21.68%, based on information provided to us by CavMac for the audit.

Special Appropriation

In the 2021 actuarial valuation, there is an additional special appropriation of 2.38% of total payroll, which is made by the State. Per TRS Board Policy, this additional appropriation reduced the contribution to be covered by employers as it reduced the additional amount need to comply with the Board's funding policy. Please note that in our opinion the report is not clear that this special appropriation was intended to be fully offset against the employer contribution in the current year, rather than accelerate a reduction in the unfunded liability.

In fact, the Board's funding policy references "accelerated funding options in recognition that the state may want to pay off the unfunded liability earlier than the closed amortization period." However, this appropriation is used to reduce the employer rates rather than pay off the unfunded liability sooner. TRS confirmed that CavMac's treatment of this additional special appropriation was applied in accordance with the Board's policy.

Total Contribution Rate

Based on the Board's funding policy and the information contained in the report, we have estimated the total contribution rate to be 47.12% (before reflecting the phase-in of assumption changes). The following table displays the components of this rate.

Actuarially Determined Contribution Based on Board Funding Policy	
	Rate
Weighted-Average Statutory Rates	21.68%
Special State Appropriation	2.38%
Additional Employer Contribution Rate	23.05%
Total Contribution Rate	47.12% [1]

[1] may not add due to rounding

Please note that the additional employer contribution rate is not being fully charged to employers in the 2021 valuation as the increases associated with the most recent experience study are being phased-in over a 5-year period. Due to this phase-in, the report does not specify the full actuarially determined contribution rate. We recommend that this disclosure be added in future reports.

Additional Contribution Rate

As noted above, the additional contribution rate to comply with the Board funding policy equals 23.05%. We did not feel that the report provides sufficient clarity on the development of this rate and recommend an exhibit be incorporated into the valuation displaying it. Below is an example of what we consider to be an appropriate disclosure.

Development of Additional Contribution Rate Based on Valuation Salaries of $3,784.4 million		
	Amount (in millions)	**Rate**
Gross Normal Cost	$613.2	16.20%
Unfunded Liability Contribution	$1,170.0	30.92%
Actuarially Determined Contribution	$1,783.2	47.12%
Statutory Contributions (Member + Employer)	$(820.7)	21.68%
Special State Appropriation	$(90.1)	2.38%
Net Additional Contribution to comply with Board Policy	$872.4	23.05%

Employers are not contributing the full additional 23.05% rate as the portion associated with most recent experience study is being phased-in over a 5-year period. The rate being phased-in equals the difference between the calculated rate of 23.05% and 14.48% per CavMac. The applicable rate as of June 30, 2021 is 16.18% (14.48% x 80% + 23.05% x 20%). While the actuarial valuation report indicates that direct rate smoothing of contribution rates is used to phase-in the impact of the experience study, we recommend the report also reference the baseline 14.48% rate and explain its derivation and use.

Under the revised ASOP No. 4 to become effective in 2023, phasing-in the impact of assumption changes on contributions is referred to as an output smoothing method. Per the revised ASOP, an actuary may select an output smoothing method that produces a value that does not fall below a reasonable range without the application of the smoothing method and be recognized within a reasonable period of time. While there is no guidance on what constitutes a reasonable range, we do agree that the recognition period should not exceed five years. Although we recognize that this type of approach may be judged to be fiscally necessary, any phase-in will ultimately push additional costs into the future.

We recommend that the actuary comment on the impact on future contribution rates of phasing in this impact.

Health Insurance Contribution Rate

For the Health Insurance Trust, the unfunded liability is amortized over a closed period. As of the June 30, 2021 valuation, the remaining amortization period is 19 years, which is in line with actuarial guidance. We note that the sum of the statutory contributions by the members, employers and the State exceed the actuarially determined contribution rate such that it would be anticipated that the unfunded liability would be paid off more rapidly than the 19-year period would indicate. Total statutory contributions equal 8.99% of payroll, whereas the actuarially determined contribution rate equals 4.64% of payroll, resulting in an excess contribution rate of 4.35%. In CavMac's sensitivity analysis provided in the report, the actuarially determined contribution rate would increase to 6.00% of payroll with a 1% decrease in the discount rate resulting in an excess contribution rate of 2.99%.

We note that the schedule of employer contributions included in the report compares the statutory contribution to the actual employer contribution. These contribution amounts have been the same each year since 2014. For the retirement benefits (and life insurance trust), a similar schedule compares the actuarially determined contributions to the actual amounts made. We would suggest a similar comparison to the actuarially determined contribution amount be included for the health insurance trust.

JFRS

While this audit focuses on the 2021 actuarial valuation, the funding policy parameters have since been modified. Per Kentucky Revised Statute § 21.525, the following are principles for calculating the total actuarially determined employer contribution beginning with the 2023 valuation:

A. Use of the Entry Age Normal actuarial cost method
B. Use of a five-year asset smoothing method.
C. Use of a 20-year closed period that will begin with the 2023 valuation to amortize the unfunded liability.
D. Use of a 20-year closed period beginning subsequent to the 2023 valuation to amortize new sources of unfunded liability (consisting of legislative changes, assumption and method changes, and experience gains and/or losses that occur since the prior valuation).
E. If the plan has surplus assets, all prior amortization bases would be eliminated, and the surplus would be amortized over a 20-year closed period.
F. Determine the normal cost contribution and actuarially accrued liability contribution on a biennium basis.
G. Employer costs for the hybrid cash balance plan shall be incorporated into the employer contribution rate of LRP and JRP.

The use of a 20-year amortization period replaced the prior amortization methodology which equaled interest plus 1% of the unfunded liability or 7.5% of the unfunded liability in total. The prior funding policy effectively resulted in an open amortization period of 27 years. We believe the change to the amortization period to use a closed 20-year period for unfunded liabilities is consistent with model practices contained in the CCA White Paper. Please note that the model practice for amortizing surpluses suggests a longer amortization period to produce a lesser offset to the contribution requirement. It suggests a period of 30 years but does agree with the elimination of all prior bases once a surplus has been achieved. While the 20-year period is shorter than the 30-year period for surpluses noted in the White Paper, we believe the 20-year period is reasonable based on the current funded ratios of the plans.

Biennium Valuations

The policy requires a funding valuation every other year (odd years) to establish the contribution requirements for the following two fiscal years. To determine these subsequent contribution requirements, USI increases the required contribution with interest by one year to account for the lag and then by two years. By establishing the contribution rate for the second year in this manner, there are certain implicit assumptions made:

1. Any investment gains and losses are reflected every two years.

2. If actual contributions differ than that calculated, any shortfall is not reflected until after the two-year period.
3. The normal cost in the second year of the biennium is expected to be the same as the first year.
    a. It does not take into account that normal cost for Tier 1 and Tier 2 participants increases with salary
    b. It does not take into account that Tier 1 and Tier 2 members who retire are replaced with Hybrid plan members, who would have a lower normal cost.

We believe the first two elements are due to the fiscal need to establish a budget on a 2-year basis and the relatively low contribution levels relative to the state budget. For the normal cost component, we suggest that USI consider performing a one-year projection of the normal cost to understand how it may change due to anticipated changing demographics and reflect this change in the calculation.

Hybrid Plan Costs

Since the retirement assets of the plan for all tiers are combined, we agree that the costs of the Hybrid Plan members should be combined with all other members.

All Systems

Normal Cost Rates by Group

Within each plan administered by KPPA, benefits vary by date of hire. The traditional tier applies to members hired prior to January 1, 2014 and the hybrid tier applies to members hired thereafter. Furthermore, the traditional tier benefits and retirement conditions vary for members hired before or after September 1, 2008. This information is provided by CavMac for TRS and by USI for JRP and LRP.

Please note that information by contingency (retirement, termination, disability, and death) is provided by GRS for KPPA, but is not provided by CavMac for TRS and by USI for JFRS.

Recommendation: To provide more information to stakeholders on the relative difference in the Plan provisions, we recommend that the normal cost rates be reported for each group by GRS for plans administered by KPPA. Please see a sample exhibit below for KERS Non-Hazardous based on information provided by GRS for purposes of this audit. In addition, we recommend normal cost rates by decrement be provided for TRS and JFRS.

Sample Normal Cost Rate by Group Exhibit
KERS Non-Hazardous
($ in millions)

	Pension	Insurance	Total
Tier 1a	13.90%	4.06%	17.96%
Tier 1b [1]	13.90%	2.29%	16.19%
Tier 2	11.38%	1.56%	12.94%
Tier 3	8.53%	1.40%	9.93%
Average	11.96%	2.54%	14.50%

[1] Tier 1b applies to members hired on or after July 1, 2003, but before September 1, 2008. Separate normal cost rates are determined for insurance benefits due to changes in benefit provisions.

Section III – Actuarial Valuation Assumptions

Selection of Actuarial Assumptions

The purpose of the actuarial valuation is to analyze the resources needed to meet the current and future obligations of the System. To provide the best estimate of the long-term funded status of the System, the actuarial valuation should be predicated on methods and assumptions that will estimate the future obligations of the System in a reasonable manner.

An actuarial valuation uses various methods and two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its long-term impact on the System, or to the operation of the System itself. Demographic assumptions are based on the emergence of the specific experience of the System's members.

Choosing actuarial assumptions is highly subjective. It is unlikely that any two actuaries, given the same set of experience statistics, would arrive at exactly the same set of actuarial assumptions for any system as complex as KYSRS. Even allowing for the minor variations that occur because of the variability of the underlying statistics and possible data anomalies, differences among actuarial approaches will occur in analyzing trends. Some actuaries prefer to match the results of recent experience very closely in setting future assumptions, while other actuaries will use recent experience as a guide but tend to change existing assumptions gradually over time. Valid arguments can be made for either approach.

We will comment on the demographic and the economic assumptions used in the June 30, 2021 valuations for retirement and insurance benefits for each of the systems. We will provide commentary and make suggestions to be considered for future experience studies. In our analysis, we refer to the following three experience studies:

- For KPPA, GRS 2018 Actuarial Experience Study for the period ending June 30, 2018 dated April 18, 2019.
- For TRS, CavMac 2020 Experience Investigation prepared as of June 30, 2020 dated September 28, 2021.
- For JFRS, USI 2020 Pension Plan Experience Study dated October 23, 2020.

Economic Assumptions

Overview

In our opinion, the packages of economic assumptions used in the June 30, 2021 valuations of pension benefits and life and health benefits are generally reasonable, although we suggest a reduction in the inflation assumption for JFRS be considered, as

well as the potential impact a reduction in inflation (if made) would have on the investment return assumption. We also recommend consideration be given to taking a holistic view in setting the economic assumptions to reflect a consistent market perspective in the economic assumptions selected across all systems.

Holistic Viewpoint of Capital Market Assumptions

For each system, the set of economic assumptions is based on the latest experience study conducted and the methodology followed by each actuarial firm:

- For KPPA, GRS bases the analysis on an average of 11 different capital market assumption outlooks at the time of the experience study. We do note that the investment return assumptions were not modified in this experience study, but reflect decisions made by the Board in 2017. Based on an inflation assumption of 2.3%, GRS recommended no change to the 5.25% investment return assumption used for KERS Non-Hazardous or SPRS retirement plans. For CERS and all of the KERS insurance funds, GRS found the current assumption of 6.25% to be reasonable but did suggest the possibility of reducing it to 6%.

- For TRS, CavMAC bases its recommendation on the 2020 Horizon Survey and recommended a reduction in the investment return assumption from 7.5% to 7.1% primarily due to a recommendation to reduce the inflation assumption from 3% to 2.5%.

- For JFRS, the investment return assumption was not specifically addressed in the experience study by USI (its Findley division produced the report). It's current investment return assumption of 6.5% is based on an inflation assumption of 3%.

While actuarial assumptions are based on long-term economic outlooks, these outlooks can vary from year to year and sometimes significantly. For instance, capital market outlooks are significantly different as of June 30, 2022 than in 2021 due to the significant increases in interest rates. Changes in financial markets can impact current asset values. For example, higher interest rates result in lower values for bonds held but higher expectations for new bonds bought.

If the systems are making decisions at different times, this could potentially lead to different decisions made on an assumption for one system versus another although the Commonwealth of Kentucky is the plan sponsor for each of the systems. The following table displays the inflation assumption, real return and nominal investment return assumptions used for each of the systems.

Components of Investment Return Assumption					
	KERS NHz / SPRS Retirement	KERS / SPRS Insurance and KERS Hz Retirement	CERS Retirement and Insurance	TRS Retirement and Insurance	JFRS Retirement and Insurance
Inflation Assumption	2.30%	2.30%	2.30%	2.50%	3.00%
Assumed Real Return	2.95%	3.95%	3.95%	4.60%	3.50%
Investment Return Assumption	5.25%	6.25%	6.25%	7.10%	6.50%

From a holistic perspective, one question would be why would the inflation assumption differ across the retirement systems? Furthermore, does the assumed real return reflect the appropriate differences in the long-term expected rate of return associated with each system's asset allocation?

In addition to these items, a plan's projected cash flows and funded ratio should be reflected in any final decision on the investment return assumption. For example, KERS Non-Hazardous and SPRS utilize a lower assumed real return to account for a shorter duration due to the very low funded ratio.

Recommendation: We recommend consideration be given to promote consistency in reviewing and recommending certain assumptions, such as the inflation and investment return assumptions, to be used in the upcoming actuarial valuations. Note that we also recommend other assumptions be reviewed for consistency such as the hybrid interest crediting assumption, mortality improvement assumption and healthcare trend and aging factors for valuing pre-65 health benefits provided by the KEHP as discussed in other sections of this report.

While there are states that are similar to Kentucky where the assumptions for each plan are established based on the individual characteristics of those plans, there are also states that set assumptions consistent across systems or plans.

- Minnesota's Legislative Commission on Pensions and Retirement was established to study pension and retirement topics, to make recommendations furthering sound pension policy for the State's public pension plans and to arrange for review and replication of the annual actuarial work, including the experience studies. All experience studies are conducted in the same year across the systems.

- Florida sets assumptions and methods each year at its annual Assumption Conference. However, the Florida Retirement System is a single system that contains seven membership classes.

- State of Washington has a Pension Funding Council that sets assumptions and methods for all but one of the retirements systems based on recommendations by the Office of the State Actuary. The law enforcement officers and firefighters (LEOFF) Plan 2 Board sets the assumptions for that plan.

Inflation

Inflation, as referred to here, means price inflation. The inflation assumption has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return and wage growth.

There is expected to be a long-term relationship between inflation and the investment return assumption. The basic principle is that the investors demand a "real return" – the excess of actual investment returns over inflation. If inflation rates are expected to be high, investors will demand expected investment returns that are also expected to be high enough to exceed inflation, while lower inflation rates will result in lower demanded expected investment returns, at least in the long run.

As noted above, KPPA utilizes an assumption of 2.3%, TRS reduced it from 3.00% to 2.50% based on CavMac's recommendation in the 2015-2020 experience study and JFRS utilizes an assumption of 3%.

CavMac and GRS considered several forecasts of inflation in making their recommendations. Please note that USI did not address inflation in its experience study.

- The median expected annual rate of inflation for the next ten years reported by the "Survey of Professional Forecasters". It was 2.21% for fourth quarter of 2018 reported by GRS for KPPA and 2.12% for fourth quarter of 2020 reported by CavMac for TRS.

- For TRS, CavMac noted a forecast from the National Association for Business Economics (NABE) showed its members largely agreed that inflation would be moderately higher for the remaining of 2021 and 2022. Note the survey was as of May 2021. For KPPA, GRS noted forward-looking expectations developed by investment consulting firms over the next ten years to be 2.20%.

- CavMac and GRS both looked at the forecast for long-term CPI increases from the Office of the Chief Actuary for the Social Security Administration. The projected ultimate average annual increase in the CPI under the intermediate cost

assumptions was 2.6% in the 2018 Trustees report and 2.4% in the 2020 Trustees Report. In the 2022 Trustees report, it is currently 2.4%.

- For TRS, CavMac notes the median inflation assumption for statewide systems was 2.5% as of 2020 according to the National Association of State Retirement Administrators (NASRA) Public Fund Survey (a survey of approximately 200 large municipal and statewide systems).

At the time of the experience studies, we believe the inflation assumptions used of 2.3% for KPPA and 2.5% for TRS are reasonable. Over the past year, inflation has increased dramatically. However, long-term inflation is not anticipated to be significantly higher than the current assumptions. Based on Milliman's capital market assumptions, long-term inflation is anticipated to be in the 2.3% - 2.5% range. The JFRS assumption of 3% exceeds these expectations.

Recommendation: We recommend that the same inflation assumption be chosen for all the systems. Based on the current market outlook, an assumption in the range of 2.3% - 2.5% would be reasonable, which would result in a reduction in the assumption used for JFRS.

Investment Return

The investment return assumption is one of the primary determinants in the calculation of the expected cost of benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct impact on the calculations of actuarial accrued liabilities, normal cost rate, and the actuarially determined contribution rate. The discount rate is the rate used to discount future benefit payments into an actuarial present value. The traditional actuarial approach used for public sector funding sets the discount rate equal to, or approximately equal to, the expected median investment return over a long-time horizon.

To develop an analytical basis for assessing the investment return assumption, GRS and CavMac reviewed forward looking long-term capital market assumptions developed by Wilshire (KPPA's investment consultant) and Aon (TRS' investment consultant). In addition, they each also considered those of other investment consultants by performing separate analysis using:

- An average of 11 investment consultant expectations of short-term outlooks (7 – 10 years) for KPPA gathered by GRS. In addition, three of the investment consulting firms provided longer term outlook (20 – 30 years).
- The capital market assumptions in the *Survey of Capital Market Assumptions: 2020 Edition* published by Horizon Actuarial Services, LLC.

Both actuarial firms utilized these other investment consultants as the basis for their recommendations. Based on the assumptions adopted, this resulted in the real returns noted in the table above. For KPPA, GRS continued to recommend expected real returns of 2.95% for the most poorly funded plans, KERS Non-Hazardous and SPRS retirement, and 3.95% for the other systems. CavMac increased the expected real return from 4.5% to 4.6%. For JFRS, the real return assumption is 3.5%.

While we believe the real return assumption chosen for each system is reasonable when considered by itself, we do not believe that the real assumptions selected are consistent when compared to each other. We address this point in the following comments.

- **Independent Milliman Analysis:** We performed additional analysis on the investment return assumption as of June 30, 2021 using Milliman capital market assumptions.

    - For KERS Non-Hazardous and SPRS, our analysis shows a 10-year expected median real return of 2.8%, which is a bit lower than the current assumption of 2.95%. Please note that we utilized Milliman's 10-year assumptions rather than 30-year assumptions to provide a more conservative measurement given the low funded ratios of the system. Although our estimated expected returns are less than the current assumption, the difference is not enough that we would say it is unreasonable.

    - For KERS Hazardous and all KERS insurance plans, our analysis shows a 20-year expected median real return of 4.15%, which is a bit higher than the current assumption of 3.95%. As the funded ratio for these plans is significantly higher than KERS Non-Hazardous and SPRS, we believe using a longer-term outlook is appropriate. This results in our current expectations exceeding the 6.25% assumption slightly.

    - For CERS retirement and insurance plans, our analysis shows a 20-year expected median real return of 4.05%, which is slightly higher than the current assumption of 3.95% and approximately 10 basis points less than KERS Hazardous and all KERS insurance plans. As the funded ratio for these plans is significantly higher than KERS Non-Hazardous and SPRS, we believe using a longer-term outlook is appropriate. This results in our current expectations exceeding the 6.25% assumption slightly.

    - For TRS, our analysis shows a 30-year expected median real return of 4.3% (lower for shorter periods), which is very similar to the Aon analysis of 4.39% cited in CavMac's experience investigation. It should be noted that although our estimated expected returns are less than the current 7.1% assumption, the difference is not enough that we would say it is unreasonable. Also, our

analysis is based on our understanding of TRS' assets which is not as extensive as Aon's.

Relative to CERS, our analysis shows a 20-year expected median real return of 4%, which is about 5 basis points lower than CERS. As such, a holistic perspective may result in a return assumption selected for TRS to be consistent or very slightly less than CERS.

- For JFRS, our analysis shows a 30-year expected median real return of 3.15%, which is a bit lower than the current assumption of 3.5%. Relative to CERS, our analysis shows a 20-year expected median real return of 2.85%, which is about 120 basis points lower than CERS. Combining this analysis with our lower anticipated inflation assumption, our estimated expected returns are approximately 1% less than the current 6.5% assumption. Based on this difference, a reduction in the investment return assumption should be considered, although this should be viewed in the context of the current capital market assumptions which have increased since June 30, 2021. Please see our further comments below.

- **Investment Expertise:** Given Wilshire and Aon have specific expertise with KPPA and TRS investments, consideration should be given in the future to giving more weight to each of their expected return calculation. Furthermore, this would eliminate mapping of asset classes that may not exist in the analysis performed by GRS or in the Horizon Survey.

  - For KPPA, GRS based its analysis on an average of 14 different return expectations. The 14 return expectations reflect short-term expectations from 11 investment firms plus long-term expectations from three investment firms. The three firms that submitted the long-term expectations had also submitted short-term expectations. Therefore, GRS provided these three firms additional weight on their short-term expectations than the other firms. We are unsure if Wilshire is one of the three firms, but even so, we are unsure why two other firms would be provided additional weight in making the recommendations. As noted, we believe more weight should be given to Wilshire or KPPA's investment consultant.

  - Timing of the Horizon Survey can also have an impact on differences in capital market assumptions with TRS' investment consultant. The Horizon Survey is typically published in August reflecting capital market assumptions as of January 1 whereas Aon's assumption may be more reflective of capital markets as of June 30. While most years this timing difference is not significant, there can be situations where they can be significantly different, such as 2022. The Horizon Survey in 2022 reflects capital market assumptions as of January 1, 2022 prior to any adjustment

for increases in inflation and in short-term interest rates that have occurred during 2022.

- **Recent Changes in Investment Environment:** Our commentary has focused on the assumption in relation to the time of the experience study and use in the June 30, 2021 valuation. However, driven by increasing fixed income yields and lower price-to-earnings ratios, capital market assumptions have increased significantly as of June 30, 2022, as compared to a year ago. Based on Milliman's capital market assumptions as of June 30, 2022, the 20-year long-term expected returns increased by approximately 60 basis points (0.6%) from Milliman's 2021 20-year expected return.

  This would increase the expected returns based on Milliman's capital market assumptions to be above the current assumptions of 5.25% and 6.25% used for KPPA and to slightly above the current 7.1% assumption for TRS but still lower than the current 6.5% assumption used by JFRS by 0.5%.

Recommendation: For KPPA and TRS, we would not suggest modifications to the investment return assumption at this time. For JFRS, we suggest a reduction in the inflation assumption be considered which may also apply in setting the investment return assumption.

We understand that HB 76 recently modified Kentucky Revised Statute § 61.670 to require at least once every two years to conduct a review of the economic assumptions, including but not limited to the inflation rate, investment return and payroll growth assumptions. This type of off-cycle review allows for smaller adjustments more often than larger adjustments that may take place after a 5-year period. While a system wants to avoid frequent changes in assumptions due to short-term fluctuations, if it waits until the end of a 5-year period, large changes in the assumption may be politically and/or economically more difficult to implement. Further, the assumptions have the potential to fall out of compliance with actuarial standards of practice. We believe adoption of this provision will assist in maintaining reasonable assumptions.

Hybrid Interest Crediting Rate Assumption

Another assumption we believe consideration should be made on a consistent basis among the systems is the interest crediting rate on the cash balance accounts for the hybrid plans. This impacts KPPA and JFRS; TRS did not offer a hybrid plan at the time of the June 30, 2021 actuarial valuation. Neither GRS nor USI address this assumption in the experience study.

The cash balance accounts are credited with member and employer payroll based contributions. These contributions are credited with interest equal to a minimum of 4% plus an amount equal to 75% of the average geometric return over the past five years in

excess of 4%. For example, if the average return over the past five years is 6%, the excess return is 2%. Taking 75% of this return equals 1.5% so each member's account would be credited with an additional 1.5% in the upcoming year. If the average return is 4% or less, then no additional return would be credited, but each account would still be credited with 4%.

Each actuary is setting the interest crediting assuming that the excess return equals the investment return assumption less 4%.

Hybrid Plan Assumed Interest Crediting Rate			
	KERS NHz / SPRS	KERS Hz / CERS	JFRS
Investment Return Assumption	5.25%	6.25%	6.5%
75% of Assumed Excess Return over 4%	0.9375%	1.6875%	1.875%
Assumed Interest Crediting Rate	4.9375%	5.6875%	5.875%

The investment return assumptions are based on a distribution of returns that typically reflect a 50% chance of achieving at least that return. In other words, there is a 50% chance that the geometric average of actual returns over a long-term horizon would exceed the assumption selected. As a result, there is a 50% chance that returns and the associated interest crediting rate could exceed the assumption. Without any minimum interest crediting rate, this chance would be offset by the 50% chance that returns are below the expected return. However, for the interest crediting rate, the low end of the distribution of possible outcomes is limited due to the application of the 4% minimum interest crediting rate. Therefore, the average expected interest crediting rate would be higher than that shown in the chart above.

To estimate the potential average interest crediting rates, we employed two analyses:

- Hypothetical historical analysis assuming the asset allocation was in effect for the prior 30 years.
- Forward looking analysis taking into account expected returns and standard deviation of returns using Milliman's 30-year capital market assumptions as of June 30, 2021 based on each plan's asset allocation.

The following chart compares the results of our analysis with the current assumption.

Hybrid Plan Assumed Interest Crediting Rate			
	KERS NHz / SPRS	KERS Hz / CERS	JFRS
75% of Assumed Excess Return over 4%	0.9375%	1.6875%	1.875%
Historical Analysis of 75% of Excess Return over 4%	1.5%	2.9%	2.8%
Forward Looking Analysis of 75% of Excess Return over 4%	2.4%	3.0%	2.3%
Assumed Interest Crediting Rate used in Valuation	4.9375%	5.6875%	5.875%
Assumed Interest Crediting Rate based on Historical Analysis	5.5%	6.9%	6.8%
Assumed Interest Crediting Rate based on Forward Looking Analysis	6.4%	7.0%	6.3%

We based our analysis on long-term 30-year returns as the hybrid account only applies to members recently hired and thus average returns would reflect a longer time horizon for these particular members.

Due to the impact of the 4% minimum return, we have determined average interest crediting rates that exceed the current assumption by up to 150 basis points (1.5%) depending on the plan.

Recommendation: We recommend that KPPA and JFRS complete a similar analysis as shown here on the interest crediting rate to determine an applicable assumption that should be used and be reflected in the next valuation. We believe this could have a material impact on the costs of the hybrid plan.

Economic Assumptions - KPPA

In this section, we review wage-related assumptions used in the KERS, CERS and SPRS actuarial valuations. GRS proposes wage inflation that differs from non-hazardous membership and hazardous duty, which includes SPRS. The total salary increase

assumption then adds on salary increases due to merit and promotion, which vary by each individual group and are higher for shorter-service members than long-service members.

Wage Inflation

Wage inflation consists of two components, 1) a portion due to pure price inflation (i.e., increases due to changes in the CPI), and 2) increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors) referred to as real wage growth.

GRS recommended real wage inflation of 1% per year for non-hazardous and 1.25% for hazardous and SPRS. These would be added to the price inflation assumption of 2.3% for the underlying salary increases prior to additional increases for promotion and merit. These levels are consistent with assumptions used in the private sector but they may be somewhat higher than used by other public retirement systems.

We believe that the 1% / 1.25% real wage growth assumption is reasonable. We do note that inflation has increased significantly since the 2021 valuation that may increase pressure on salaries in the near future.

Payroll Growth

The future rate of payroll growth is an assumption used in the development of the level percent of pay amortization amount of the Unfunded Actuarial Accrued Liability (UAAL) in developing the UAAL contribution rate under the funding policy.

For KERS and SPRS, the payroll growth assumption is set to 0%. As noted in the experience study, actual payroll had declined during the 10-year period measured at that time for KERS Non-Hazardous and SPRS, and there was only a small increase (0.62%) for KERS Hazardous. GRS recommended to maintain the 0% payroll growth assumption for these systems, and we believe this assumption is reasonable.

For CERS, the payroll growth assumption was set to 2%. Typically, the payroll growth is equal to the general wage growth assumption, which would be 3.3% and 3.55%, respectively. In the experience study, GRS noted actual changes in payroll over the past 10-years was 1.31% for CERS Non-Hazardous and 1.19% for CERS Hazardous. GRS recommended to maintain the payroll growth assumption at 2%, we believe this assumption is reasonable.

Salary Increases due to Merit & Promotion

GRS studied merit and promotion pay increases by plan. Employees by plan were segmented into short-service and long-service based on GRS' observation of the data. For hazardous duty, 10 years was used as the split, 11 years for KERS Non-Hazardous and 15 years for CERS Non-Hazardous. For members with service in excess of these levels, GRS proposes no additional salary increases due to merit and promotion. We agree that length of service is generally the best predictor of future merit increases. For Hazardous groups and SPRS, we are a bit surprised that no increases are included after 10 years as we typically see longevity and promotions to continuing beyond 10 years of service. In looking at the charts included in the experience study, actual salary increases exceeded inflation by 3.8% for KERS Hazardous, 2.7% for CERS Hazardous and 2.5% for SPRS. Reducing these increases by the 1.25% wage inflation assumption would appear to suggest that increases due to merit and promotion may continue beyond this 10-year period.

We recommend that an assumption be incorporated for salary increases due to merit and promotion for hazardous and SPRS members with at least 10 years of service if the next experience study continues to see these types of increases.

Economic Assumptions - TRS

In this section, we review wage-related assumptions used in the TRS actuarial valuation.

Wage Inflation

As noted in the CavMac experience study report, wage inflation consists of two components, 1) a portion due to pure price inflation (i.e., increases due to changes in the CPI), and 2) increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors) referred to as real wage growth.

TRS reduced the real wage growth assumption from 0.50% to 0.25% consistent with CavMac's recommendation in the experience study. CavMac considered both Social Security data and forecasts of real wage growth which are higher than 0.50%, but ultimately made its recommendation based on the past experience for Kentucky teachers being lower than the 0.50% and their assumption that it is unlikely that public sector employees can match the productivity rates of those in the private sector.

After the reduction in the real wage growth, this assumption is lower than that used by most public sector retirement systems and lower than what we usually recommend. However, we agree that there is merit to the idea that teacher compensation patterns may be different than other employees, as we have observed lower real wage growth among teachers.

For use in the June 30, 2021 actuarial valuation, we believe that the 0.25% real wage growth (2.75% total wage growth) assumption was reasonable.

Payroll Growth

The future rate of payroll growth is an assumption used in the development of the level percent of pay amortization amount of the Unfunded Actuarial Accrued Liability (UAAL) in developing the UAAL contribution rate under the funding policy. The current payroll increase assumption is equal to the general wage inflation assumption of 2.75%. We also typically set the payroll increase assumption equal to the general wage inflation assumption, unless there is a specific circumstance that would call for an alternative assumption.

CavMac notes that payroll growth has been less than expected over the last 10 to 15 years; however, CavMac cites some positive population growth within the state and the correlation with the need for teachers. On balance, they conclude that it is reasonable to keep the payroll growth assumption equal to the general wage growth assumption. We believe this assumption is reasonable, but if in the next experience study the data does not support this assumption, we believe consideration should be given to reducing the assumption.

Rates of Salary Increase - Merit

This assumption relates to increases in each individual's salary due to promotion or longevity (often referred to as merit) that are in excess of the general wage increase. Based on CavMac's recommendation, new merit salary scale rates which vary by service were adopted for use in the June 30, 2021 valuation. The recommended changes appear reasonable based on CavMac analysis, and we believe they were reasonable for use in the June 30, 2021 valuation. In particular, we agree with the change to a service-based scale as opposed to the old table that varied by age.

We suggest that in future experience studies consideration be given to studying this assumption over a longer period than five years. CavMac notes the primary difficulty actuaries have in studying merit which is that it can be hard to isolate what part of an individual member's salary increase is due to general wage growth and what part is due to merit. To perform their analysis, CavMac assumes an ultimate merit rate of 0.25% for long service members and then based on that calculates the merit salary increases at shorter service levels. This is accurate to the extent the assumed ultimate merit rate is correct. By using a longer period, short term fluctuations can be minimized and an estimate of the actual general wage growth over the period and the ultimate merit rate can be made.

Economic Assumptions - JFRS

In this section, we review wage-related assumptions used in the JRP and LRP actuarial valuations. USI notes that experience for salary increases was less than 1% per year from 2013 to 2019 but does not provide any evidence supporting the review. While raises for judges and legislators can follow a different pattern than the typical public sector employee, we do suggest an experience chart be included in the next experience study.

USI recommended no change to the assumption unless the Board provided additional insight. The assumption specified 1% salary increases for the next five years and 3.5% thereafter. With an inflation assumption of 3%, this would indicate a real wage inflation assumption of 0.5%, which is more than assumed for TRS and less than assumed for KPPA. We believe a long-term assumption for real wage inflation of 0.5% - 1.5% to be reasonable depending on the employee group.

Please note that USI does not specifically state the 5-year period for which the 1% of pay increases would apply. In the 2021 valuation, they applied for 4 years subsequent to the valuation date although the valuation report noted 3 years. We discuss this further in the Section IV of this report. Furthermore, the 1% of pay applied to all years retroactively for purposes of determining benefits under the Entry Age Normal cost method. We discuss this further in Section V of this report.

We believe the assumptions selected are reasonable for the 2021 actuarial valuation, we do suggest more clarity be provided in its use and disclosure.

Demographic Assumptions

Overview

Actuarial Standard of Practice (ASOP) No. 35 governs the selection of demographic and other noneconomic assumptions for measuring pension obligations. ASOP 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

We found that the methodologies used to prepare the experience study were appropriate and that the assumptions developed comply with the guidance provided by ASOP 35. We have offered a few suggestions for considerations in future experience studies. The ultimate purpose of any actuarial experience study is to provide a basis for setting the actuarial assumptions for future valuations. We believe that the statistical analysis

included in the CavMac and GRS experience study reports and the resulting recommendations are reasonable. Although the USI experience study report has limited statistical analysis, partially due to the small plan size of JRP and LRP, we believe the recommendations are reasonable.

Annuitant Mortality Assumption

Please note that our comments are based on the assumptions in place as of June 30, 2021, and do not reflect any potential adjustments due to the Covid-19 pandemic.

Mortality rates are used to project the length of time benefits will be paid to current and future retirees and beneficiaries. The selection of a mortality assumption affects plan liabilities because the estimated value of retiree benefits depends on how long the benefit payments are expected to continue. There are clear differences in the mortality rates by gender and non-disabled versus disabled retired members.

In 2019 the Retirement Plans Experience Committee (RPEC) of the Society of Actuaries ("SOA") issued the "Pub-2010" family of static base mortality tables. The 2010 in the title refers to the central year of collected study data. These are the first tables published by the RPEC based solely on public sector experience. This family of mortality tables include specific tables for general employees, public safety, and teachers. In addition, each set of tables includes above median and below median rates based on benefit amount. We note that each of the actuaries for the systems have selected to use some variation of these tables for at least a portion of their system's population.

For the KPPA systems, GRS developed system specific mortality tables based on the experience for all the systems combined. We reviewed their methodology, which focused on those retirees between ages 58 and 94. We found their discussion to be consistent with actuarial practice and reasoning to be appropriate taking into account the credibility of the experience. We do note that they indicated that there were 5,078 male deaths and 5,060 female deaths during the 5-year period ending June 30, 2018 indicating that they are "99% confident that the experience for the 5-year observation period are within 5% and 3% of the true mortality experience for males and females, respectively". We agree that this many deaths would provide a credible set to build a system specific mortality table. Please note that the charts shown in the experience study report are based on benefit amount. We do suggest that experience also be shown on a count basis.

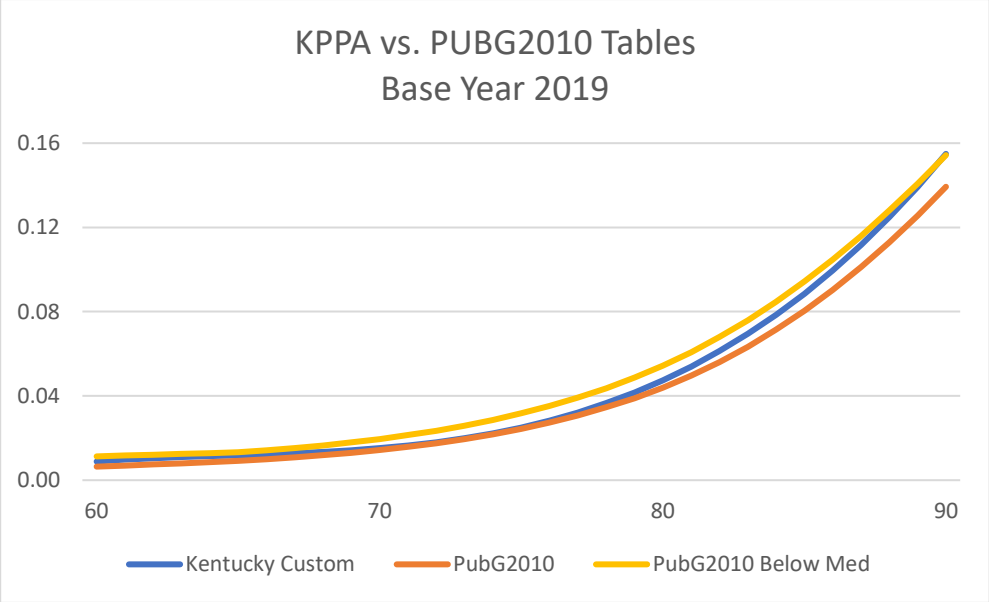
On a benefits basis, GRS indicates that there were $767,000 benefits associated with male deaths and $491,000 benefits associated with female deaths during the study period. Based on the reported number of actual deaths by gender, this converts to an average benefit of $151 and $97, respectively. These amounts do not appear to be consistent with the actual retiree benefit amounts. We suggest GRS review to ensure that the scale is correct in the report exhibits and that the benefits associated with the deaths were tabulated correctly.

GRS developed one mortality table and used it for all non-disabled members in receipt, with no differentiation based on whether the member was a retiree or a beneficiary, or whether the member had served as a general employee or in a public safety role. For each of the systems, we reviewed the results for the probability of death for healthy and disabled retired members and found them to be reasonable and generally consistent with the methods we usually recommend. We have the following observations, but we have no recommended changes but offer some considerations for the next experience study.

1. **Benefit Weighting:** When analyzing mortality experience, we believe rates should be studied on either benefits-weighted or liability-weighted basis for pension assumptions. Analysis has shown that higher benefit/liability retirees tend to live longer than lower benefit/liability retirees. CavMac and GRS used a benefit-weighted approach in their mortality analysis to account for this relationship. We agree with this approach. There is no credible experience for JFRS to report.

2. **New Mortality Tables**:

    a. GRS constructed their own tables based on KPPA experience for post-retirement healthy mortality experience rather than basing it on the Pub-2010 tables. They do use the Pub-2010 table series for other situations as discussed below. To put the table developed by GRS in context, we found that the rates of mortality were between the standard general employee table and the Below Median version. The following graphs compares the rate of mortality by age for the 2019 base year.



The tables developed by GRS are in compliance with actuarial standards although we offer suggestions below in separating experience of hazardous duty members and contingent survivors in the next experience study. GRS may also wish to adjust the PubG tables to the extent that the fit is reasonable.

b. For TRS, the PubT-2010 tables for teachers, with customization to TRS retiree experience, was recommended in the experience study and is being used in the valuation. We agree with the use of the newer tables.

c. For JFRS, USI recommended the PubG-2010 Above Median table, which would reflect lower mortality for this population than a standard public employee population. We agree with the selection of the Above Median table.

3. **Mortality Tables by Membership Group:** Based on various mortality studies published by the Society of Actuaries, it is generally expected that mortality rates will vary between those who had worked in general employment versus public safety versus in the classroom. For KPPA, GRS developed one post-retirement mortality table for all non-disabled members, with no differentiation between non-hazardous membership and hazardous duty, including SPRS. Since the liabilities and costs for each system are developed independently, we are unsure why this one particular assumption comprises of all groups rather than the demographics of each specific group. We suggest that KPPA determine if this assumption should be determined separately or in a combined fashion. We suggest combining KERS and CERS non-hazardous members together and the KERS and CERS hazardous plus SPRS together. We also suggest that this information be provided in the next experience study even if one combined table is recommended or not.

4. **Contingent Survivor Mortality**: The analysis of contingent survivor mortality experience reflects the experience of survivors where the member has previously died, and the survivor is now receiving payments. That is, it excludes contingent beneficiaries where the retiree is receiving the payment and no pension benefit is currently being paid to the contingent beneficiary. We caution against using the experience of the in-payment survivors to set the assumption for the not-in-payment contingent beneficiaries, as studies have shown in-payment survivors have materially higher mortality rates at ages less than 85 than contingent beneficiaries of members who are still alive and receiving benefits. This is sometimes referred to as the "grieving widow effect." The RPEC notes that the contingent survivor mortality rates were developed solely from the experience data for surviving beneficiaries after the death of the primary member. This assumption could also impact the development of the actuarial equivalent factors for retirees electing a joint and survivor annuity. Assuming a shorter life span for a beneficiary will reduce the cost of these options and produce a larger relative benefit.

a. For KPPA, the experience for contingent beneficiaries was included in GRS' analysis of the postretirement mortality assumption. We suggest that this experience be studied separately in the next experience study.

b. For TRS, we suggest that a healthy post-retirement mortality table be used for beneficiaries while the retiree is alive and use the contingent mortality table only upon death of the retiree.

c. For JFRS, USI does not use the contingent survivor mortality table. We believe this is a reasonable choice for this plan.

5. **Applicable Mortality for Healthcare Benefits**: For healthcare benefits, mortality would not typically reflect benefit weighting as the liability is not based on benefit amount. For healthcare benefits, we suggest consideration be given in the experience study to incorporating an analysis on the number of deaths as compared to the headcount-weighted version of the Pub-2010 mortality tables. If GRS continues to develop tables based on actual KPPA experience, we suggest a table be developed based on headcount weighted for insurance purposes. We would anticipate that use of headcount-weighted tables would produce a lower liability in the healthcare valuation. However, since teachers tend to be a more homogeneous group, there will likely be less difference between the two approaches than a typical public employee retirement system for this group. We do note that USI is using headcount-weighted for the JFRS insurance valuations.

   As with the retirement benefits, we would caution against using the contingent survivor mortality for dependents of current retirees. This could have a greater impact on the liabilities of the healthcare valuation since benefits are provided to dependents while the retiree is alive.

6. **Pre-Retirement & Disability Mortality:**

   a. For pre-retirement mortality for KPPA systems, GRS recommended using mortality rates based on the Pub-2010 tables. Specifically, for Non-Hazardous employees they recommended the PubG-2010 table for general employees and for Hazardous and State Police employees, they recommended the PubS-2010 table for Public Safety employees. We believe this is a reasonable assumption.

      For disability mortality for KPPA systems, GRS recommended using the Pub-2010 Disabled Mortality Table with a 4-year set forward based on the experience of the systems. We found the selection of this assumption to be reasonable.

b. For TRS, similar to retiree mortality, the active employee and disabled mortality assumptions are based on the Pub-2010 employee and disability mortality tables for teachers with adjustment based on TRS' experience. We believe this is a reasonable assumption.

c. For JFRS, the pre-commencement version of the Above Median version of the PubG-2010 table was selected, which is consistent with the selection for the post-retirement mortality assumption. We believe this is a reasonable assumption.

7. **Pandemic Impact**: In the US, there was a significant increase in mortality rates in second quarter of 2020 through the first quarter of 2022, which are likely driven by the pandemic and may not be indicative of future experience. For purposes of the experience study, CavMac made no explicit adjustment for this. Since only the last quarter of the study overlapped with the higher mortality period, the impact on the results should have been relatively small.

Mortality Improvement Scale

In general, it is widely accepted that mortality will continue to improve in the future. This means that the expected life expectancy for someone who reaches age 65 in 20 years from now will be greater than the expected life expectancy for someone who is age 65 today. Since the liability for a pension promise is heavily dependent on how long the member is expected to live, it is important that future mortality improvement be taken into consideration.

To provide an estimate of the gradual improvement expected in mortality in the future, beginning in 2014 the Society of Actuaries (SOA) has created projections of mortality improvement in "MP" tables that are updated each year. It has become very common for pension actuaries to utilize some version of the SOA's MP tables for estimating future mortality improvements.

For KPPA, GRS noted that the SOA MP tables (through 2018) have an ultimate annual improvement rate of about 1%, while there are select rates in effect for the first 15 years. In their experience study, GRS noted that the more recent SOA MP tables had to scale back the mortality improvement rates initially published in the SOA's 2014 MP table, while the ultimate rates remained consistent between the MP-2014 through MP-2018 tables. In addition, they found the ultimate rates to be more consistent with other demographer sources. Based on this, they concluded that it is more appropriate to utilize the ultimate mortality improvement rates for all years as compared to utilizing the select rates for the first 15 years. Accordingly, they recommended use of the ultimate rates from the SOA MP-2014 table. We would note that beginning with the MP-2020 mortality improvement scale table, the ages with ultimate improvement rates of 1% was modified to be based on age where some ages are anticipated to be greater and some less than the 1%

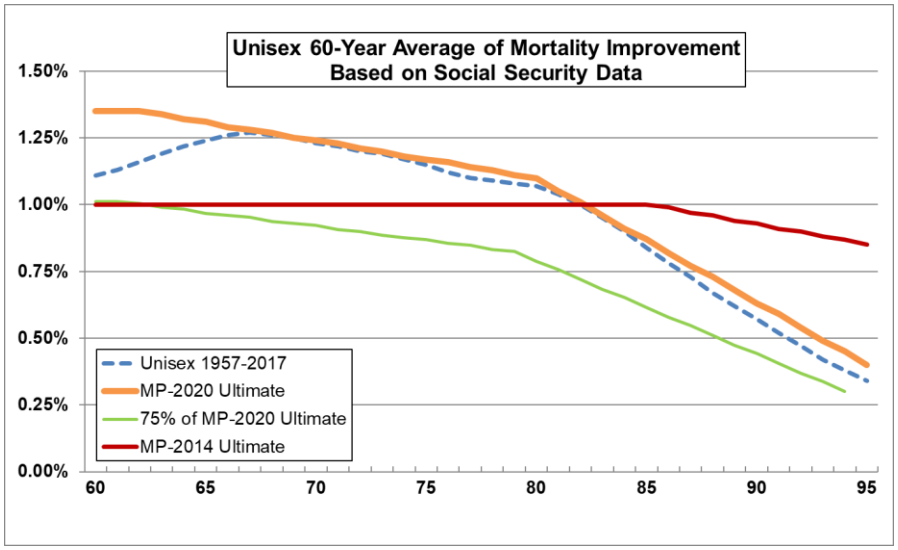
assumption previously included in the SOA tables. While we believe the selection of the ultimate mortality improvement rates from the SOA MP-2014 table was reasonable at the time of the experience study, we do suggest that the latest MP table be reviewed for selection in the next experience study, including its select and ultimate rates.

For TRS, in the experience study report, CavMac recommended the valuation use the most recent version, at that time, of the MP table (MP-2020 version) multiplied by 75%. The rationale for only partially recognizing this table is that the SOA in its annual updates has consistently reduced the level of expected improvement reflected in MP tables from previous years.

We agree with the recommendation to use a mortality improvement scale and using the most recent one published by the SOA is appropriate. Given the uncertainty surrounding future improvements in mortality, we believe the recommended table is reasonable, although it is not what we have been recommending to our clients. As CavMac correctly notes, the projected rates of improvement predicted by the SOA have declined since the MP table was first published in 2014; however, this decline has only applied to the short-term rates (the first 15 years). The long-term projected rates (after 15 years) of improvement have only changed once. As noted above, the MP-2020 table modified the long-term rates from a constant 1% across most ages to rates that vary by age, which resulted in generally longer life expectancies for future retirees. Therefore, consideration should be given to whether such a reduction in the long-term standard rates is appropriate.

Milliman has studied data from the Social Security Administration (SSA) website. The SSA provides historical rates of death from 1900 to 2017. From the most recent 60-year period available in this data, Milliman calculated historical mortality improvement. The SSA database was used because of its size, credibility, and public availability.

The graph below shows the average rates of mortality improvement by age for a this 60-year period compared to the MP-2020 ultimate rates (those applicable 15 years in the future and later) with the recommended rates of the 2014 MP ultimate scale for KPPA (red line) and 75% of the MP-2020 rates for TRS (green line).



Of course, past results are no guarantee that the same patterns will be repeated in the future, but it does provide some perspective on how the recommended improvement assumption compares with actual historical improvements. Note that the green 75% of MP-2020 Ultimate line only shows the valuation rates of mortality improvement after 15 years. In the first 15 years, the valuation rates are less than the green line shown in the graph. This means that in the first 15 years, the difference between the valuation assumptions and actual historical experience is even greater than shown in the graph.

Although our preference is to use the unadjusted mortality projection scale, it should be noted that there are other systems using reduced versions of the MP-2020 projection scale. For example, analysis performed by actuaries at the largest state retirement system (CalPERS) found that 80% of the MP-2020 scale was more representative of mortality improvement over the last 20 years among its retirees.

For JFRS systems, USI recommended using the SOA MP-2020 table unadjusted. We found this assumption to be reasonable.

While we find each assumption selected reasonable for each system, they are different from each other in how they forecast mortality improvement. Since these are all employees of the Commonwealth of Kentucky, and its municipalities and other governmental agencies, we would not expect rates of mortality improvement to differ for each group.

Recommendation: As noted above, we recommend that consideration be given to promote consistency for certain assumptions to be used in the upcoming actuarial valuations, and we recommend the mortality improvement assumption be included in that review.

Other Demographic Assumptions – KPPA

Withdrawal

For KPPA, GRS recommended termination or withdrawal rates based on service weighted by compensation for each plan separately. The experience for male and female members was combined to provide for greater statistical credibility. Prior to 2016 the termination experience included pre-retirement mortality experience. Since this period was included in the experience study, all of the pre-retirement mortality experience in the study was included in the study. The final resulting termination assumption was then adjusted by the pre-retirement mortality rates noted above.

In the experience study GRS noted that actual rates of withdrawal were much higher than expected and they purposely did not increase the rates all the way to match the experience to avoid over-adjusting the assumption. Having a withdrawal assumption that produces an actual to expected ratio above 100% results in a conservative estimate of the liability.

Overall, we agree with the approach used by GRS in setting this assumption. The use of membership group and service is appropriate and reasonable along with weighting the experience by payroll.

In addition to the probability a member withdraws from active employment, an assumption must be made as to whether that member will take a refund of their contributions upon withdrawal or keep their contributions with KPPA and receive a deferred monthly allowance at a later date. The valuation assumes the member takes the more valuable of the two options. This is a reasonable assumption.

Retirement

Rates of retirement vary by plan, tier, eligibility for unreduced retirement benefits, and available retiree medical benefits. Based on these items, there are numerous different combinations to be considered in setting retirement rates. For hazardous employees and SPRS, GRS recommended continued use of a service-based retirement assumption that varies by tier. For Non-Hazardous employees, they recommended continued use of an age-based assumption with distinctions based on gender with differences based on the value of medical premium subsidy expected to be received.

We generally found the selection of the retirement assumptions to be reasonable and appropriate subject to the following additional comments.

1. For members hired on or after July 1, 2003, GRS recommended to use 80% of the rates recommended for members hired before July 1, 2003 to account for the change in retiree medical benefits for ages below age 65. As there is little

experience for this group, this determination is primarily based on actuarial judgement. For members hired prior to July 1, 2003 who retire with at least 20 years of service, members would receive a premium subsidy equal to the full premium. For members hired after July 1, 2003, members receive a monthly supplement towards medical coverage in retirement equal to $10 for non-hazardous and $15 for hazardous per year of service with 1.5% annual increases. We believe an adjustment is reasonable and agree that an 80% adjustment until age 65 is reasonable absent actual experience.

2. The benefit multiplier for Tier 2 Non-Hazardous employees (hired between September 1, 2008 and January 1, 2014) is based on service at termination. While there is presumably very little retirement experience available for these employees at this time, it may be reasonable to consider implementing service-based retirement rates since they may be more likely to retire once a key service threshold is attained.

3. Under the various plans the unreduced retirement eligibility is based on age or service or a combination of both age and service. When a member first meets the age and service criteria for an unreduced retirement, we typically see a spike in those retiring in that year. In the next experience study, we suggest that GRS consider reviewing rates of retirement at first eligibility separately from other ages. We believe this could have an impact on non-hazardous rates of retirement.

4. In the experience study report, GRS notes that adjustments are made to set retirement rates for Tier 2 and Tier 3 members from those developed for Tier 1 members. They note these differences are due to differences in retirement benefits and retiree medical benefits, but do not necessarily detail the rationale for the specific changes in retirement rates. For example, a SPRS members with 31 years of service would receive the same benefit under Tier 2 as Tier 1. However, the retirement rate at 31 years of service is 58% under Tier 1 and only 22.4% under Tier 2. It was noted that due to changes in retiree medical benefits, the retirement rates for Tier 2 were set to 80% of Tier 1 if hired prior to July 1, 2003, but this difference is greater than this adjustment. We recommend that GRS review the retirement rates by Tier within each group to clarify the adjustments made to the rates determined based on the experience study data and provide appropriate justification and rationale for the adjustments.

Disabilities among Active Members

The assumptions for rates of disability from active status vary by membership group and age. In the experience study GRS recommended rates that were greater than the previous rates, mostly to account for a lag in the reporting of disabilities. It has been our experience that there is often a lag between when a member leaves active employment and when they are approved for a disability retirement, so not all disability retirements

may be included in the experience study. We agree with the methodology used by GRS to account for this lag.

It is also in our experience that there may be situations where a member may become disabled, but may not apply for disability:

- Members with less than 5 years of service are not eligible for disability benefits and therefore, members who terminate employment due to disability would most likely be categorized as a termination. GRS makes an adjustment to the rates of termination for pre-retirement deaths that cannot be distinguished from regular terminations, but no such adjustment is made for disabilities during the first five years. We recommend not applying the rates of disability prior to the member reaching the eligibility requirement.

- Once a member has accrued a certain number of years of service, such as 27 years for Tier 1 non-hazardous or 20 years for Tier 1 SPRS, a disability benefit would not be payable, and the retirement benefit would be payable. We suggest that in these situations the rates of disability do not apply in the actuarial valuation and members in these situations are excluded from the experience study.

We do note that GRS does not vary the rates of disability by gender. While this may appropriate for hazardous duty and SPRS due to the nature of the job, we typically see experience vary by gender for general public sector employees.

Other Demographic Assumptions - TRS

Withdrawal

The withdrawal assumption was based on quinquennial age group and further split between gender and service group (less than 5 years, 5 to 10 years, and 10 or more years). CavMac provides analysis for these groups on a compensation-weighted basis. Based on this analysis and CavMac's recommendation, the withdrawal rates were lowered.

Based on CavMac's analysis, the withdrawal rates proposed in the experience study and used in the June 30, 2021 valuation are aligned with actual experience, and the assumptions appear reasonable. One aspect of the withdrawal assumption that we recommend CavMac consider for the next experience study is whether the rate should vary by each year of service so there are not significant jumps in the assumption from one service grouping to the next.

In addition to the probability a member withdraws from active employment, an assumption must be made as to whether that member will take a refund of their contributions upon withdrawal or keep their contributions with TRS and receive a deferred monthly allowance

at a later date. The valuation assumes the member takes the more valuable of the two options. This is a reasonable assumption. Our only recommendation is that the assumption for future refunds be disclosed in the valuation and discussion of this be added to future experience studies.

Rates of Service Retirement

The service retirement assumption has rates that vary by age, with rates that tend to be lower at younger ages and higher at older ages. The rates are further split by gender and whether the member has more or less than 27 years of service. An additional adjustment (increase in the rates) is made in the year the member is first eligible for unreduced retirement with 27 years of service. Analysis was done on a headcount weighted basis. Based on the results of the 2015-2020 experience study, the service retirement rates were increased at most ages.

The recommended changes appear reasonable based on CavMac analysis, and we believe they were reasonable for use in the June 30, 2021 valuation.

We have two suggestions for consideration in future experience studies. First, we suggest consideration be given to additional analysis by years of service, as we have found retirement patterns vary based on years of service of the member. Of particular note for TRS is the different benefit percentages that apply at different service levels. For example, for certain members the retirement benefit is a 2.0% formula with less than 10 years of service but increases to 2.5% when the member reaches 10 years of service. In this type of situation, it is unlikely the member would retire with 8 or 9 years of service, but the likelihood would increase significantly at 10 years of service. Our experience with other teacher retirement systems is that the members are knowledgeable about their retirement benefits, and they make retirement decisions based upon them.

A similar situation exists with members hired on July 1, 2008 or later where the applicable percentage increases at several service levels. This formula is likely to have a noticeable impact on retirement patterns for this group, as compared to the older group. The current service retirement assumption does not differentiate between the pre-2008 and post-2008 hires. It would make sense to do custom analysis on the retirement rates of post-2008 hires, but at this point there is not meaningful data to perform this type of analysis, and there will not be for a number of years. We suggest consideration be given in the next experience study to having separate retirement assumptions for the post-2008 hires that are reflective of their benefit formula which would need to be set primarily based on actuarial judgment.

Second, we suggest consideration be given to performing the analysis on a liability or compensation-weighted basis, as that approach can provide a more accurate measurement of the liability. We do note that teachers tend to be a fairly homogeneous

group, so this type of analysis may not produce materially different results, but we still believe it is worthwhile (if this analysis has not already been completed).

Neither the valuation report nor the experience study appears to disclose an assumption for when deferred vested members will commence their retirement benefit. We recommend the assumption and rationale be added to future reports.

Other Assumptions and Methods

Based on our review of CavMac's analysis in the experience study, we believe the other assumptions and methods (probability of disability, administrative expense load, probability of marriage, unused sick leave load and part-time service) used in the June 30, 2021 valuation are reasonable.

Other Demographic Assumptions - JFRS

Withdrawal

For JRP the termination assumption was updated to assume no terminations prior to retirement. This assumption seems reasonable.

For LRP, there was very little experience, so the assumption was updated to the Society of Actuaries Basic Turnover table. This assumption seems reasonable. However, we suggest that USI consider if a termination assumption based on service would be more reasonable than an assumption based on age.

Retirement

In their experience study USI developed their retirement rates for both JRP and LRP based on the member's eligibility for normal retirement with a breakdown by year for those within 5 years of normal retirement age. In addition, USI extended the retirement rates past normal retirement age until age 70, recognizing that some members are working past normal retirement age.

We recognize that there is very little data for these plans and generally believe the retirement rates selected are reasonable subject to the following comments.

1. For both JRP and LRP, USI might consider developing retirement rates based on age instead of time until normal retirement age also while taking into account the service requirement for unreduced retirement. In general, we find age to be a more relevant indicator of a when a member may choose to retire. Recognizing that there is likely limited data at each age, USI may consider incorporating 10 years of experience to see if that provides more credibility.

2. USI applies an additional 20% rate of retirement at 27 years of service for the traditional tiers. However, the experience study does not note the actual experience at this service point. We suggest an analysis of this assumption be included in future reports.

3. As noted above, for both JRP and LRP, USI extended the retirement rates from normal retirement age until age 70. Previously the retirement rate at normal retirement age was 100%. This meant that all members would retire once they attain normal retirement age and anyone already past normal retirement age was expected to retire immediately. Under the new assumption, the retirement rate at normal retirement age was reduced to 20%, the retirement rate between normal retirement age and age 70 was set to 33% and age 70 was set to 100%. We agree with the change although typically we find the rate of retirement at normal retirement age to be higher than subsequent ages.

4. For LRP, the proposed rates recommended did not necessarily seem to match up with the actual experience observed and the prior assumption, although there was very limited experience. For example, the assumption for five years before normal retirement age (NRA-5) of 15% was set similar to the previous assumption of 16.7% yet there were no retirements at this point. On the other hand, the rates at three (NRA-3) and four years (NRA-4) before normal retirement age were decreased to 7.5% although actual experience exceeded 15% and the current assumption exceeded 20%. We recommend that USI provide additional rationale for the assumptions selected.

Other Assumptions

In the LRP a member's benefit is based on the highest 36 months of state salary, even if that salary is earned while not a member of the LRP. For example, a member may be active in the LRP for 20 years and then work for the State at higher pay for 5 years. The LRP benefit would be based on the higher pay earned after leaving the legislative position. While it is expected that some members will have their benefit determined based on non-legislative compensation, which is generally higher than legislative compensation, this compensation information and impact on the member's benefit is not known until the member applies for retirement. To account for the expected liability associated with this provision, USI reviewed the impact that this provision had on retirees who commenced their benefit during the study period and determined the average impact of using the non-legislative compensation for all retirees was a 36% increase in the member's retirement benefit. Therefore, they recommended to continue to load the liability for those not yet retired by 40%.

Often actuaries have to incorporate a load for certain items that occur at retirement and are not known at the time of the actuarial valuation, such as loads for additional service, increases in earnings, etc. Instituting a load of 40% is fairly significant.

Additionally, this provision impacts members who have ceased legislative service and have not yet retired. If the member retires with a LRP pension, then any subsequent non-legislative salary earned would not impact the LRP pension. Therefore, this provision only impacts current and future terminated members. The load is applied to the liability of all active members in addition to terminated members, which affects people who are projected to leave the system directly into retirement. If the load was limited to terminated members, the percentage load would be much higher, but affect fewer people.

While this load seems to be consistent for quite some time, it does not necessarily mean that it would occur in the future. Changes in administration may result in less or more legislative members accepting state jobs.

We believe the analysis and subsequent recommendation completed by USI to be reasonable, although a load of 40% has a material impact on the valuation, so additional review may be appropriate. If available, we suggest that JFRS submit to KPPA and TRS a list of current terminated members who have not commenced to receive updated salary information. This information could then be provided to the actuary and an estimated benefit for specific members could be incorporated into the valuation.

Assumptions for Insurance Benefits

Many of the assumptions used in the valuation of retirement allowances are also used in the valuation of health care and life insurance benefits. Additional assumptions used in the June 30, 2021 insurance valuations are discussed below.

TRS Investment Return – Health & Life

The investment return assumptions used for the Health Trust and Life Trust valuation as of June 30, 2021 were equal to the 7.1% used in the pension valuation. These were lowered from 8.0% (Health Trust) and 7.5% (Life Trust) based on the recommendations in the 2015-2020 experience study. CavMac made this recommendation as they note the various trusts showed similar long-term projections. While the current asset allocations for the three trusts are different, TRS confirmed that this is due to a transition from the prior allocation. To the extent that the transition is short-term in nature, we agree that use of the same assumption is reasonable. If the transition will be extended over a significant period, we believe this phase-in period should be reflected in the assumption selected.

Premium Valuation

The per capita claim costs are effectively set to the premiums charged for each plan. The purpose of the insurance trust is to fund the healthcare premiums anticipated to be paid in future years. Pre-65 premiums are determined by the Kentucky Employees' Health Plan (KEHP). The retirement systems provide benefits upon eligibility for Medicare.

The premiums charged by KEHP are blended rates based on the combined experience of active and retired members. As retired members prior to Medicare eligibility have higher costs than active members on average, actuarial standards of practice require the actuary to reflect this higher cost when performing a valuation of retiree health benefits. This higher cost is typically referred to as the implicit rate subsidy. Since the trust funds pay the specific premiums charged for each individual, the value of the implicit rate subsidy is not reflected in the funding valuations. We believe this is a reasonable approach in developing the funding liabilities for the insurance benefits.

We do note that this deviation from actuarial standards of practice is not allowed for purposes of determining liabilities under GASB statements No. 74 and 75. Reviewing those reports was outside the scope of this audit.

Aging Factors

In estimating the projected premiums, the actuary determines whether those premiums would increase in the future due to aging. As healthcare costs increase with age, if a population's average age increases, then the average cost of the population would increase, in addition to any further increases due to healthcare trend. Each actuary applies aging factors somewhat differently for each system:

- For KPPA, GRS applies aging factors to the Medicare plans but not the pre-65 KEHP plans. Since KPPA purchases its own Medicare policies and those polices are priced based on KPPA data, GRS applies the aging factors such that each individual reflects their expected cost.

- For TRS, CavMac follows a similar approach as GRS.

- For JFRS, USI does not apply aging factors to the Medicare plans but does apply aging factors to the pre-65 costs. The Medicare plans purchased by JFRS are commercially rated and as such no aging related to JFRS experience would occur. While they do reflect aging factors for pre-65 costs, these factors are still based on the combined premium for actives and early retirees and thus, do not include a value for the implicit rate subsidy.

For KPPA, the Medicare aging factors are based on table 4 in the Society of Actuaries 2013 study "Health Care Costs – From Birth to Death". These factors are for a plan that uses Medicare carve-out coordination and are not specific to a Medicare Advantage plan. Most KPPA retirees are covered by a Medicare Advantage plan just for KPPA retirees.

For TRS, the source of the Medicare aging factors was not provided. In addition, TRS retirees are covered by a Medicare Advantage plan just for TRS retirees.

Although section 3.7.7 of ASOP 6 requires that the actuary use age-specific costs in the development of the per capita costs, the ASOP 6 practice note dated March 2021 notes that Medicare Advantage ("MA") and Medicare Advantage Prescription Drug plans ("MAPD") have a relatively flat age and gender curve after federal payments and supports not age-rating these types of plans.

Recommendation: Based on ASOP 6 and the ASOP 6 practice note, for KPPA and TRS we recommend that GRS and CavMac either utilize MA and MAPD specific aging factors to develop per capita claim costs to reflect the flat age and gender curve or not age-rate the plan as supported by the ASOP 6 practice note.

While different approaches are taken on this issue, we believe the assumptions used by each actuary are reasonable and in compliance with actuarial standards of practice.

Recommendation: As noted above, we recommend that consideration be given to promote consistency for certain assumptions to be used in the upcoming actuarial valuations, and we recommend the approach used for applying aging factors or not applying age factors, especially for benefits received from the KEHP, be included in that review.

Health Care Cost Trend Rates

In setting trend rates ASOP 6 provides the following guidance under Section 3.12:

- "The actuary should consider separate trend rates for major cost components such as hospital, prescription drugs, other medical services, Medicare integration, and administrative expenses. Even if the actuary develops one aggregate set of trend rates, the actuary should consider these cost components when developing the aggregate set of trend rates."

- When developing a long-term trend assumption and the select period for transitioning, the actuary should consider relevant long-term economic factors such as projected growth in per capita gross domestic product (GDP), projected long-term wage inflation, and projected health care expenditures as a percentage of GDP. The actuary should select a transition pattern and select period that reasonably reflects anticipated experience.

Based on ASOP 6, we recommend that the actuaries consider the following:

1. For JFRS, trends that differ for pre-Medicare benefits and Medicare benefits rather than a single trend to reflect any short-term differences in the expected trends for the two components.

2. The time to the ultimate rate for both pre-Medicare and Medicare. For KPPA and TRS, GRS and CavMac reach the ultimate rate sooner than Milliman normally recommends to its clients.

3. Relevant long-term economic factors, including considering health costs share of GDP.

To illustrate the impact of these considerations, we developed trend assumptions incorporating the Getzen model developed by the Society of Actuaries (SOA). The Society of Actuaries (SOA) developed and regularly updates this long-term medical trend model based on detailed research performed by a committee of economists and actuaries, which included a representative from Milliman. Milliman uses this model as the foundation for the trend that it recommends to our clients for postretirement health valuations, with certain adjustments designed to produce trends that are appropriate for employer plans. These adjustments include incorporating assumed administrative cost trend where applicable and removing the impact of age-related morbidity (since age-related morbidity assumptions are applied separately in the valuation when applicable).

Ultimate rates were determined considering historic and projected rates of real growth, long-term inflation and additional growth attributable to technology, and medical costs as a component of gross domestic product (GDP).

A summary of the cumulative impact on the liability of the difference between the actuaries' trend assumptions and Milliman's assumptions is shown below. For purposes of this trend comparison, Milliman's assumptions reflect the actuaries' assumptions for inflation (2.3% for KPPA, 2.5% for TRS, and 3% for JFRS).

Comparison of Cumulative Healthcare Trend - KPPA Based on Milliman's Model vs GRS		
Duration from Valuation Date	**Pre-Medicare**	**Medicare**
5	-3.8%	-4.2%
10	-7.0%	-7.3%
20	-3.0%	-3.4%

Based on this analysis for KPPA, Milliman would determine a liability lower by 3% - 4% for pre-Medicare benefits and Medicare-eligible benefits. Please note that we estimate that 65% of the KERS and CERS Non-Hazardous liability and 35% of the KERS and CERS Hazardous liability plus SPRS are associated with Medicare-eligible benefits.

Comparison of Cumulative Healthcare Trend – TRS Based on Milliman's Model vs CavMac		
Duration from Valuation Date	**Pre-Medicare**	**Medicare**
5	-5.9%	1.4%
10	-7.7%	3.0%
20	-4.4%	6.7%

Based on this analysis for TRS, Milliman would determine a liability lower by 4% - 5% for pre-Medicare benefits and higher by 5% - 6% for Medicare-eligible benefits. Please note that we estimate that 60% of the liability is associated with Medicare-eligible benefits. The trend from Milliman's model would result in a liability approximately 1% - 2% higher overall.

Comparison of Cumulative Healthcare Trend – JFRS Based on Milliman's Model vs USI		
Duration from Valuation Date	**Pre-Medicare**	**Medicare**
5	-2.5%	-3.3%
10	-2.7%	-3.4%
20	-0.7%	-1.5%

Based on this analysis for JFRS, Milliman would determine a liability lower by 1% - 2% for pre-Medicare benefits and lower by 2% - 3% for Medicare-eligible benefits. Please note that we estimate that 85% of the liability is associated with Medicare-eligible benefits.

While Milliman would utilize different trend factors, we believe the assumptions selected by each actuary are reasonable and in compliance with actuarial standards.

Recommendation: As noted above, we recommend that consideration be given to promote consistency for certain assumptions to be used in the upcoming actuarial valuations and we recommend the healthcare trend assumptions be included in that review. For instance, we recommend that a consistent trend model, such as the Getzen model, be used to set the healthcare trend assumptions. We would anticipate the same trend be used for the pre-Medicare benefits across the systems as early retirees all participate in KEHP and thus, projected increases in healthcare costs should be the same. Short-term trends for Medicare benefits could reflect the individual characteristics of each system and the input of the healthcare providers.

Application of Healthcare Costs

In valuing insurance benefits, additional data is required on dependents of retirees. From a retirement benefits perspective, benefits paid to beneficiaries are paid upon the death of a retiree. From an insurance benefits perspective, dependents receive benefits while the retiree is alive as well as, potentially, upon the death of retiree. This requires the actuary to collect information on current dependents who are receiving health insurance coverage plus make assumptions regarding the number of dependents to be covered in the future. The associated costs of covering dependents are then valued over the current or future dependent's coverage lifetime.

GRS and CavMac both receive this information and value the additional cost of dependent coverage over the assumed lifetime of the dependent for KPPA and TRS, respectively ("individual basis").

On the other hand, USI performs the valuation on a "contract basis" for JFRS. Meaning that the coverage is valued over the retiree's lifetime and does not consider the dependent's independent lifetime. The cost of the coverage does include the value of dependent coverage if one is currently covered or assumed to be covered in the future. While actuarial standards do not require the actuary to value coverage on an individual basis versus a contract basis, we do find it unusual to use a contract basis and recommend that USI consider modifying its approach to an individual basis.

Section IV – Actuarial Valuation Report

Actuarial Standards of Practice

We reviewed the June 30, 2021 actuarial valuation reports from the perspective of serving as an actuarial communication and Statement of Actuarial Opinion (SAO). There are a number of Actuarial Standards of Practice (ASOPs) that apply to the development of the valuation results and the preparation of the actuarial valuation report. We found that the valuation report is in compliance with the applicable ASOPs (see below), but we have identified several suggestions for consideration for future valuation reports.

The following ASOPs are applicable to pension actuarial reports:

- ASOP 4: Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
- ASOP 6: Measuring Retiree Group Benefits Obligations and Determining Retiree Group Benefits Program Periodic Costs or Actuarially Determined Contributions
- ASOP 23: Data Quality
- ASOP 27: Selection of Economic Assumptions for Measuring Pension Obligations
- ASOP 35: Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations
- ASOP 41: Actuarial Communications
- ASOP 44: Selection and Use of Asset Valuation Methods for Pension Valuations
- ASOP 51: Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions
- ASOP 56: Modeling

Review of Compliance with the ASOPs and Suggestions for Future Reports

ASOP 4: This ASOP provides guidance to actuaries when preparing pension valuations, as well as certain other SAOs. The ASOP requires the actuary to include a number of items in the actuarial report, including the purpose of the measurement, summary of plan provisions, data and actuarial methods and assumptions, as well as certain additional information.

The valuation reports for all systems appeared to include the required information.

ASOP 6: This ASOP provides guidance to actuaries when preparing healthcare valuations including the selection of healthcare specific assumptions. Effectively, it incorporates the provisions of ASOP 4 for pension valuations in terms of selection and disclosure of actuarial methods and the provisions of ASOP 35 but applicable to healthcare specific assumptions.

Since the funding valuations for the insurance benefits only value the healthcare premiums and do not reflect the value of the implicit rate subsidy, this is a deviation from ASOP 6. GRS and CavMac both note that this is a deviation from ASOP 6, and thus, are

in conformance with actuarial standards. Although USI does use aging factors for pre-65 costs, the aging factors apply to the combined premium for both active and early retirees and thus, do not include the value of the implicit rate subsidy, which is consistent with the valuation of the other systems. We suggest that USI include a statement that the premiums valued do not incorporate the implicit rate subsidy, and thus, is a deviation from ASOP 6.

As discussed above in Section III, the healthcare assumptions selected appear to be reasonable and appropriate. In addition, the valuation report contains a description of the assumptions used and where there is a deviation from ASOP 6. The experience study referenced in the valuation report contains justification for the assumptions that were selected. Therefore, the valuation reports are in compliance with ASOP 6 excluding the one issue noted above for JFRS.

ASOP 23: This ASOP provides guidance to actuaries when selecting, reviewing, using, or relying on data supplied by others, when performing actuarial services. The ASOP requires the actuary to disclose the source of the data, whether the actuary reviewed the data, and to indicate any concerns about the data and if there are any limitations on the actuarial work product as a result of those concerns.

The reports indicate the source of the data and note that while the actuary checked for year to year consistency, they did not audit the data. This approach is consistent with the requirements of the ASOP and general actuarial practice.

ASOP 27: This ASOP provides guidance to actuaries when selecting economic assumptions for measuring pension obligations in a defined benefit plan. The ASOP also requires actuaries to disclose the assumptions used as well as the rationale for the selection of the assumptions.

As discussed above in Section III, the economic assumptions selected appear to be reasonable and appropriate. In addition, the valuation report contains a description of the assumptions used, and the experience study referenced in the valuation report contains justification for the assumptions that were selected. Therefore, the valuation reports are in compliance with ASOP 27.

Please refer to Section III above for our comments on the economic assumptions.

ASOP 35: This ASOP provides guidance to actuaries when selecting demographic assumptions for measuring pension obligations in a defined benefit plan. The ASOP also requires actuaries to disclose the assumptions used as well as the rationale for the selection of the assumptions.

As discussed above in Section III, the demographic assumptions selected appear to be reasonable and appropriate. In addition, the valuation report contains a description of the

assumptions used, and the experience study referenced in the valuation report generally contains justification for the assumptions that were selected. Therefore, the valuation reports are in compliance with ASOP 35.

Please refer to Section III above for our comments on the demographic assumptions as well as below for some additional disclosure suggestions.

ASOP 41: This ASOP provides guidance to actuaries when issuing actuarial communications. The ASOP requires actuaries to include various disclosure items in the actuarial report including the intended user, scope, purpose, actuarial qualifications.

The reports prepared by the relevant System Actuaries included the required information. Therefore, the valuation reports are in compliance with ASOP 41.

ASOP 44: This ASOP provides guidance to actuaries when selecting an asset valuation method for an actuarial valuation.

The asset valuation method for each system recognizes 20% of actuarial investment gains and losses with no corridor around the market value of assets. We find the asset valuation method is in compliance with ASOP 44. In particular, this method satisfies Section 3.3 and 3.4 of the ASOP in that it is without any bias.

ASOP 51: This ASOP provides guidance to actuaries on the assessment and disclosure of the risks that future measurements may differ from that which is expected.

KPPA

The valuation reports discuss several risks facing each of the plans and presents various risk metrics with an explanation of the importance of those metrics. The report includes key risk metrics such as the asset volatility ratio, the liability volatility ratio, liquidity ratio, contribution percentage and maturity ratio.

In addition, there is an additional letter addressed to the Board illustrating the sensitivity of the costs of the plan with changes in the discount rate, price inflation, and wage inflation per Kentucky Revised Statute § 61.670.

Therefore, the reports are in compliance with ASOP 51.

TRS

The valuation report discusses several risks facing TRS and presents various risk metrics to illustrate the sensitivity of the costs of the plan with changes in the discount rate, price inflation, and wage inflation, in addition to other disclosures required under ASOP 51. Therefore, we believe that the report is in compliance with ASOP 51.

We would note the following observations for consideration in future reports:

1) The valuation report illustrates a sensitivity analysis for multiple scenarios by varying the discount rate, price inflation, and wage inflation. The report does not define any of these risks such as investment risk, interest rate risk, inflationary risk, or contribution risk and does not discuss any other risks.

2) Other risks that may be worth discussing include demographic, contribution, and maturity risks. For example, we recommend including the asset volatility ratio and the liability volatility ratio as these are measures of the system's maturity which affects the magnitude of any contribution rate increase or decrease.

JFRS

The valuation reports discuss several risks facing each of the plans covering investment risk, demographic risks and other factors. Therefore, we believe the reports are in compliance with ASOP 51.

We suggest additional items be included in future reports such as the asset volatility ratio, the liability volatility ratio, liquidity ratio, maturity ratio and discussion on contribution risks.

ASOP 56: This ASOP provides guidance to actuaries when performing actuarial services that require modeling. The ASOP requires certain disclosures including the intended purpose of the model, any material limitations or known weaknesses of the model, and the extent of any reliance on a third-party model.

KPPA

The reports prepared by GRS included the required information. Therefore, the valuation reports are in compliance with ASOP 56.

TRS

The June 30, 2021 valuation report does not clearly discuss the use or reliance of models. This ASOP was effective for work done on or after October 1, 2020 and therefore the 2021 valuation report is not in compliance. However, the June 30, 2022 valuation report has an additional paragraph that discusses models and is in compliance with ASOP 56.

JFRS

The June 30, 2021 valuation reports do not clearly discuss the use or reliance of models. This ASOP was effective for work done on or after October 1, 2020 and therefore the

2021 valuation report is not in compliance. We recommend that these disclosures be included in the 2023 reports.

Summary of Plan Provisions

KPPA

We believe that the plan provision section provides a robust summary, but recommend the following item be incorporated:

- The benefit multipliers for Tier 2 participants apply to all past service once the requirement is met. We suggest the report clarify this provision.

TRS

We believe that the plan provision section provides a robust summary, but recommend the following items be incorporated:

- For members hired on or after 7/1/2008, the valuation report says that the allowance is equal to a percentage of final salary without noting that the percentage is multiplied by the member's benefit service. For comparison, the Summary Plan Description (SPD) has a similar description of the percentages but notes that they are the "retirement factors" and not the "retirement allowance."
- The SPD notes that the retirement allowance cannot exceed the last annual compensation for a member or their final average salary. The valuation report does not state this provision.
- The valuation report lists the minimum benefit of $440 per year of service with the pre 7/1/2008 hire plan provisions. Based on the SPD, this minimum also applies to members hired after 7/1/2008 but is not noted in the plan provisions for that group.
- A surviving spouse of an active member with less than ten years of service is eligible for a death benefit of $2,160 or $2,880 depending on their income. The SPD notes that this benefit can also be paid to the surviving spouse of a member with over ten years of service while they wait to qualify for an annuity benefit. The valuation report does not include this provision.
- The interest rate used to credit contributions should be disclosed in the valuation report.

JFRS

We believe that the plan provision section provides a robust summary, but recommend the following item be incorporated:

- JFRS hybrid plan members receive a monthly premium subsidy for health insurance equal to $10 per month per year of service. Based on language in the statute, the monthly subsidy increases 1.5% per year each July 1. At the time of the June 30, 2021 valuation, USI applied the 1.5% increase from each member's date of retirement rather than from the inception of the provision for all members. We understand that this provision was corrected in the 2022 valuation. We suggest clarity be provided in the report on this provision.

Summary of Actuarial Assumptions

KPPA

The summary of actuarial assumptions included in the actuarial valuation report is a robust summary and includes nearly all of the assumptions reflected in the valuation model. In future valuation reports, we suggest the following assumptions be included:

- The factors used to convert the Tier 3 cash balance accounts into an annuity should be disclosed in the valuation report.
- The actuarial equivalent factors used for determining death benefits should be disclosed in the valuation report.
- It is our understanding that the monthly blended premium as of July 1, 2021 used to determine retiree contributions for Medicare benefits is $206.95. This should be disclosed in the report.
- It is our understanding that the healthcare participation assumption for future terminated vested participants is the same as for current terminated vested participants. This should be disclosed in the report.
- It is our understanding that current retirees with family healthcare coverage are assumed to keep this coverage for five years, with spousal coverage thereafter. This should be disclosed in the report.

TRS

The summary of actuarial assumptions included in the actuarial valuation report is a robust summary and includes nearly all of the assumptions reflected in the valuation model. In future valuation reports, we suggest the following assumptions be included:

- The unused sick leave is noted as 3% for "all active liability at the time of retirement." Based on discussions with CavMac, the 3% load is applied to the retirement decrement for active members while a 2.5% load is applied to the death and termination decrements, a 2% load is applied to the disability decrement, and a 2% load applied to vested terminated liabilities. These various loads are not noted in the report.

- CavMac communicated that they assume members will take the greater of the contribution balance or an annuity when valuing the termination decrement for active members. This is not disclosed in the report.
- The experience investigation report notes that part-time active members are assumed to accrue 0.25 years of service though it is unclear if this assumption applies only to benefit service or to eligibility service too. The valuation report is silent on this assumption.
- The mortality rates shown for active members in the June 30, 2021 valuation report are not consistent with the description of the mortality table but are instead rates as of 2018. CavMac updated this for their June 30, 2022 valuation report.
- The valuation report is unclear that age 60 is used for benefit commencement timing for active members who terminate employment in the future while vested. A different benefit commencement timing assumption is used for current vested terminated members. These assumptions were not disclosed in the report.
- The valuation report should disclose the assumption for the timing of decrements.
- The valuation report does not discuss any assumptions about reciprocity service for active or terminated employees. Based on discussions with CavMac, current known reciprocity service is included in eligibility service for active members but no assumption is included for any future reciprocity service. We suggest this assumption should be disclosed in the report.
- In Milliman's review of an active sample life for a part-time member hired prior to 7/1/2008, CavMac said they assumed a 2% multiplier for all part-time members rather than basing the multiplier on the individual's service or hire date. This assumption is not stated in the valuation report.
- A surviving spouse of an active member with less than ten years of service is eligible for a death benefit of $2,160 or $2,880 depending on their income. Unmarried children are also eligible for certain death benefits. CavMac does not include what benefits they assume for spouses or the number of children.
- For post-65 costs for OPEB, CavMac adjusts the Medicare Eligible Health Plan (MEHP) costs for different ages. CavMac uses the $211 premium for 2022, then trends it backwards six months using the 5.125% medical trend assumption. CavMac then applies a normalization factor to calculate a $161.11 age 65 per capita claim cost. The $161.11 amount and the procedure to derive it should be disclosed in the report.

JFRS

- In the valuation report, the salary increase assumption is noted as 1% for the next three years and 3.5% thereafter. During replication, the 1% salary increase assumption was used for next four years and 3.5% thereafter to match. We recommend that the specific years the 1% is intended to apply be noted in the valuation report.
- The salary increase assumption of 1% is also used to determine member salaries "backwards" from the valuation date to date of hire. Salaries prior to the valuation

date are used in developing the actuarial accrued liability under the Entry Age Normal cost method. A lower backwards salary rate will result in a higher actuarial accrued liability. We are unsure if this application of the 1% salary increase assumption was intended and suggest it be clarified in the next valuation report.

- The assumption regarding price inflation is not disclosed in the report.
- The valuation report should disclose the assumption for the timing of decrements.

Section V – Parallel Valuation

Our approach to performing a parallel valuation is two-fold. First, we calculate and compare actuarial calculations for selected individual sample members with those produced by the System Actuary. Second, we run the full census data through our valuation software to compare overall valuation results. Below we discuss some important differences between the actuarial valuation programs used by GRS, CavMac, USI, and Milliman, then we present the results of our parallel valuation.

Differences in Actuarial Software

Both the retirement and insurance valuations use the entry age actuarial cost method to determine annual contribution requirements and the unfunded actuarial accrued liability. Although actuaries are well versed in the standard actuarial cost methods available, there are differences in interpretation and implementation from firm to firm such that no two actuarial valuation software programs perform calculations exactly the same way. Even if the firms use the same actuarial valuation software, differences in programming and techniques can also result in differences. As shown below, the results of our parallel valuation for each system are similar. Overall, the values produced by the actuaries are reasonable and comply with relevant actuarial standards.

Individual Sample Member Liability Calculations

As noted above, our approach involves first attempting to replicate the actuarial calculations for selected individual sample members. This allows us to understand the actuary's valuation programming on a micro basis and enables us to customize our valuation programming to perform similar calculations as much as possible. Each actuary provided us with total liability results for several selected members covering the various divisions, plans and groups. While the actuaries did not provide us with detailed individual sample member liability calculations, they did provide complete and timely responses as requested and, in some cases, reviewed output from our system to discuss potential causes of differences in results that led to our conclusions. While we cannot state for certain that every detail of the valuation program is correct for each decrement for each division, plan and group, we do believe that each actuary has appropriately reflected all major benefits available to members of each of the systems based on the total results of our parallel valuation.

Full Parallel Valuation Runs - Pension

The following tables compare the present value of future benefits, actuarial accrued liability, and normal cost for each of the systems by status and Tier calculated by Milliman in our replication valuation versus the results reported in the actuarial valuation reports. Milliman's figures should not replace the results reported in the Actuarial Valuation and are only appropriate for actuarial review purposes and are not suitable for other purposes.

The present value of benefits represents the present value of future cash flows from the system based on the plan provisions and application of the actuarial assumptions. The

application of the entry age normal cost method would then allocate this present value to service attributed to past service for determining the actuarial accrued liability, service attributed to the upcoming year of service for determining the normal cost and to service attributed to future service for determining benefits to be paid by future normal costs.

KERS

The following tables compare the results of our parallel replication valuation of the retirement benefits split by tier and status for KERS Non-Hazardous and Hazardous groups, separately.

For KERS Non-Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 1.8%. On an actuarial accrued liability basis, our replication is within 1.6% and we are within 1.7% of the normal cost rate.

One reason for the difference is that in performing the audit, GRS indicated that they excluded the non-hazardous benefit for retirees with both a non-hazardous benefit and a hazardous benefit from the valuation. We estimated that this increased KERS non-hazardous liabilities by approximately 1.8%.

For KERS Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 0.1%. On an actuarial accrued liability basis, our replication is within -0.1% and we are within -1.4% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of KERS Non-Hazardous and Hazardous plans based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
KERS
($ in millions)

	Valuation Report		Milliman's Review		Percent Difference of Milliman / GRS	
	Non Hazardous [1]	Hazardous	Non Hazardous	Hazardous	Non Hazardous	Hazardous
Present Value of Future Benefits						
Actives						
Tier 1 Traditional	4,047,896	328,747	4,017,652	332,444	-0.7%	1.1%
Tier 2 Traditional	601,930	109,235	617,457	110,553	2.6%	1.2%
Tier 3 Hybrid	436,369	128,034	447,412	126,425	2.5%	-1.3%
Total	5,086,195	566,016	5,082,520	569,423	-0.1%	0.6%
Inactives	689,684	51,492	700,564	51,613	1.6%	0.2%
Retirees	11,736,267	864,939	12,047,197	863,383	2.6%	-0.2%
Total	17,512,146	1,482,447	17,830,281	1,484,419	1.8%	0.1%
Active Accrued Liability						
Tier 1 Traditional	3,424,925	280,289	3,362,399	280,292	-1.8%	0.0%
Tier 2 Traditional	341,861	62,321	344,450	63,397	0.8%	1.7%
Tier 3 Hybrid	128,635	36,203	128,293	35,734	-0.3%	-1.3%
Total	3,895,421	378,812	3,835,142	379,423	-1.5%	0.2%
Total Accrued Liability	16,321,372	1,295,243	16,582,903	1,294,419	1.6%	-0.1%
Normal Cost as % of Payroll	11.96%	16.01%	12.16%	15.79%	1.7%	-1.4%

[1] The liability for the non-hazardous benefits for retirees with both a non-hazardous benefit and a hazardous benefit, was not included in the 2021 actuarial valuation.

CERS

The following tables compare the results of our parallel replication valuation of the retirement benefits split by tier and status for CERS Non-Hazardous and Hazardous groups, separately.

For CERS Non-Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 2.0%. On an actuarial accrued liability basis, our replication is within 1.9% and we are within 0.2% of the normal cost rate.

One reason for the difference is that in performing the audit, GRS indicated that they excluded the non-hazardous benefit for retirees with both a non-hazardous benefit and a hazardous benefit from the valuation. We estimated that this increased CERS non-hazardous liabilities by approximately 1.4%.

For CERS Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 0.0%. On an actuarial accrued liability basis, our replication is within 0.0% and we are within -0.8% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of CERS Non-Hazardous and Hazardous plans based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
CERS
($ in millions)

	Valuation Report		Milliman's Review		Percent Difference of Milliman / GRS	
	Non Hazardous [1]	Hazardous	Non Hazardous	Hazardous	Non Hazardous	Hazardous
Present Value of Future Benefits						
Actives						
Tier 1 Traditional	5,558,336	1,773,571	5,501,832	1,784,866	-1.0%	0.6%
Tier 2 Traditional	870,855	510,731	891,233	510,332	2.3%	-0.1%
Tier 3 Hybrid	977,936	433,593	989,781	415,247	1.2%	-4.2%
Total	7,407,127	2,717,895	7,382,846	2,710,446	-0.3%	-0.3%
Inactives	623,791	77,921	630,492	77,082	1.1%	-1.1%
Retirees	8,774,177	3,699,392	9,131,347	3,708,906	4.1%	0.3%
Total	16,805,095	6,495,208	17,144,685	6,496,433	2.0%	0.0%
Active Accrued Liability						
Tier 1 Traditional	4,705,533	1,492,116	4,625,511	1,483,020	-1.7%	-0.6%
Tier 2 Traditional	504,084	259,867	508,395	259,690	0.9%	-0.1%
Tier 3 Hybrid	287,321	100,162	280,470	99,074	-2.4%	-1.1%
Total	5,496,938	1,852,145	5,414,376	1,841,784	-1.5%	-0.6%
Total Accrued Liability	14,894,906	5,629,458	15,176,215	5,627,772	1.9%	0.0%
Normal Cost as % of Payroll	10.44%	18.39%	10.46%	18.25%	0.2%	-0.8%

[1] The liability for the non-hazardous benefits for retirees with both a non-hazardous benefit and a hazardous benefit, was not included in the 2021 actuarial valuation.

SPRS

The following tables compare the results of our parallel replication valuation of the retirement benefits split by tier and status for SPRS.

In total, we were able to replicate present value of future benefits in the valuation report within 0.1%. On an actuarial accrued liability basis, our replication is within 0.4% and we are within -3.1% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of SPRS based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
SPRS
($ in millions)

	Valuation Report	Milliman's Review	Percent Difference of Milliman /GRS
Present Value of Future Benefits			
Actives			
Tier 1	197,591,995	196,790,235	-0.4%
Tier 2	62,049,133	62,034,311	0.0%
Tier 3	34,287,357	33,988,549	-0.9%
Total	293,928,485	292,813,095	-0.4%
Inactive	10,465,000	10,426,034	-0.4%
Retirees	850,336,000	852,165,282	0.2%
Total	1,154,729,485	1,155,404,411	0.1%
Active Accrued Liability			
Tier 1	162,482,361	161,990,731	-0.3%
Tier 2	23,570,932	26,191,208	11.1%
Tier 3	6,404,920	6,612,463	3.2%
Total	192,458,213	194,794,402	1.2%
Total Accrued Liability	1,053,259,213	1,057,385,718	0.4%
Normal Cost as % of Payroll	26.13%	25.32%	-3.1%

TRS

The following tables compare the results of our parallel replication valuation of the retirement benefits split by participant group and status.

In total, we were able to replicate present value of future benefits in the valuation report within -0.5%. On an actuarial accrued liability basis, our replication is within -0.4% and we are within -2.0% of the normal cost rates (combined university and non-university).

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of TRS based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of CavMac's results.

Comparison of June 30, 2021 Valuation Results
Teachers
($ in millions)

	CavMac	Milliman	Percent Difference
Present Value of Future Benefits			
Actives			
University hired before 7/1/2008	$ 485.5	$ 482.5	-0.6%
University hired after 7/1/2008	235.5	234.1	-0.6%
Non-University hired before 7/1/2008	13,892.9	13,779.2	-0.8%
Non-University hired after 7/1/2008	4,776.2	4,742.2	-0.7%
Total Actives	19,390.1	19,238.0	-0.8%
Inactives (Includes Actives)	19,893.9	19,736.2	-0.8%
Retirees	24,863.8	24,789.6	-0.3%
Total Present Value of Future Benefits	44,757.7	44,525.8	-0.5%
Actuarial Accrued Liability			
Actives			
University hired before 7/1/2008	420.1	417.3	-0.7%
University hired after 7/1/2008	129.8	130.1	0.2%
Non-University hired before 7/1/2008	11,554.1	11,464.1	-0.8%
Non-University hired after 7/1/2008	2,110.1	2,108.6	-0.1%
Total Actives	14,214.1	14,120.1	-0.7%
Inactives (Includes Actives)	14,717.9	14,618.3	-0.7%
Retirees	24,863.8	24,789.6	-0.3%
Total Actuarial Accrued Liability	39,581.7	39,407.9	-0.4%
Normal Cost as a % of Payroll (After NC Loads)			
University	12.28%	12.15%	-1.0%
Non-University	16.41%	16.05%	-2.2%

JFRS

The following tables compare the results of our parallel replication valuation of the retirement benefits split by tier and status for JRP and LRP, separately.

For JRP in total, we were able to replicate present value of future benefits in the valuation report within -1.8%. On an actuarial accrued liability basis, our replication is within -1.7% and we are within -2.8% of the net employer normal cost.

For LRP in total, we were able to replicate present value of future benefits in the valuation report within -1.4%. On an actuarial accrued liability basis, our replication is within -1.7% reflecting the 40% load and we are within -2.7% of the net employer normal cost.

One reason for the difference is that in performing the audit, USI indicated that they incorrectly applied a mortality table in developing the liabilities for the traditional plan. USI stated the impact on the actuarial accrued liability for the traditional plan for JRP and LRP was an overstatement of 1.557% and 1.75%, respectively. It is our understanding that this issue was corrected in the 2022 GASB valuation.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of JRP and LRP based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of USI's results.

Comparison of June 30, 2021 Valuation Results
Judicial Retirement Plan
($ in millions)

	USI [1]	Milliman	Percent Difference
Present Value of Future Benefits			
Actives			
Traditional	$133.5	$129.9	-2.7%
Hybrid	$7.5	$7.5	0.0%
Total Actives	$141.0	$137.4	-2.6%
Inactives	$3.7	$3.6	-2.7%
Retirees	$258.3	$254.8	-1.4%
Total Present Value of Future Benefits	$403.0	$395.8	-1.8%
Actuarial Accrued Liability			
Actives			
Traditional	$115.3	$112.5	-2.4%
Hybrid	$2.2	$2.2	0.0%
Total Actives	$117.5	$114.7	-2.4%
Inactives	$3.7	$3.6	-2.7%
Retirees	$258.3	$254.8	-1.4%
Total Actuarial Accrued Liability	$379.5	$373.1	-1.7%
Net Employer Normal Cost			
Traditional	$2.6	$2.5	-3.1%
Hybrid	$0.2	$0.2	1.2%
Total Normal Cost	$2.8	$2.7	-2.8%

[1] In performing the audit, USI indicated that they incorrectly applied a mortality table in developing the Traditional Plan's liabilities. USI stated the impact on the Traditional Plan's Actuarial Accrued Liability was an overstatement of 1.557%.

Comparison of June 30, 2021 Valuation Results
Legislators Retirement Plan
($ in millions)

	USI [1]	Milliman	Percent Difference
Present Value of Future Benefits			
Actives			
Traditional	$10.9	$10.7	-1.8%
Hybrid	$1.8	$1.8	0.0%
Total Actives	$12.7	$12.5	-1.6%
Inactives	$4.0	$4.1	2.5%
Retirees	$52.3	$51.4	-1.7%
Total Present Value of Future Benefits	$69.0	$68.0	-1.4%
Actuarial Accrued Liability			
Actives			
Traditional	$10.0	$9.8	-2.0%
Hybrid	$0.7	$0.7	0.0%
Total Actives	$10.7	$10.5	-1.9%
Inactives	$4.0	$4.1	2.5%
Retirees	$52.3	$51.4	-1.7%
Total Actuarial Accrued Liability	$67.0	$66.0	-1.5%
Total Actuarial Accrued Liability (Includes Load [2])	$72.6	$71.4	-1.7%
Net Employer Normal Cost			
Traditional	$0.1	$0.1	-2.9%
Hybrid	$0.1	$0.1	-2.4%
Total Normal Cost (excludes Load [2])	$0.2	$0.2	-2.7%

[1] In performing the audit, USI indicated that they incorrectly applied a mortality table in developing the Traditional Plan's liabilities. USI stated the impact on the Traditional Plan's Actuarial Accrued Liability was an overstatement of 1.75%.

[2] A 40% load is reflected for non-legislative salaries

Full Parallel Valuation Runs – Insurance

The following tables compare the present value of future benefits, actuarial accrued liability, and normal cost for each of the system by status calculated by Milliman in our replication valuation versus the results reported in the actuarial valuation reports for the insurance benefits. Milliman's figures should not replace the results reported in the Actuarial Valuation and are only appropriate for actuarial review purposes and are not suitable for other purposes.

Similar to the pension benefits, the present value of benefits represents the present value of future cash flows from the system based on the plan provisions and application of the actuarial assumptions. The application of the entry age normal cost method would then allocate this present value to service attributed to past service for determining the actuarial accrued liability, service attributed to the upcoming year of service for determining the normal cost and to service attributed to future service for determining benefits to be paid by future normal costs.

Please note that it is not unusual for differences in actuarial programming to result in larger differences on a valuation covering healthcare benefits due to the application of aging factors and healthcare trend, the change in per capita claim costs and premiums when eligible for Medicare, and leveraging caused by contributions made by retirees.

KERS

The following tables compare the results of our parallel replication valuation of the insurance benefits split by status for KERS Non-Hazardous and Hazardous groups, separately.

For KERS Non-Hazardous in total, we were able to replicate present value of future benefits in the valuation report within -0.6%. On an actuarial accrued liability basis, our replication is within -1.2% and we are within 3.9% of the normal cost rate.

For KERS Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 0.5%. On an actuarial accrued liability basis, our replication is within -3.6% and we are within -3.1% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of KERS Non-Hazardous and Hazardous plans based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
KERS Insurance
($ in millions)

	Valuation Report		Milliman's Review		Percent Difference of Milliman / GRS	
	Non Hazardous	Hazardous	Non Hazardous	Hazardous	Non Hazardous	Hazardous
Present Value of Future Benefits						
Actives	1,186.4	182.1	1,164.3	178.0	-1.9%	-2.3%
Inactive	148.2	11.0	145.4	8.6	-1.9%	-22.4%
Retirees	1,461.6	277.0	1,470.0	286.0	0.6%	3.2%
Total	2,796.2	470.1	2,779.7	472.5	-0.6%	0.5%
Active Accrued Liability	964.3	136.4	927.6	131.5	-3.8%	-3.6%
Total Accrued Liability	2,574.1	424.5	2,543.0	426.0	-1.2%	0.4%
Normal Cost as % of Payroll	2.54%	4.46%	2.64%	4.32%	3.9%	-3.1%

CERS

The following tables compare the results of our parallel replication valuation of the insurance benefits split by status for CERS Non-Hazardous and Hazardous groups, separately.

For CERS Non-Hazardous in total, we were able to replicate present value of future benefits in the valuation report within -1.1%. On an actuarial accrued liability basis, our replication is within -2.0% and we are within 0.7% of the normal cost rate.

For CERS Hazardous in total, we were able to replicate present value of future benefits in the valuation report within 1.0%. On an actuarial accrued liability basis, our replication is within 1.0% and we are within -1.7% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of CERS Non-Hazardous and Hazardous plans based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
CERS Insurance
($ in millions)

	Valuation Report		Milliman's Review		Percent Difference of Milliman / GRS	
	Non Hazardous	Hazardous	Non Hazardous	Hazardous	Non Hazardous	Hazardous
Present Value of Future Benefits						
Actives	2,155.4	723.0	2,129.7	717.3	-1.2%	-0.8%
Inactive	191.1	21.2	182.4	18.1	-4.6%	-14.8%
Retirees	1,644.6	1,196.3	1,633.4	1,224.9	-0.7%	2.4%
Total	3,991.1	1,940.5	3,945.6	1,960.3	-1.1%	1.0%
Active Accrued Liability	1,614.8	533.7	1,566.9	526.3	-3.0%	-1.4%
Total Accrued Liability	3,450.5	1,751.2	3,382.8	1,769.2	-2.0%	1.0%
Normal Cost as % of Payroll	3.07%	4.83%	3.09%	4.75%	0.7%	-1.7%

SPRS

The following tables compare the results of our parallel replication valuation of the insurance benefits split by status for SPRS.

In total, we were able to replicate present value of future benefits in the valuation report within 1.7%. On an actuarial accrued liability basis, our replication is within 1.7% and we are within -4.5% of the normal cost rate.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of SPRS based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of GRS' results.

Comparison of June 30, 2021 Valuation Results
SPRS Insurance
($ in millions)

	Valuation Report	Milliman's Review	Percent Difference of Milliman / GRS
Present Value of Future Benefits			
Actives	86.5	86.6	0.1%
Inactive	4.0	3.9	-2.6%
Retirees	202.7	207.7	2.4%
Total	293.2	298.1	1.7%
Active Accrued Liability	65.7	65.4	-0.4%
Total Accrued Liability	272.4	276.9	1.7%
Normal Cost as % of Payroll	7.35%	7.02%	-4.5%

TRS

The following tables compare the results of our parallel replication valuation of the Retiree Health and Life Insurance Trusts split by participant group and status for TRS.

In total, we were able to replicate present value of future benefits in the valuation report within 1.4%, actuarial accrued liability within 2.5%, and the normal cost rate within 10 basis points.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of TRS based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of CavMac's results.

Comparison of June 30, 2021 Valuation Results
Teachers
($ in millions)

	CavMac	Milliman	Percent Difference
Present Value of Future Benefits			
Actives			
University	$ 100.4	$ 98.4	-2.0%
Non-University	2,397.1	2,397.8	0.0%
Total Actives	2,497.5	2,496.2	-0.1%
Inactives (Includes Actives)	2,552.2	2,546.1	-0.2%
Retirees	1,635.7	1,583.2	-3.2%
Total Present Value of Future Benefits	4,187.9	4,129.3	-1.4%
Actuarial Accrued Liability			
Actives			
University	73.3	70.4	-4.0%
Non-University	1,693.0	1,665.6	-1.6%
Total Actives	1,766.3	1,736.0	-1.7%
Inactives (Includes Actives)	1,821.0	1,785.8	-1.9%
Retirees	1,635.7	1,583.2	-3.2%
Total Actuarial Accrued Liability	3,456.7	3,369.0	-2.5%
Normal Cost as a % of Payroll			
University	1.92%	2.02%	5.2%
Non-University	1.92%	2.02%	5.2%

JFRS

The following tables compare the results of our parallel replication valuation of the insurance benefits split by status for JRP and LRP, separately.

For JRP in total, we were able to replicate present value of future benefits in the valuation report within 0.5%. On an actuarial accrued liability basis, our replication is within 0.5% and we are within 0.7% of the net employer normal cost.

For LRP in total, we were able to replicate present value of future benefits in the valuation report within 2.7%. On an actuarial accrued liability basis, our replication is within 3.5% and we are within -9.6% of the net employer normal cost.

One reason for the difference is the 1.5% annual increase in the monthly medical insurance stipend for hybrid plan members is reflected in Milliman's parallel valuation from inception of the provision. The original valuation included the 1.5% increase from each member's date of retirement. Another reason for the difference is that in performing the audit, USI indicated that 5 inactive members and 1 retiree were excluded from the LRP valuation. We believe the difference in the normal cost is due to few employees included and the application of the entry age normal cost method. We believe the results produced by USI are reasonable and the result is due to differences in actuarial programming.

These small differences are expected when comparing calculated liabilities for a complex valuation. As the results do not deviate significantly excluding the issues noted, Milliman's audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of JRP and LRP based on the assumptions and methods.

In summary, we view the results as a successful replication by Milliman of USI's results.

Comparison of June 30, 2021 Valuation Results
Judicial Insurance Plan
($ in millions)

	USI	Milliman	Percent Difference
Present Value of Future Benefits			
Actives	$20.9	$21.0	0.5%
Inactives	$0.4	$0.3	-1.3%
Retirees	$22.1	$22.2	0.5%
Total Present Value of Future Benefits	$43.4	$43.5	0.5%
Actuarial Accrued Liability			
Actives	$16.9	$16.9	0.0%
Inactives	$0.4	$0.3	-1.3%
Retirees	$22.1	$22.2	0.5%
Total Actuarial Accrued Liability	$39.4	$39.4	0.2%
Normal Cost	$0.7	$0.7	0.7%

Comparison of June 30, 2021 Valuation Results
Legislators Insurance Plan
($ in millions)

	USI	Milliman	Percent Difference
Present Value of Future Benefits			
Actives	$4.1	$4.0	-2.4%
Inactives [1]	$1.3	$1.6	28.9%
Retirees [1]	$10.9	$11.1	1.6%
Total Present Value of Future Benefits	$16.2	$16.7	2.7%
Inactives [1]	$1.3	$1.6	28.9%
Retirees [1]	$10.9	$11.1	1.6%
Actuarial Accrued Liability			
Actives	$3.5	$3.5	0.0%
Inactives [1]	$1.3	$1.6	28.9%
Retirees [1]	$10.9	$11.1	1.6%
Total Actuarial Accrued Liability	$15.6	$16.2	3.5%
Normal Cost	$0.1	$0.1	-9.6%

[1] During the audit, USI indicated that 5 inactive members and 1 retiree were excluded from the liability.