



111 SW Fifth Avenue
 Suite 3700
 Portland, OR 97204
 Tel 503 227 0634
 milliman.com

April 29, 2019

VIA E-MAIL

Kevin Olineck
 Director
 Oregon PERS

Re: Legislative Fiscal Office Combined Concepts

Dear Kevin:

As requested, we have prepared a combined analysis of several concepts requested by the Legislative Fiscal Office (LFO) regarding the benefits and financing of Oregon PERS. We understand LFO would like to see two versions of this analysis, which were described as Scenario #1 and Scenario #2 in the request. However, these scenarios varied only in one aspect related to the amortization concept. As a result, we've been able to address this variation below in the text, without repeating the rest of the concepts from the scenarios.

Our understanding of the combined concepts described by LFO is summarized below.

Concept	Description
<p>Redirect Member Contributions</p>	<ul style="list-style-type: none"> • A portion of the 6% of payroll member contribution to Individual Account Program (IAP) would be redirected beginning January 2020, in the following amounts: <ul style="list-style-type: none"> ○ Tier 1 and Tier 2: 2.5% of payroll ○ OPSRP: 0.75% of payroll • This redirect would only apply to members who earn \$30,000 or more. This threshold would be indexed in future years. <ul style="list-style-type: none"> ○ We understand the \$30,000 threshold would apply as an eligibility cliff. In other words, a Tier 2 member with \$30,000 of pay would have 2.5% redirect on their full salary, while a member with \$29,999 in pay would have no redirection at all. • Redirected amounts would be deposited into new accounts in the Tier 1 /Tier 2 and OPSRP programs, would not be eligible for inclusion in the Money Match calculation under Tier 1/Tier 2, and would serve as an offset to employer normal cost rate contributions (the cost assigned to the current year of service for active members)
<p>Final Average Salary Limit</p>	<ul style="list-style-type: none"> • Final Average Salary used to calculate benefits would be limited to \$195,000 for service on or after January 1, 2020. • The limit would apply to the calculation of all OPSRP pension benefits and for Tier 1/Tier 2 benefits determined under the Full Formula or Formula Plus Annuity calculation methods. Tier 1/Tier 2 benefits determined under the Money Match calculation would not be affected.

Offices in Principal Cities Worldwide

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

Concept	Description
	<ul style="list-style-type: none"> The initial limit of \$195,000 would be indexed in future years using the same factor used by the IRS for the IRC 401(a)(17) compensation limit, which is based on annual changes in a national Consumer Price Index (CPI). The Final Average Salary associated with service earned before January 1, 2020 would be unaffected by the limit, and would reflect salary growth after the effective date, if applicable.
Money Match Interest Rate	<ul style="list-style-type: none"> Currently, the Money Match annuitization interest rate used to convert account balances to monthly lifetime annuities is equal to the long-term investment assumption adopted by the PERS Board (currently 7.20%). This concept would reduce the Money Match annuitization interest rate to one half of the long-term investment assumption adopted by the PERS Board. For this analysis, we have shown the effect of using 3.6% as the Money Match annuitization interest rate prospectively beginning January 1, 2020.
Extend amortization period for a portion of Tier 1/Tier 2 Unfunded Actuarial Liability (UAL)	<ul style="list-style-type: none"> Currently, new experience gains and losses are amortized as a level percent of projected payroll over a fixed amortization period from the rate-setting valuation in which the experience is first recognized. The period is 20 years for Tier 1/Tier 2 experience and 16 years for OPSRP experience. This concept would take a portion of the existing Tier 1/Tier 2 UAL and reamortize it over a longer period: either 24 years (requested in Scenario #1) or 26 years (Scenario #2). The LFO concept requested that the “legacy and inactive” UAL would be the portion reamortized. However, the UAL is not directly attributable in this way – there is no such thing as an “active UAL” or “inactive UAL”, as the system’s assets do not subdivide into such categories. As discussed with PERS, we have illustrated this concept assuming that 70% of the Tier 1/Tier 2 UAL balance is reamortized as of December 31, 2019 (the next rate-setting valuation). The 70% figure approximates the share of the system Accrued Liability attributable to retired and inactive members in recent valuations.
Contributions on Rehired Retiree Member Payroll	<ul style="list-style-type: none"> Under current statute and PERS administrative policy, members who are receiving pension benefit payments may return to work while still receiving their monthly benefit, subject to a limit on annual hours of public employment, which varies by employment tier and is waived under certain circumstances. Employers are not currently required to pay contributions on retired member payroll. We understand the LFO concept would apply full employer contribution rates to retired member payroll, effective January 1, 2020.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

Concept	Description
	<ul style="list-style-type: none"> • We understand projected retired member payroll would still be excluded when calculating future contribution rates during rate-setting valuations. • This analysis projects the additional contributions that may result from such a change, based on projected future employer contribution rates and an estimate of current payroll for rehired retired members provided by PERS. Our analysis does not consider any potential change in the level of such payroll that could result from a policy change (including removing the limit on annual hours worked as a retired member, or a modification of employer and/or member behavior as a consequence of this policy change).

The analysis in this letter primarily focuses on applying the concepts described above and using a 24-year period for the partial Tier 1/Tier 2 reamortization. The results under the alternate approach of using a 26-year period for the reamortization are provided via footnotes in the tables below.

It was requested to provide analyses both for the combined effect of the concepts above, as well as separate individual analyses. However, the combined effects of the individual concepts analyzed in this letter can be viewed the sum of the effects of the individual concepts. This statement holds for the particular concepts analyzed because none of them affect projected future benefits for large segments of the current membership in a manner that materially modifies actuarially calculated contribution rates. As a result, we have shown the effect of each concept individually, and the results can be aggregated for the combined effect.

The consultants who worked on this assignment are pension actuaries. We have not explored any legal issues with respect to these change concepts. Milliman’s advice is not intended to be a substitute for qualified legal or accounting counsel.

SUMMARY OF EFFECT ON ACTUARIAL VALUATION RESULTS AND CONTRIBUTION RATES

Detailed discussion of each component of the combined proposal is provided below in separate sections.

The table below summarizes key December 31, 2017 valuation results for pension benefits prior to reflecting any LFO concept, along with the change in those results from the different concepts described above.

“Accrued Liability” refers to the net present value of projected future benefits allocated to service already completed as of the valuation date in accordance with the current actuarial cost allocation method, while “Total Liability” also includes the value allocated to projected future service for current active members. The contribution rate shown is a blended rate reflecting the weighted averages of Tier 1, Tier 2, and OPSRP payroll as of the valuation date. The base contribution rate is shown on an uncollared basis. Since individual rate components (normal

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

cost rate, UAL rate) under the FAS Limit concept are less than 10 basis points, contribution rates shown in the table for that item are to the nearest 0.01% of payroll. For the remaining concepts, results are to the nearest 0.05%, as shown in our other analysis letters.

The system-wide December 31, 2017 valuation results are shown below.

	12/31/2017 Total Liability (\$B)	12/31/2017 Accrued Liability (\$B)	2019-2021 Uncollared Base Pension Employer Contribution Rates (% of Payroll)		
			Normal Cost	UAL	Total
12/31/2017 Pension Valuation Results	\$92.4	\$84.1	11.60%	17.60%	29.20%
IAP Redirect: 2.5% of Tier 1/Tier 2 and 0.75% of OPSRP for over \$30,000 (as indexed)*	N/A	N/A	(1.00%)	(0.00%)	(1.00%)
FAS Limit of \$195K (as indexed)	(\$0.03)	(\$0.02)	(0.02%)	(0.01%)	(0.03%)
Lower Money Match interest rate to 3.60%**	(\$0.5)	(\$0.5)	(0.00%)	(0.40%)	(0.40%)
Extend portion of Tier 1/Tier 2 UAL amortization to 24 years***	N/A	N/A	(0.00%)	(3.35%)	(3.35%)
Contributions on Rehired Retired Members*	N/A	N/A	(0.00%)	(0.50%)	(0.50%)

* *Effect of contribution-related concepts reflect implementation at 1/1/2020 (6 months into the 2019-2021 biennium). Patterns would change over time as discussed further below. Rates shown for contributions on rehired retired members are estimated rate equivalents on projected salary currently subject to pension contributions and are not anticipated to serve as up-front offsets to employer contribution rates.*

** *Effect of Money Match interest rate change is before consideration of potential changes in retirement behavior. Much of the estimated liability reduction is tied to inactive members, many who may be able to retire prior to the effective date of any change.*

*** *Extended amortization would not affect 2019-21 rates. Illustrative effect as of 2021-23 is shown instead. If the extended amortization period was 26 years, the resulting UAL rate decrease would be 3.85%.*

The concepts of redirecting member IAP contributions, extending the amortization period, and applying contribution rates to rehired retired members can be viewed as financing modifications, as opposed to benefit modifications for the Tier 1, Tier 2, or OPSRP programs. As such, they would not affect the Total Liability or Accrued Liability for the system. (Redirecting member IAP contributions would be a benefit modification to the IAP program, as discussed below.)

The concepts of applying a FAS limit or lowering the Money Match annuitization interest rate are benefit modifications. However, both apply to a subset of non-retired members. The FAS limit would only affect high-paid members with future pay in excess of the limit, as indexed. The Money Match annuitization change would only affect Tier 1/Tier 2 members for whom the Money Match formula under current statutory and administrative procedures provides the largest benefit calculation. This most notably affects inactive members who have not yet retired.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

To the extent a large portion of this group retires prior to the effective date, the actual liability effect would be smaller than illustrated above.

For the concept of charging employer contribution rates on the payroll of rehired retired members, it is not anticipated that any initial offset to rates would occur at the effective date of such a change. Instead, the impact of this change would emerge over time as the additional contributions accumulate and help reduce projected future UAL compared to UAL projections absent those additional contributions. For comparison with the other concepts, amounts shown in the table convert the estimated dollar amount of these additional contributions into a percentage of payroll equivalent, with the rate calculated as a percentage of the payroll currently subject to pension contributions. Please see the separate section on this concept later in this letter for more details.

The 2019-2021 pension employer contribution rates were adopted by the PERS Board based on the December 31, 2017 valuation. Some of the effects of the concepts described above would not be fully evident until the 2021-2023 pension employer contribution rates, which will be based on the December 31, 2019 valuation.

- Our understanding of the proposed changes to the amortization period is that the changes would first be effective with the December 31, 2019 rate-setting actuarial valuation, which calculates proposed 2021-2023 pension employer contribution rates.
- The offset to the employer contribution rate provided by redirecting future member contributions for the 2019-2021 biennium reflects that the change would be in effect for only 18 months of the 24 month biennium. The 2021-2023 biennium would reflect a full period of this change. However, over time the average offset will decline as the Tier 1/Tier 2 payroll shrinks and OPSRP payroll continues to grow. In the long-term this offset will trend toward the 0.75% of payroll amount applicable to OPSRP members (or lower, since that rate only applies to members with pay above \$30,000, as indexed).
- The estimated effect shown above for charging employer contribution rates on rehired retired member payroll for the 2019-2021 biennium reflects that the change would be in effect for only 18 months of that 24 month biennium. This is projected to grow in the 2021-2023 biennium when it would be in effect for the full period.

To reflect these dynamics, the table below shows a preliminary estimate of Uncollared Base Pension Employer Contribution Rates projected as of the December 31, 2019 valuation, along with the initial projected change in the contribution rates from the proposed concepts. For the two benefit modification concepts, the table below just repeats the estimated rate impact shown above. We have not performed a separate analysis of how these effects might change at the December 31, 2019 valuation.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

	2021-2023 Estimated Uncollared Base Pension Employer Contribution Rates (% of Payroll)		
	Normal Cost	UAL	Total
Estimated 12/31/2019 Pension Valuation Results	11.10%	21.20%	32.30%
IAP Redirect: 2.5% of Tier 1/Tier 2 and 0.75% of OPSRP for over \$30,000 (as indexed)	(1.20%)	(0.00%)	(1.20%)
FAS Limit of \$195K (as indexed)*	(0.02%)	(0.01%)	(0.03%)
Lower Money Match interest rate to 3.60%*	(0.00%)	(0.40%)	(0.40%)
Extend portion of Tier 1/Tier 2 UAL amortization to 24 years **	(0.00%)	(3.35%)	(3.35%)
Contributions on Rehired Retired Members***	(0.00%)	(0.80%)	(0.80%)

* Shown with estimated 2019-2021 rate impacts for illustration.

** If the extended amortization period was 26 years, the resulting UAL rate decrease would be 3.85%.

*** Rates shown for contributions on rehired retired members are estimated rate equivalents on projected salary currently subject to pension contributions and are not anticipated to serve as up-front offsets to employer contribution rates.

The preliminary estimate of December 31, 2019 results shown in the table above is based on actual investment experience for 2018, and on the assumption that all other demographic and economic experience in 2018 and 2019 follows current Board-adopted assumptions, including an actual investment return of +7.20% for 2019. In addition, it reflects the current Board-selected assumed rate of 7.20% as the assumed rate for the December 31, 2019 valuation. The PERS Board is scheduled to select an assumed rate for the December 31, 2018 and December 31, 2019 actuarial valuations in July 2019, and the selected rate could differ from the current assumed rate of 7.20%. If the assumed rate is reduced, the projected contribution rates for 2021-2023 would increase.

Further detail on our analysis and our understanding of the application of these concepts is provided separately for each concept below.

REDIRECT MEMBER CONTRIBUTIONS

Our analysis is based upon our understanding of the concept as informed by discussions with PERS staff. Based on these discussions, our analysis assumes member contributions as described above would be prospectively redirected to help fund Tier 1, Tier 2 and OPSRP benefits. These redirected contributions would not add to the Money Match-eligible account balance for Tier 1 and Tier 2 members. For estimating financial impact, we assumed redirected contributions would commence January 2020. We also understand the exemption for members with salary below \$30,000 (as indexed) would apply as described below.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

The policy of redirecting part of the member contribution to the IAP to help fund Tier 1, Tier 2 and OPSRP benefits can be considered a financing modification for Tier 1, Tier 2 and OPSRP and a benefit modification for the IAP. Other than refunds of the redirected member contributions that may be provided for members that leave employment prior to satisfying system vesting requirements, such a policy does not change the projected benefits paid under Tier 1, Tier 2 and OPSRP but rather adds an additional source of contributions used to help fund those benefits. Such a policy change would modify IAP benefits since future contributions to the IAP (for members with pay in excess of the threshold) would be 3.5% of pay for Tier 1 and Tier 2 members and 5.25% of pay for OPSRP members, rather than the current 6.0% of pay. This would lower the account balance members are projected to accumulate in the IAP. A simplified illustration of this is provided below in the section titled "Effect on IAP accounts".

For OPSRP members, we have not analyzed any liability that would occur if such member contributions were eligible to be refunded in the event a member terminated prior to vesting in the System. The actual cost of such a provision would depend on specific plan design features, particularly the level of interest crediting, if any, on refunded contributions for non-vested members. While not analyzed, the projected annual cost of a refund of non-vested member contribution feature would be a minor fraction of 0.75% of OPSRP payroll.

In order to incorporate a rough estimate of how the \$30,000 indexed threshold would affect results, we reviewed the amount of projected 2018 payroll from the December 31, 2017 actuarial valuation attributable to members with pay below \$30,000. For Tier 1 and Tier 2, those members represented about 3% of overall Tier 1 and Tier 2 pay. For OPSRP, it represented about 9%-10% of overall OPSRP pay. As a result, we applied a 3% reduction to initial contribution amounts for Tier 1/Tier 2 members and a 10% reduction for initial contribution amounts for OPSRP members in our analysis. This is only a rough estimate of the actual effect that might occur, which would depend on details regarding the administrative application, method of indexing, and other factors.

While a relatively small proportion of system payroll is attributable to pay below this level, implementing such a cliff threshold would present several challenges, including:

- It would not be known whether or not a member will ultimately exceed the threshold for the year at the time amounts are paid for early pay periods. As a result, it would not be clear whether or not the relevant percentage of member contribution should be redirected. We understand a monthly approach might be used to try to address this, but that can present separate issues. (A member could earn over \$30,000 and subsequently have a low pay month – would the intent be to exempt that pay period from the redirect?)
- The cliff aspect of the threshold provides for starkly different financial outcomes for members just above or below the cut-off. This could produce an incentive for pay levels near the threshold to be managed to remain below.
- Members with some optionality in how they are paid (e.g. school employees who may be given a choice between being paid over the school year or over a 12 month period) could lead to varying results for otherwise similarly situation individuals if the monthly approach is used.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

Effect of Redirecting Member IAP Contributions

For members with pay above the threshold, the offset to the employer contribution rate provided by redirecting future member contributions represents 2.5% of payroll for the Tier 1/ Tier 2 population and 0.75% of OPSRP payroll. The estimated dollar amount of redirected contributions can be calculated for each biennium and converted to a percentage of system-wide payroll that would offset the contribution otherwise paid by employers under this concept. Tier 1/Tier 2 is a closed group and the group's payroll is expected to decline over time. As a result, while the average system-wide offset provided by the redirected member contributions starts as a blend of the 2.5% Tier 1/Tier 2 amount and the 0.75% OPSRP amount, over time the average will trend to a bit below 0.75% of overall PERS payroll, given the exemption for pay below the threshold. The estimated impact by biennium using the most recently adopted actuarial valuation assumptions is shown in the following table.

Employer Rate Offset as a Percent of Total Subject Salary Provided by Redirecting 2.5% of Tier 1/Tier 2 Payroll and 0.75% of OPSRP Payroll for Members Over \$30,000 Threshold Starting January 2020			
	From Tier 1/Tier 2	From OPSRP*	Total
2019-2021	0.7%	0.3%	1.0%
2021-2023	0.7%	0.5%	1.2%
2023-2025	0.6%	0.5%	1.1%
2025-2027	0.5%	0.5%	1.0%
2027-2029	0.3%	0.6%	0.9%
2029-2031	0.3%	0.6%	0.9%

*Redirection is shown prior to any estimated effects of a return of member contributions for OPSRP members who fail to satisfy minimum vesting requirements. Estimating any such effects would require an articulated policy regarding interest crediting on returned member contributions for members who leave PERS-covered employment prior to satisfying OPSRP vesting requirements. The cost would be a minor fraction of 0.75% of OPSRP payroll.

The 2019-2021 impact is lower than the 2021-2023 impact because the assumed implementation date falls 6 months into the 2019-2021 biennium. The system-average estimates are sensitive to the actual rates of retirement and termination for Tier 1/Tier 2 members and employer hiring and salary practices.

This analysis assumes that total system payroll grows at the valuation assumption of 3.5% per year, and that the share of Tier 1/Tier 2 payroll declines as projected by the actuarial valuation's employee turnover assumptions. The projected system payroll for each biennium is shown below.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

Projected System Payroll – Subject Salary (\$Billions)			
	Tier 1/Tier 2	OPSRP	Total
2019-2021	\$7.6	\$14.0	\$21.6
2021-2023	\$6.8	\$16.4	\$23.2
2023-2025	\$5.9	\$18.9	\$24.8
2025-2027	\$5.0	\$21.6	\$26.6
2027-2029	\$4.1	\$24.4	\$28.5
2029-2031	\$3.2	\$27.3	\$30.5

Another way to illustrate the effect of redirecting future member contributions is to consider the present value of the future employee contributions that would help fund the Tier 1/Tier 2 and OPSRP benefits under such a concept. At the December 31, 2017 valuation, considering only active members of the system at that date and assuming that contributions were redirected beginning in 2020 for members with salary over \$30,000, the present value as of December 31, 2017 of the redirected 2.5% member contributions for Tier 1/Tier 2 members is approximately \$0.5 billion. The present value of the redirected 0.75% for OPSRP members as of December 31, 2017 is approximately \$0.3 billion. The present value of redirected contributions for OPSRP members who join PERS after 2017 is not included in the above amounts. As a result, if this IAP redirect concept took effect starting in 2020, the present value of the redirected contributions as of December 31, 2017 would be \$0.8 billion. For reference, the system's unfunded actuarial liability, excluding side accounts, for pension benefits as of December 31, 2017 was \$22.3 billion.

Effect on IAP Accounts

As requested, we also prepared hypothetical examples of how the redirection of a portion of the member contribution may affect a member's IAP account balance at retirement. These illustrations are simplified, but are meant to show a representative magnitude of the anticipated average effect for members at different points in a full working career. We have prepared illustrations for three different examples:

- **Tier 1 example:** Joined 1/1/1995 and has earned 25 years of service as of 1/1/2020. Member first contributed to IAP as of 1/1/2004 (when program was created after 2003 reforms). Member will retire 1/1/2025. How much lower would retirement IAP balance be if 2.5% of member contribution is redirected for final five years of working career (1/1/2020 to 12/31/2024)?
- **Tier 2 example:** Joined 1/1/2000 and has earned 20 years of service as of 1/1/2020. Member first contributed to IAP as of 1/1/2004 (when program was created after 2003 reforms). Member will retire 1/1/2030. How much lower would retirement IAP balance be if 2.5% of member contribution is redirected for final ten years of working career (1/1/2020 to 12/31/2029)?

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

- **OPSRP example:** Joined 1/1/2010 and has earned 10 years of service as of 1/1/2020. Member contributed to IAP immediately (since joined system after 2003 reforms). Member will retire 1/1/2040. How much lower would retirement IAP balance be if 0.75% of member contribution is redirected for final twenty years of working career (1/1/2020 to 12/31/2039)?

For all illustrations, we have assumed participants earn 7.0% annual investment return on their IAP accounts during the working career, have pay increases of 4.0% per year, and have pay above the \$30,000 threshold.

The percentage reduction in the projected IAP balance at retirement for each example is shown in the table below. The reduction in projected retirement IAP balance is smaller (in percentage terms) for the Tier 1 illustrative member than the Tier 2 illustrative member because there are fewer years for the redirected contributions to have an effect. The effect on the Tier 2 illustration is greater than OPSRP illustration, as the Tier 2 example has a larger amount of the contribution redirected, while the OPSRP member has a smaller amount redirected.

Example	Illustrative Reduction in IAP Balance at Retirement
Tier 1 (2.5% redirect for final 5 years)	(7.8%)
Tier 2 (2.5% redirect for final 10 years)	(12.5%)
OPSRP (0.75% redirect for final 20 years)	(7.1%)

FINAL AVERAGE SALARY LIMIT

We understand the proposed \$195,000 limit on FAS would apply prospectively (i.e., only for benefits associated with service performed after 2019), would be indexed over time, and would affect both Tier 1/Tier 2 members and OPSRP pension members.

Specifically, we understand the Final Average Salary used in the benefit calculations for service performed before January 1, 2020 would be unaffected by the limit, and would also reflect post-2019 salary growth, if applicable.

- For example, if an OPSRP general service member retires with a FAS of \$220,000 prior to application of this concept's indexed limit, has 15 years of service prior to January 1, 2020, and 10 years of service after that date, we understand the initial benefit calculation (prior to any adjustment for early commencement or form of payment) would be:

$$[1.5\% \times 15 \times \$220,000] + [1.5\% \times 10 \times (\text{Lesser of } \$220,000 \text{ or Indexed Limit})]$$

Tier 2 and OPSRP pension participants are already subject to a limit on the amount of annual salary in any year that may be reflected in the FAS calculation. This limit is consistent with the level prescribed in Internal Revenue Code Section 401(a)(17), which is \$280,000 in 2019 and

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

indexed with inflation in future years. Tier 1 members currently do not have any limit on the annual salary reflected in the FAS calculation. We understand the proposed indexed limit would be applied to the calculated FAS, not to the annual salary amounts used in the FAS calculation.

The effect of prospectively introducing a lower limit will be to reduce projected future benefits (and associated liabilities) for the small minority of Tier 1, Tier 2, and OPSRP members with future salary over the selected indexed limit. This limitation would not affect the benefits or liabilities for members whose benefit is determined by the Money Match calculation.

Our analysis assumed that employer contribution rates would continue to apply to all subject salary, including salary in excess of the indexed limit.

The relatively small magnitude of the changes to liabilities and contributions rates from the FAS limitation concept reflects the fact that a small percentage of members actually have salary levels in excess of the indexed limit, and that applying such a limit prospectively affects only a portion of those members' projected benefits. That portion is smaller for older, longer-service members, who tend to make up a disproportionate share of the members with pay over any level of FAS limit.

The percentage of active members by tier as of the December 31, 2017 actuarial valuation who are projected to have 2018 salary in excess of the proposed initial limit of \$195,000 are shown below:

Percentage of 12/31/2017 active members with projected 2018 salary exceeding \$195,000	
Tier 1	0.8%
Tier 2	0.3%
OPSRP	0.2%

MONEY MATCH ANNUITIZATION INTEREST RATE

The Money Match benefit formula calculation for Tier 1/Tier 2 members annuitizes the member account balance plus the matching employer amount. The annuitization calculation uses the system's actuarial life expectancy tables and an annuitization interest rate.

For a given account balance to annuitize, using a lower annuitization interest rate provides a smaller initial monthly benefit, all else equal. Mathematically, the conversion from account balance to monthly annuity is accomplished by assuming the member lives to life expectancy (using unisex factors) while receiving level monthly payments and that the undistributed portion of the account balance increases with the annuitization interest rate due to assumed future investment returns. Please note the emphasis on the word "level" in the prior sentence, as the annuitization calculation for Money Match retirees has historically been performed without

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

regard to future cost of living allowance (COLA) increases. This means that account balances are annuitized to provide a lifetime annuity without COLA, and then employer contribution rates are calculated in a way to provide 100% employer funding of the COLA increase on the calculated annuity benefits, as directed by PERS's administrative interpretation of statute.

Currently the interest rate used for the annuitization calculation is the same as the Board-adopted assumed rate. For retirements in 2019, this rate is currently 7.20% and was adopted by the Board in July 2017. (The assumed rate will be reviewed in 2019 and any adopted rate change would be effective for retirements in 2020 and 2021.) We understand the concept under discussion would require the interest rate for the annuitization calculation be set at half of the Board's assumed rate, possibly with some type of minimum or "floor" rate (whether tied to a published index or a fixed number). For our analysis, we illustrate the effect of using a 3.60% annuitization interest rate.

For reference, we provided an analysis of a similar concept in a letter dated October 28, 2016, which illustrated a 3.50% annuitization rate. While several aspects of the analysis have changed since that time (including the level of the assumed rate), a comparison to the prior analysis illustrates the diminishing impact of such a change over time due to changes in the demographics of not-yet-retired Tier 1 and Tier 2 members. The prior analysis, which assumed the lower annuitization rate would apply to retirements beginning in 2018, reduced Total Liability by \$0.9 billion. As shown in the table above, our current analysis shows a Total Liability reduction of \$0.5 billion, approximately 60% of the effect from the prior analysis. This is largely due to the passage of two years between the effective dates of the annuitization change in the two studies. Because the share of active members whose future retirement benefits are projected to be determined by the Money Match formula is declining, a change in the Money Match annuitization factors has a diminishing impact over time.

The table below shows the percentage decrease in the factors of a single life annuity retirement for non-disabled Tier 1 / Tier 2 members at two sample retirement ages.

	<u>Change to Money Match Benefit Factor*</u>	
	<u>Age 55 Retirement</u>	<u>Age 65 Retirement</u>
3.60% Annuitization Rate	-33.8%	-28.5%

**Based on mortality assumption in effect for 2018-2019 retirements*

Tier 1/Tier 2 members have benefits calculated under both Money Match and Full Formula, and get the larger of the two calculated benefits. (Members eligible for a benefit calculated under Formula Plus Annuity have a comparison of three benefit formulas.) Of members currently projected to have their benefit determined by Money Match, some would continue to be projected as Money Match retirements when valued under the lower annuitization rate while others would be projected to retire under Full Formula after reflecting the lower rate. For the first group of members, the changes shown above for the Money Match benefit factor are representative of the anticipated changes in their initial benefits. For the second group of members, the changes would be less than shown above because the Full Formula calculation,

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

which is unaffected by an annuitization rate change, would serve as a floor limiting the decrease in the initial benefit amount.

The combined impact of these two outcomes would be to reduce projected benefits for some members and to accelerate the system's continuing transition towards Full Formula serving as the dominant Tier 1/Tier 2 benefit formula. This reduces both the Accrued Liability and Normal Cost determined under the actuarial cost method.

Of the \$0.5 billion reduction in Accrued Liability estimated for this concept, approximately \$0.4 billion is attributable to the effect of the change on inactive members. Inactive members no longer work in PERS-covered employment but have not yet commenced receipt of benefits. Many of these members, particularly those with the highest individual liabilities, may be eligible to retire immediately. A change to the Money Match annuitization rate that lowered projected benefits may cause inactive members who otherwise would have deferred retirement to accelerate their retirement to before the effective date of the change. This could significantly limit the actual liability reduction associated with a change in provisions and **lead to a materially smaller effect than shown above.**

EXTEND AMORTIZATION FOR A PORTION OF TIER 1/TIER 2 UAL

Milliman recently provided an analysis of several requested alternative amortization methods in a letter dated April 18, 2019. Please see that letter for additional information regarding the effect of lengthening the amortization period and the context surrounding such a policy decision.

The current proposed LFO concept was worded to imply that the reamortization would occur only for UAL associated with retired and inactive members. However, the UAL cannot be actuarially subdivided into that sort of active versus retired split because assets are not separated and tracked by member status. In other words, contributions and earnings on those contributions are pooled and are not separately ascribed to active, inactive, and retired members.

As a result, for the purpose of this study we interpreted the request to be equivalent to reamortizing 70% of the projected remaining Tier 1/Tier 2 UAL as of December 31, 2019. This portion of the UAL would be reamortized over a 24 year period, or alternatively, over a 26 year period. The remaining 30% of Tier 1/Tier 2 UAL would continue to be amortized according to the current schedules, and future experience gains and losses in subsequent biennia would be amortized over closed 20 year periods.

Current Amortization Policy

The current policy of the PERS Board is to amortize all unanticipated changes in UAL that occur during a two-year period between rate-setting actuarial valuations. The amortization of the unanticipated UAL changes is over a fixed period. Unanticipated changes in UAL can occur from a variety of sources. Those sources include actual investment or demographic experience differing from actuarial assumptions, changes in the assumptions and/or methods used in the

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

valuation, and changes in projected benefits via legislative and/or judicial actions. Currently, the fixed amortization period is 20 years for Tier 1/Tier 2 experience and 16 years for OPSRP experience. Since rates are set biennially, every two years a new biennial experience “amortization base” is established. Effective December 31, 2013, the remaining balances of all Tier 1/Tier 2 amortization bases were combined and reamortized over 20 years.

When a new amortization base is established as part of a rate-setting valuation, a first year amortization payment is calculated based on the size of the base, the length of the amortization period, and the system payroll growth and investment return assumptions. That payment is then combined with calculated payments for prior amortization bases to develop a total UAL amortization payment for the year. Dividing the total payment by the expected applicable payroll for the coming year results in the uncollared UAL rate.

An amortization approach that uses fixed periods and establishes multiple amortization bases is referred to as a “fixed”, “layered”, or “closed” amortization method. This contrasts with an “open” or “rolling” amortization method, where a first year payment is recalculated each rate period for the entire UAL as of the calculation date. If the amortization period of an open method calculation is set too high, the UAL would continue to grow in perpetuity even in the event that actual future experience matches all the actuarial valuation’s assumptions and all contributions are made in accordance with the funding policy.

For PERS, amortization payments for each UAL amortization base are calculated using a “level percent of payroll” amortization method based on the expected growth in annual system payroll, currently assumed to be 3.5% per year. Most large public pension systems with actuarially calculated contribution rates use a level percent of payroll amortization approach. A budgeting advantage for employers of this approach is that the annual amortization payment associated with each amortization base remains level as a percent of payroll throughout the amortization period as long as payroll grows at the assumed rate. This contrasts with a “level dollar” amortization method, in which the annual amortization payment remains constant in dollar terms over the amortization period. Assuming payroll increases during the amortization period, a level dollar amortization payment becomes smaller as a percentage of payroll as the payoff period progresses.

For Oregon PERS, any new UAL amortization base established is set to the selected amortization period for the given benefit program (Tier 1/Tier 2, OPSRP, RHIA, RHIPA), regardless of the nature of the event that gave rise to the base. This contrasts to the practice of some systems, which may vary the length of the amortization period according to the source or magnitude of the amortization base. An amortization base arising from a method or assumption change, for example, might be amortized over a different number of years than an amortization base arising from gains or losses on demographic or investment experience.

Under the current policy, layers of gain and/or loss amortizations accumulate over time as previous experience is amortized and new experience emerges. As of the December 31, 2017 actuarial valuation, the resulting schedule amortized different portions of the Tier 1/Tier 2 UAL

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

over 16, 18, and 20 year periods. For OPSRP, the schedule amortized portions of the UAL are over 6, 8, 10, 12, 14, and 16 year periods.

As part of its regular biennial review of actuarial methods and assumptions, the PERS Board could choose to change the current amortization policy. Alternatives could include lengthening or shortening amortization periods, employing a “rolling” amortization method rather than a “fixed” method, using a level dollar instead of a level percent of payroll approach, or introducing varying amortization periods based on the source or magnitude of the unanticipated UAL change.

Amortization Policy and Rate Collar

The changes in contribution rates for alternative amortization methods discussed in this letter affect the uncollared UAL contribution rate. Under the current PERS contribution rate calculation policy, a “rate collar” limits the magnitude of changes in contribution rates, systematically spreading large changes in actuarially calculated contribution rates over several biennia. The contribution rate in effect for a biennium after applying the rate collar is known as the “collared” contribution rate.

The system-average uncollared 2019-2021 Tier 1/Tier 2 contribution rate from the December 31, 2017 actuarial valuation was 3.99% of payroll higher than the collared 2019-2021 Tier 1/Tier 2 contribution rate adopted by the PERS Board. If actual future experience is near assumption, the collared Tier 1/Tier 2 contribution rate is expected to increase significantly for the 2021-2023 biennium. Reflecting the effects of both this continued anticipated collared increase and the published OPERF investment return of +0.48% in 2018, we currently project that if the 2019 investment return meets the assumption of +7.20%, the system-average collared base rate will increase by 6.59% of payroll for the 2021-2023 biennium. That increase would leave about a 0.50% of payroll difference between 2021-2023 uncollared and collared rates.

Because the uncollared Tier 1/Tier 2 rate is higher than the collared rate, a change in amortization period may lower the uncollared rate but have a lesser impact or no impact at all on the collared rate (the rate employers actually pay) in the near term. For example, a reduction in the uncollared 2021-2023 rate such as the 3.35% of payroll shown above if 70% of the Tier 1/Tier 2 UAL was reamortized over 24 years would first eliminate the projected difference between the system average 2021-2023 uncollared and collared rates of approximately 0.50% of payroll as a system average. As a result, the reduction in the system average 2021-2023 collared rate is projected to be approximately 2.85% of payroll. However, please note that the rate collar calculation occurs separately for each rate pool and so the effect for individual employers will differ from the system average.

Deterministic (Steady Return) Modeling and Effect of Proposals on Financial Projections

The attached exhibits show system-wide results from deterministic (steady return) projections, assuming future actual investment returns are +7.20% each year or +5.00% each year. The exhibits compare the system average employer collared base pension rates, system average

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

funded status (excluding and including side accounts), and unfunded actuarial liability under the alternative amortization methods discussed in this letter.

The UAL excluding side accounts is estimated to be \$26.6 billion as of the end of 2018. As noted by the first graph in Exhibit IV, under current amortization policy the UAL is projected to be fully amortized (i.e., reach \$0) by the end of 2035 if actual future investment return is equal to +7.20% annually. Under the alternative amortization policies we analyzed, in the at-assumption scenario for actual future investment return the UAL would only decrease by around one-half during that seventeen year period. As noted by the second graph in Exhibit IV, if actual future investment return is only equal to +5.00% annually, under current amortization policy the UAL is projected to decrease by several billion dollars between now and 2035. Under the alternative amortization policies we analyzed, in that below-assumption scenario for actual future investment return, the UAL materially increases during the seventeen year period. It would go up between \$7 billion and \$10 billion depending on the policy alternative modeled.

CONTRIBUTIONS ON REHIRED RETIRED MEMBER PAYROLL

PERS allows members who are receiving pension benefit payments to return to work with PERS-participating employers as “active members” or as “retired members”. Participants returning to work as retired members are subject to a limit on annual hours of public employment, which varies by employment tier and is waived under certain circumstances. If returning as an active member, pension benefit payments stop and the member starts accruing additional benefits. If returning as a retired member, pension benefit payments continue and the member does not accrue additional benefits. Under current PERS policy, employers are not required to pay contributions on retired member payroll.

We understand the proposal currently under consideration would eliminate the exemption on employers paying contributions on retired member payroll. (We understand some related proposals would also eliminate the limit on annual hours of public employment for retired members, but that is not contemplated in our analysis.) Based on input from PERS, we understand that retired member payroll would still be excluded from the payroll considered when calculating an employer’s (or rate pool’s) contribution rate under the legislative proposal. In other words, the payroll used to calculate contribution rates (which would exclude retired member payroll) would be smaller than the payroll to which those rates are applied (which would include retired member payroll). As a result, the amount of money actually contributed by an employer would consistently be larger than was contemplated when the actuarially determined contribution rate was calculated, all else being equal. The resulting additional contributions on retired payroll would be applied towards reducing the employer’s (or rate pool’s) unfunded liabilities (or increasing the funding surplus, if applicable).

Key data, methods, assumptions, and plan provisions for analyzing this concept include:

- Published OPERF calendar year 2018 investment returns of +0.48% are reflected. Future investment returns are projected at 7.2% annually.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

- Retired member payroll is assumed to grow at 3.5% annually, starting from published calendar year 2017 values of \$270.6 million for Tier 1/Tier 2 and \$3.8 million for OPSRP.
- The proposed policy change is assumed to take effect on January 1, 2020.
- Calculations are performed on a system-average basis for Tier 1/Tier 2 and OPSRP.
- Projected future contribution rates in this analysis reflect current policies and plan provisions, and do not incorporate any changes for other concepts presented in this letter.

Key results from a deterministic projection reflecting the legislative proposal are presented below, along with a comparison to results from a “baseline” projection reflecting current PERS contribution policy.

The following table shows projected retired member payroll and contributions under the proposal on a biennial basis throughout the period modeled. Note that the average contribution rates for retired member payroll are higher than the system-average contribution rates shown elsewhere in this section. This is because retired member payroll is heavily weighted towards Tier 1/Tier 2 members with higher contribution rates, while system-wide payroll is weighted more towards OPSRP members with comparatively lower contribution rates.

Projected Rehired Retiree Biennial Payroll and Base Contributions (\$Millions)										
Biennium	2017-19	2019-21	2021-23	2023-25	2025-27	2027-29	2029-31	2031-33	2033-35	2035-37
Payroll	\$568.2	\$608.7	\$652.0	\$698.5	\$748.2	\$801.5	\$858.6	\$919.7	\$985.2	\$1,055.4
Contributions	\$0.0	\$106.8	\$184.4	\$208.4	\$223.3	\$243.5	\$296.3	\$321.1	\$338.0	\$320.0

In order to provide a comparison of this concept to others discussed in this letter, we converted the estimated projected contributions above into estimated rate equivalents based on projected salary currently subject to pension contributions, as shown in the table below.

Estimated Rate Equivalent of Projected Rehired Retiree Contributions (\$Millions)										
Biennium	2017-19	2019-21	2021-23	2023-25	2025-27	2027-29	2029-31	2031-33	2033-35	2035-37
Contributions	\$0.0	\$106.8	\$184.4	\$208.4	\$223.3	\$243.5	\$296.3	\$321.1	\$338.0	\$320.0
Biennial Payroll*	\$20,200	\$21,600	\$23,200	\$24,800	\$26,600	\$28,500	\$30,500	\$32,700	\$35,000	\$37,500
Rate Equivalent	0.0%	0.5%	0.8%	0.8%	0.8%	0.9%	1.0%	1.0%	1.0%	0.9%

* Projected biennial payroll currently subject to pension contributions (i.e. excluding projected payroll for rehired retired members).

The following table shows projected system-average collared “base” pension contribution rates on active member payroll. Collared base pension rates exclude the effect of side account rate offsets, pre-SLGRP liability (or surplus) rates, contributions to the RHIA and RHIPA programs,

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

contributions to the IAP, and payments for debt service on pension obligation bonds issued by certain employers.

The policy change would not impact actuarially determined contribution rates until the 2023-2025 biennium due to the 18-month lag between the actuarial valuation date as of which contribution rates are calculated and the start-of-biennium date on which the rates come into effect. Since the policy change is assumed to take effect on January 1, 2020, the December 31, 2021 actuarial valuation would be the first rate-setting actuarial valuation with results that reflect the financial effects of contributions paid by employers on retired member payroll, meaning the contribution rates effective July 1, 2023 would be the first ones affected by the policy change.

System-Wide Average Collared Base Pension Contribution Rates on Active Member Payroll											
Biennium	2017-19	2019-21	2021-23	2023-25	2025-27	2027-29	2029-31	2031-33	2033-35	2035-37	2037-39
Baseline	20.85%	25.23%	31.82%	32.52%	32.21%	31.60%	31.13%	30.37%	29.37%	22.52%	12.67%
New policy	20.85%	25.23%	31.82%	32.40%	31.93%	31.14%	30.51%	29.58%	28.43%	21.42%	11.58%
Impact	0.00%	0.00%	0.00%	(0.12%)	(0.28%)	(0.46%)	(0.62%)	(0.79%)	(0.94%)	(1.10%)	(1.09%)

Limitations

Projections were performed on a system-average basis for Tier 1/Tier 2 and OPSRP, and all results shown in this letter are on a system-average basis. In general, no employer actually pays the system-average rate. Instead, an employer’s individual contribution rate is determined based on its specific Tier 1/Tier 2 rate pool status (SLGRP, School District, or independent employer) and its payroll mix, among other factors. Similarly, the extent to which any individual employer would be affected by the proposed policy change would vary based on the employer’s rate pooling arrangement and payroll mix. In particular, the extent to which an individual employer relies on retired members as part of its workforce would greatly influence the extent to which the employer is impacted by the policy change.

This study does not reflect any potential changes in retired member payroll that might result from changes in employer staffing decisions regarding the rehiring of retired members. For example, requiring contributions on retired member payroll would increase the cost to employers of re-employing retired members, possibly leading to a decrease in the number of retired members that employers choose to rehire in the future. Alternatively, if the cap on annual hours of public employment for retired members was eliminated, it might result in employers increasing the amount of work assigned to retired members, resulting in an increase in retired member payroll.

While we would expect any potential decrease (or increase) in future retiree payroll resulting from the policy change to be largely offset by a corresponding increase (or decrease) in active member payroll, there would still be some impact on projected results due to different ways that retired member payroll and active member payroll are treated under the proposed policy. Since retired member payroll is excluded from the payroll used to calculate contribution rates but not the payroll to which contribution rates are applied, the policy in some sense results in extra “unanticipated”

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

contributions to amortize the system UAL. If payroll were to shift away from retired members and more toward active members as a result of the policy change, then the amount of “unanticipated” contributions on retired payroll would be less than projected in this analysis. However, such a shift from retired members to active members would increase the valuation payroll for active members used to calculate contribution rates. All else equal, that would lower contribution rates on active member payroll as amortization contributions are spread over a larger active member payroll base.

This study does not include a stochastic projection or any deterministic projections at alternative interest rates or alternative levels of actual future investment return. We could provide such additional analysis if requested, but we do not anticipate that either of these approaches would significantly alter or expand upon the conclusions presented in this letter. Given that we are not lawyers and Milliman is not a law firm, this letter does not provide an opinion on any potential issues related to compliance with federal regulations if the limit on annual hours of public employment of retired members is eliminated.

Further, due to the limited scope of this analysis, we have not modeled any potential UAL effect of members modifying their retirement patterns in response to this proposal. An example of a potential effect, the UAL could decrease if a material number of members who are eligible for immediate unreduced retirement choose to retire later than they otherwise would in response to this concept’s enactment.

DATA, METHODS, ASSUMPTIONS AND PROVISIONS

Other than the exceptions and additions discussed in this letter, the data, methods, assumptions, and plan provisions used to calculate employer contribution rates are the same as those used in the December 31, 2017 System-wide Actuarial Valuation Report, published on September 28, 2018, and in our December 7, 2018 and February 1, 2019 presentations to the PERS Board. That information, including a discussion of the inherent limitations of use of actuarial valuation results, is herein incorporated to this letter by reference.

ACTUARIAL BASIS AND QUALIFICATIONS

In preparing this letter and the valuation report on which it is based, we relied, without audit, on information (some oral and some in writing) supplied by Oregon PERS. This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. These estimates depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of the System and reasonable expectations); and which, in combination, offer a reasonable estimate of anticipated experience affecting the System.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

Future actuarial measurements may differ significantly from the current measurements presented in this estimate due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, additional cost or contribution requirements based on the plan's funded status, or a change in the cost allocation method); and changes in plan provisions or applicable law. Due to the limited scope of this estimate, we did not perform an analysis of the potential range of future measurements. The Oregon PERS Board has the final decision regarding the valuation assumptions and adopted the assumptions used in the December 31, 2017 valuation in July 2017.

Actuarial computations presented in this estimate are for purposes of providing a high-level analysis of the requested policy scenarios to the System. As such, they cannot be relied upon for financial reporting or other purposes, and calculations for purposes other than this use may be significantly different from the estimates contained in this letter. Accordingly, additional determinations may be needed for other purposes.

Milliman's work is prepared solely for the use of Oregon PERS. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are pension actuaries. We have not explored any legal issues with respect to the scenarios modeled. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

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

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

If you have any questions about our response or need any additional information, please let us know.

Sincerely,



Matt Larrabee, FSA, EA, MAAA
Principal and Consulting Actuary



Scott D. Preppernau, FSA, EA, MAAA
Principal and Consulting Actuary

MRL:sdp

cc: Debra Hembree, Marjorie Taylor

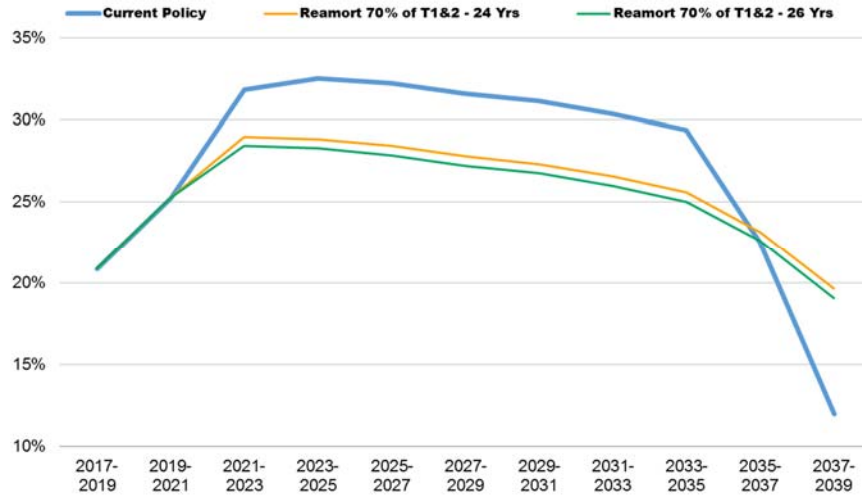
Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

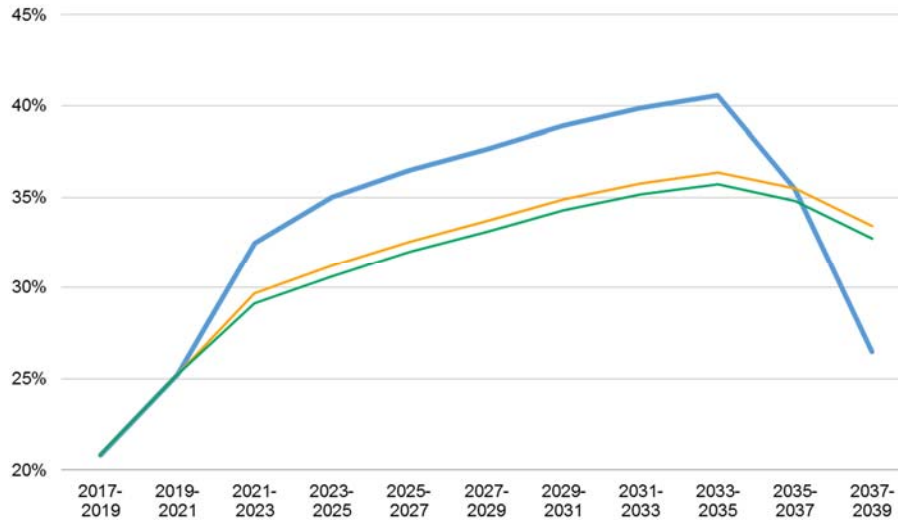
Analysis of Legislative Fiscal Office Concepts:
Effect of Reamortization First Effective with 2021-2023 Rates

System Average Employer Collared Base Pension Rates

+7.20% Actual Annual Future Return



+5.00% Actual Annual Future Return



Rates shown exclude contributions for IAP, RHIA and RHIPA benefits, rate offsets for employer side accounts, and the cost of debt payments on employer pension obligation bonds.

This analysis reflects the current Board-selected assumed rate of 7.2% throughout the projection period.

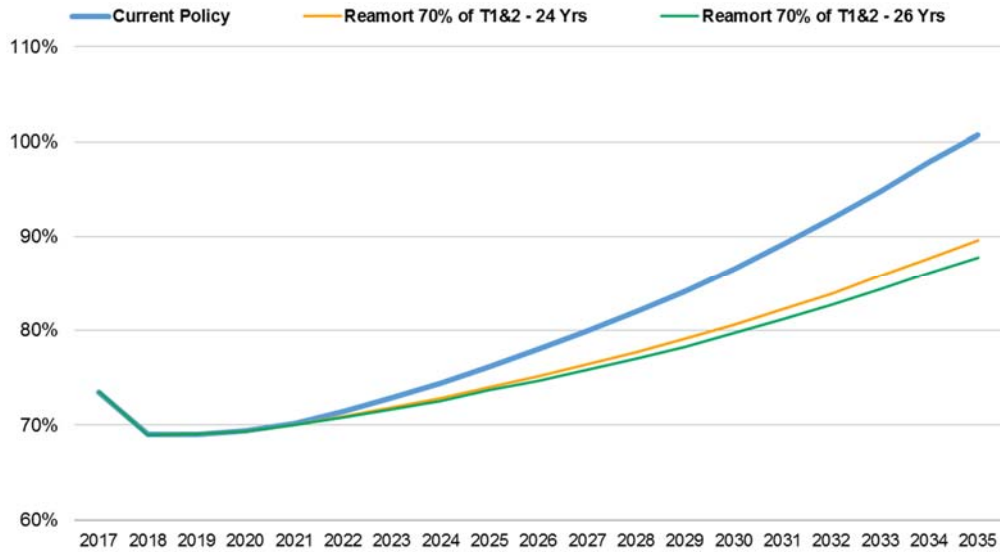
Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

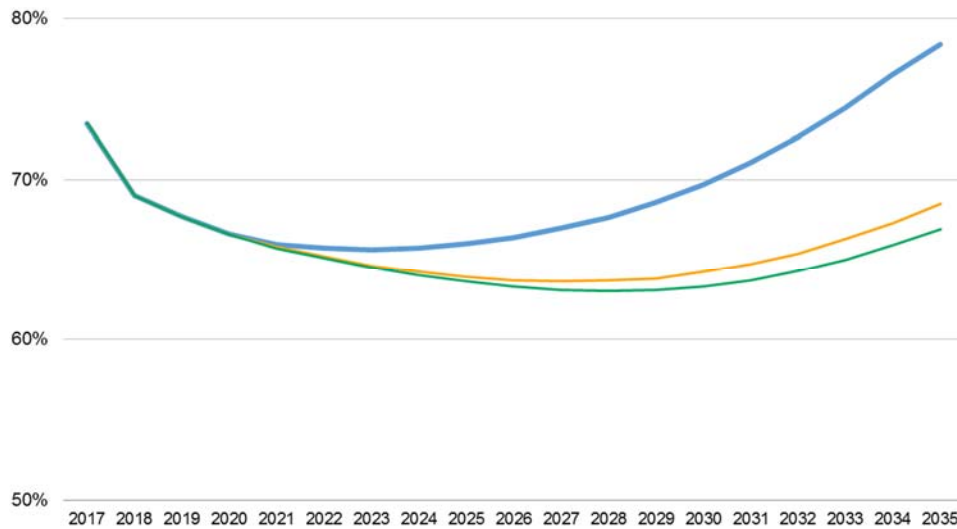
Analysis of Legislative Fiscal Office Concepts:
Effect of Reamortization First Effective with 2021-2023 Rates

System Average Funded Status (Excluding Side Accounts)

+7.20% Actual Annual Future Return



+5.00% Actual Annual Future Return



This analysis reflects the current Board-selected assumed rate of 7.2% throughout the projection period.

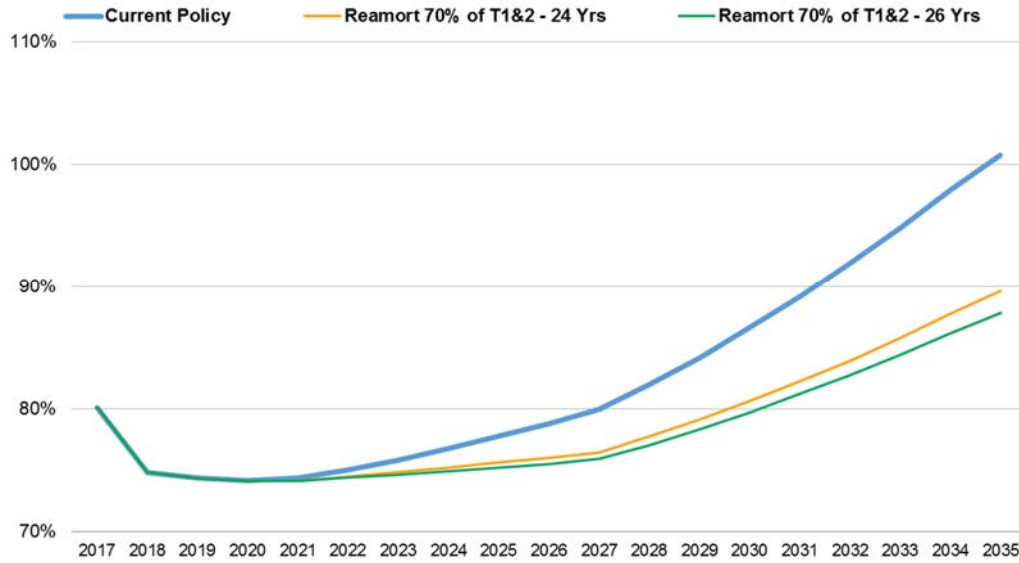
Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

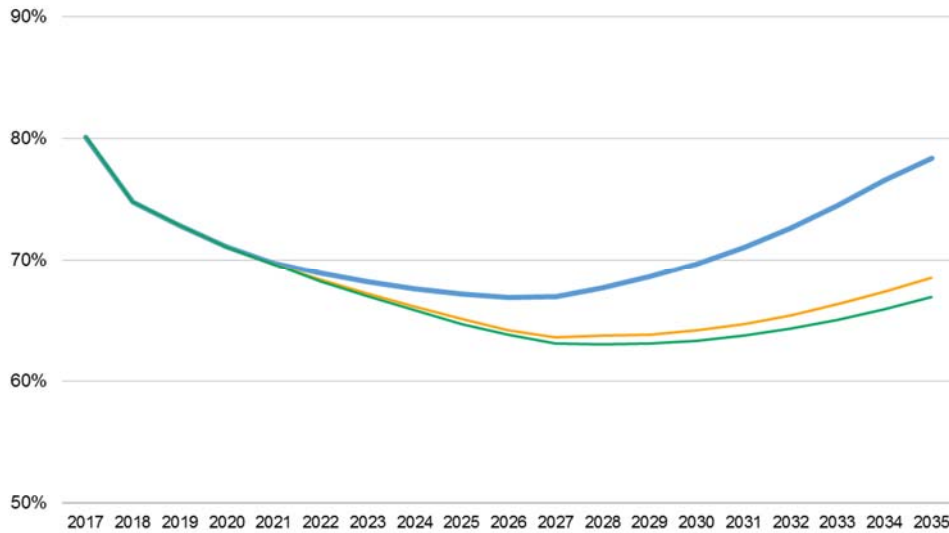
Analysis of Legislative Fiscal Office Concepts:
Effect of Reamortization First Effective with 2021-2023 Rates

System Average Funded Status (Including Side Accounts)

+7.20% Actual Annual Future Return



+5.00% Actual Annual Future Return



This analysis reflects the current Board-selected assumed rate of 7.2% throughout the projection period.

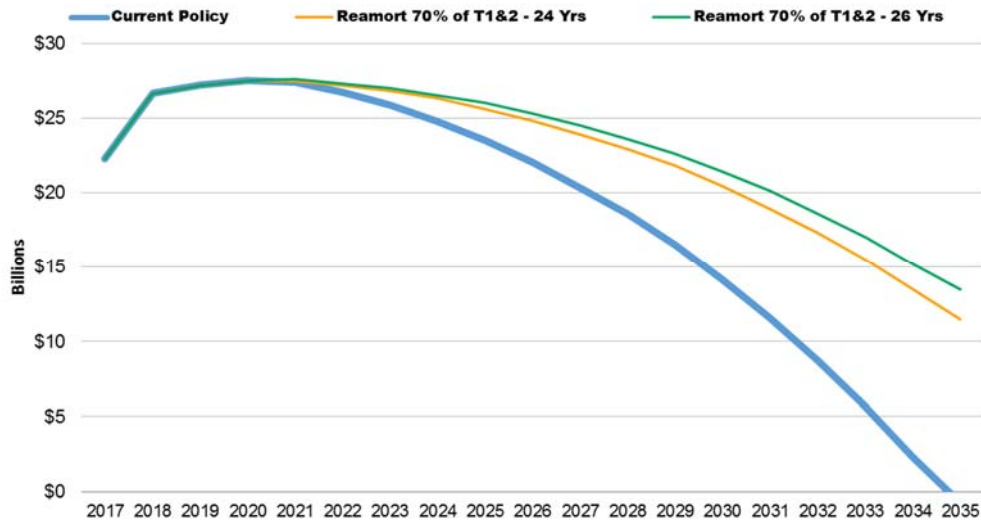
Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

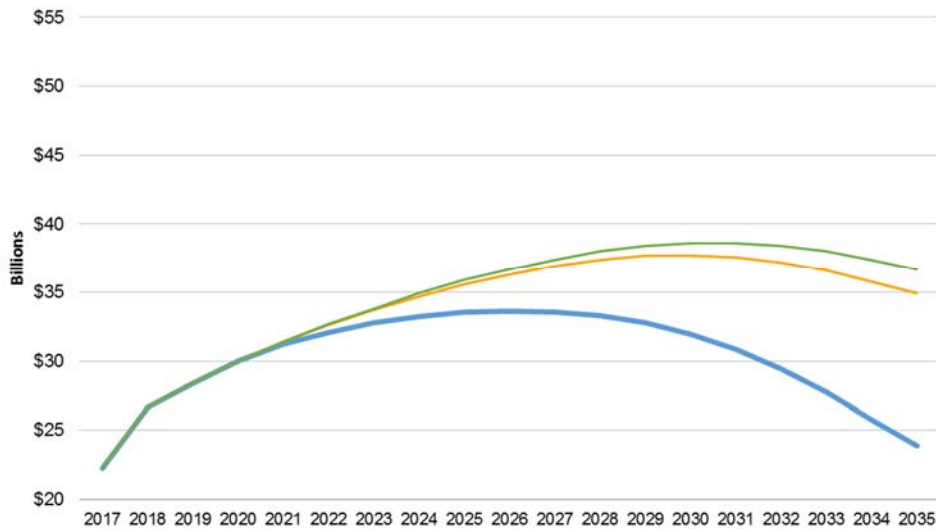
Analysis of Legislative Fiscal Office Concepts:
Effect of Reamortization First Effective with 2021-2023 Rates

Unfunded Actuarial Liability (Excluding Side Accounts)

+7.20% Actual Annual Future Return



+5.00% Actual Annual Future Return



This analysis reflects the current Board-selected assumed rate of 7.2% throughout the projection period.

Milliman

This work product was prepared solely for Oregon PERS for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.