INDIANA PUBLIC RETIREMENT SYSTEM

Risk Analysis Report
June 2024

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CavMac
Actuarial Consulting Services

July 18, 2024

Board of Trustees
Indiana Public Retirement System
1 North Capitol, Suite 001
Indianapolis, IN 46204

Re: Risk Analysis Report

Dear Members of the Board:

At your request, we have performed a study of the actuarial-related risks faced by the Indiana Public Retirement System (INPRS). This report is designed to support and expand on information contained in the annual INPRS actuarial valuation reports. While the exhibits and graphs shown in this report are based on the June 30, 2023 INPRS actuarial valuation, the analysis of the results and the discussion of the implications for INPRS and its stakeholders are expected to remain substantially unchanged for the next few years.

The primary objective of this report is to provide the analysis of risk, as required under Actuarial Standard of Practice Number 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions.* There are other risks that INPRS faces, including issues such as cyber security, a catastrophe to the physical location, embezzlement, and many others. These are outside the scope of our analysis, which focuses only on those risks relating to the variance in the measurement of the benefit obligations as well as the contribution rates. There is no specific action by the INPRS Board whether required or expected in response to this report, although it is possible that a deeper understanding of the risks faced by the System may prompt some additional discussion or study.

In preparing our report, we utilized the data, methods, assumptions, and benefit provisions described in the June 30, 2023 actuarial valuations of INPRS, which should be consulted for a complete description. HEA 1004, passed in the spring of 2024, changed the way the Supplemental Retirement Accounts are to be funded. While specifics are still to be developed, we have reflected what we believe to be a reasonable implementation of the new law in the analysis provided in this report. While HEA 1004 also changed some provisions relating to the DROP program, these changes were not deemed material enough to reflect at this time. Some of the results in this report are based upon modifying one or more of the valuation assumptions as noted in the discussion of the analysis being performed.

In order to prepare the results in this report, we have utilized actuarial models that were developed to measure liabilities and develop actuarial costs. These models include tools that we have produced and tested, along with commercially available valuation software that we have reviewed to confirm the appropriateness and accuracy of the output. In utilizing these models, we develop and use input parameters and assumptions about future contingent events along with recognized actuarial approaches to develop the needed results.

Future actuarial measurements may differ significantly from the current measurements presented in this report 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 or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law.

The consultants who worked on this assignment are pension actuaries with significant public plan experience. In addition, the signing actuaries are independent of the System and the plan sponsor. 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 the assumptions and methods used meet the guidance provided in the applicable Actuarial Standards of Practice. Furthermore, the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonable based on the actual experience of the System. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein. We would be happy to answer further questions.

We respectfully submit the following report and look forward to discussing it with you.

Sincerely,

Brent. A. Banister, PhD, FSA, EA, FCA, MAAA
Chief Actuary

Edward Koebel, FCA, EA, MAAA
Chief Executive Officer

Virginia Fritz, FSA, EA, FCA, MAAA
Senior Actuary

OVERVIEW

Actuarial Standard of Practice Number 51 (ASOP 51)

Actuarial Standards of Practice (ASOPs) are issued by the Actuarial Standards Board and are binding for credentialed actuaries practicing in the United States. These standards generally identify what the actuary should consider, document and disclose when performing an actuarial assignment. In September 2017, ASOP 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*, was issued as final with application to measurement dates on or after November 1, 2018. This ASOP applies to funding valuations, actuarial projections, and actuarial cost studies of proposed plan changes.

A typical retirement system faces many different risks. The greatest risk for a retirement system is the inability to make benefit payments when due. If system assets are depleted, benefits may not be paid which could create legal and litigation risk. The term "risk" is most commonly associated with an outcome with undesirable results. However, in the actuarial world risk is defined as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience each year will not unfold exactly as anticipated by the assumptions. This uncertainty, whether favorable or unfavorable, creates risk. ASOP 51 defines risk as the potential of actual future measurements deviating from expected future measurements due to actual experience that is different than the actuarial assumptions.

Identifying Risks

The first step in a project such as this is to identify the significant risks that affect how INPRS liabilities are measured and contributions determined. Some risks, such as investment return for a funded retirement plan, are obvious, but there are others that are not as clear. There is no definition of "significant" to clearly define which risks should be considered, nor is it always possible to know in advance before performing analysis whether certain risks are significant or not.

The identification of risks is also specific to the retirement plan being studied. Some plan design features, such as lump sums based on market interest rates, could increase the risk a plan faces, while features that adjust benefits based on actual investment return may reduce the risk to the plan. Thus, this analysis for INPRS is uniquely prepared for INPRS and the risks it faces. Different plans are subject to different risks.

The more significant risks discussed in this report include:

- Investment risk – actual investment returns differ from the assumption
- Other economic risks – for example, inflation coupled with corresponding changes in investment return, wage growth, and COLAs
- Mortality risk – a sudden, long-term shift in mortality rates up or down from those currently anticipated
- Retirement and termination risk – the rates at which members leave employment for retirement or other reasons permanently changes from what is currently assumed
- Active membership and payroll growth risk – the risk that the population and payroll (upon which funding is often based) increase or decrease in an unexpected manner
- Contribution risk – the risk that the funding policy will not result in adequate funding of a plan

- TRF Pre-'96 contribution risk – this Fund has unique contribution risks which are considered
- Risk of benefit improvements – the risk of improving benefits when funded ratios are strong

Assessing Risks

In this report, we consider a variety of risks faced by INPRS. A common theme for most retirement plans is that risks change as a plan matures. Because this is a fundamental issue, ASOP 51 requires the disclosure of appropriate measures of a plan's maturity. In the section of this report that considers maturity measures, we provide a number of illustrations to help demonstrate this trend. It is worth noting that the eight funds in INPRS have some differences that relate to the nature of retirement eligibility and the historical inclusion of certain employment categories. This uniqueness can help explain why certain events may affect the groups differently.

There are some risks that are inherently difficult to quantify, while other risks are mitigated or exacerbated by plan design and funding policy. In our section on qualitative analysis, we discuss some of these risks. We also discuss how the INPRS contribution rate policy addresses some of the risks faced by INPRS.

Finally, we conclude this report with a quantitative assessment of some of the significant demographic and economic risks. The purpose of this analysis is to provide some perspective on the magnitude of the risks faced by INPRS.

Methodology and Disclaimers

Actuarial valuations are based on mathematical models and assumptions that attempt to reflect the most likely outcome of future contingent events. There is inherent randomness in many of the events that are modeled. For instance, an individual who is at an age where 2% of similar individuals are expected to die will either survive or die – there is no real-world scenario of being 98% alive. Mathematically, however, we value this individual as 0.98 of a living person and reflect a 0.02 death (with possible benefits to a survivor). This is appropriate using the statistical principle of the Law of Large Numbers which asserts that if we could experience many repetitions of the current state of affairs, the average result would be approximately what our model values are. There will, however, be only one outcome and that is currently unknown. This actuarial model is an attempt to estimate the most likely outcome. Alternatively, we could value a large number of random, plausible scenarios in which the member survived 98% of the time and died 2% of the time. Such an approach would require very significant computational resources, while not producing commensurate improvements in the resulting measurement.

In this report, we also utilize projection models in which we attempt to estimate the results produced by future valuations. There is inherently a wide range of outcomes as can be seen in the section of stochastic results in this report. It is important to note that these models are designed to be comparative rather than predictive. In other words, if the results of a sustained low return result in a funded ratio about 10% lower than the baseline, this would likely still be approximately true, even if there were some changes in an unrelated variable such as the benefit structure or the rate of mortality improvement. The output of projection models provides the expected trend of future valuation results, recognizing that actual experience will fluctuate as it follows that general trend.

OVERVIEW

The results in this report are based on the June 30, 2023 valuations with their underlying data, assumptions, and methods. There were bills passed in the 2024 legislative session that changed the way the supplemental retirement benefits are to be funded for PERF, TRF Pre-'96, TRF '96, EG&C, and LE DB. Funding for future supplemental benefits would be based on providing a 13th check or a 1% cost-of-living adjustment, depending upon retirement date. This change has been reflected in this analysis. Additionally, other provisions, such as the increase in the DROP period from 3 to 5 years for the '77 Fund and EG&C, are generally minor in nature from a funding perspective, and so were not reflected in this report. It is important to keep in mind that the results presented in this report are intended to help illustrate how the various Funds respond to variability in investment markets or human behavior and are not intended to predict what will happen in the future.

This report is intended to provide information to help the Board and other interested parties better understand how the risks faced by INPRS might unfold. There is no intent to provide any suggested course of action, or even to suggest that any course of action be considered. Should the Board be interested in a more extensive understanding or taking additional steps to manage risk, further study may be warranted.

Conclusions

Risk is not necessarily a negative concept. As humans, we regularly take risks such as driving in an automobile because we believe that the gain to be received outweighs the possible negative consequences. We do, however, take steps to mitigate the risk by looking both ways at an intersection before proceeding, wearing seatbelts, etc. We do these things because we have some understanding of the sources of risk. The goal of this report is to help the INPRS Board and staff understand the major risks facing INPRS' funding, thereby allowing a reasoned approach to operating and guiding the Funds.

MATURITY OF THE SYSTEM

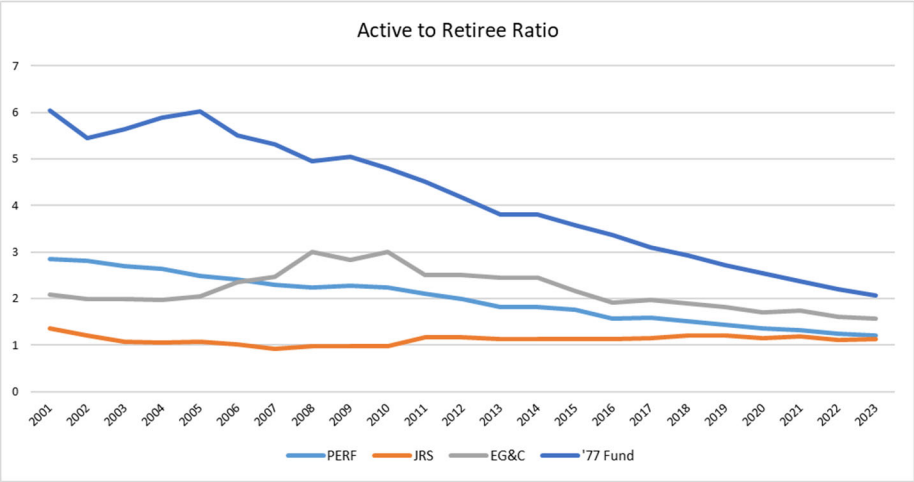
While INPRS was officially created in 2011, the funds that were combined into this new entity date back much earlier – the Indiana Public Employees' Retirement Fund (PERF) began in 1945 and the Indiana State Teachers' Retirement Fund (TRF) dates back to 1921. For public retirement systems that have been around for 50 to 75 years or more, there has been a shift in the demographics of these systems as the population is aging and baby boomers have begun to retire. This change is not unexpected and has, in fact, been anticipated in the funding of the retirement systems. Even though it was anticipated, the demographic shift and maturing of the plans have increased the risk associated with funding the systems, since funding is generally related to active payroll. There are different ways to measure and assess the maturity level of a retirement system and we will discuss several in this section of the report.

Historical Active to Retiree Ratio

One way to assess the maturity of the system is to consider the ratio of active members to retirees. In the early years after a retirement system is established, the ratio of active to retired members will be very high as the system is largely composed of active members. As the system matures over time, the ratio starts to decline. A very mature system often has a ratio near or below one. In addition, if the size of the active membership declines over time, it can accelerate the decline in the ratio.

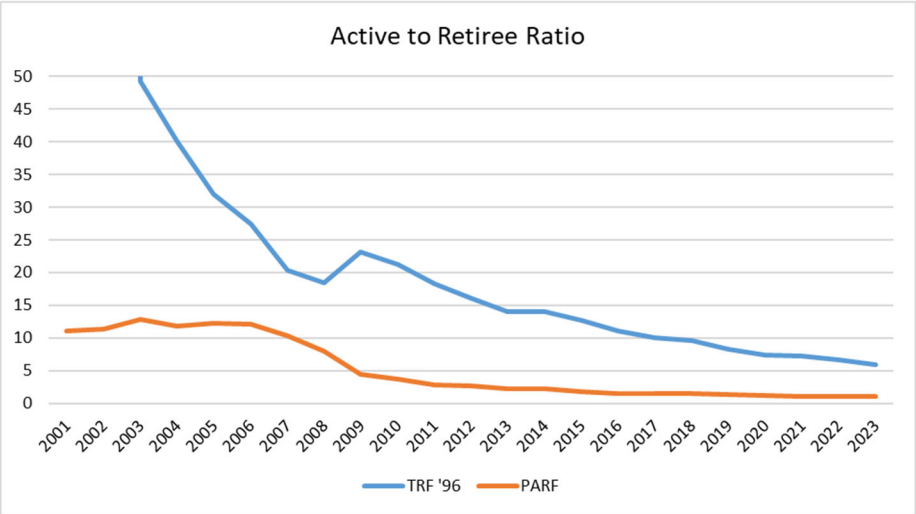
As the following graphs illustrate, this ratio of actives to retirees has been declining over time for most of the INPRS funds.

<u>Ongoing, Mature Plans: PERF, '77 Fund, JRS, and EG&C</u>



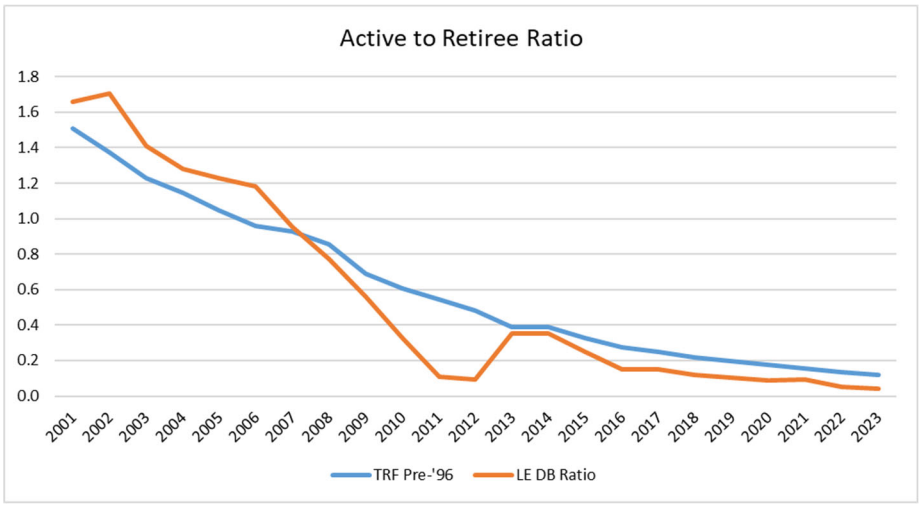
The Funds shown here are reasonably stable, mature funds and, therefore, the active to retiree ratio is generally flat or declining. The '77 Fund was still relatively new at the beginning of the period graphed and therefore has greater decline in the ratio. Note that the EG&C Fund had growth in active membership in the mid-2000's that caused a temporary distortion to the general pattern.

Ongoing, Newer Plans: TRF ’96 and PARF



As relatively newer funds (PARF was created in 1989 and TRF ’96 in 1996), these two funds have a very high proportion of actives. The decline is most dramatic for TRF ’96 Fund, going from over nearly 300 actives per retiree in 2001 to under 10 at the present. As time passes, these ratios will begin to resemble the patterns of the more mature funds.

Closed Plans: TRF Pre-’96 and LE DB



Because the TRF Pre-’96 and LE DB Funds are closed, there is a continued decline in the ratio as the remaining active members gradually transition to retirees.

Asset Volatility Ratio

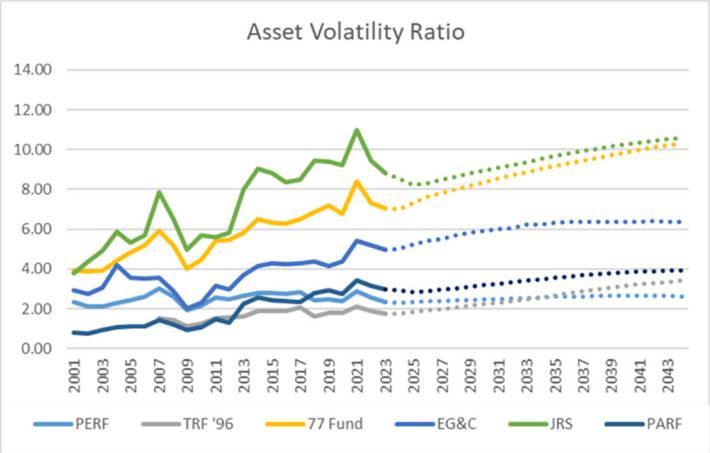
As a retirement system matures, the size of the market value of assets increases relative to the covered payroll of active members on which the System is funded. The size of the plan assets relative to covered payroll, sometimes referred to as the asset volatility ratio, is an important indicator of the contribution risk for the Funds. Particularly when investment experience different from expected is reflected by changes in the contribution rate applied to the active payroll, this ratio can help explain variation in contribution rates. The higher this ratio, the more sensitive a plan's actuarially determined contribution rate is to investment return volatility.

It is important to note that while a large ratio is an indication that the actuarially determined contributions are more volatile, the ratio will also be larger for a well-funded plan than for a poorly-funded plan. Thus, it is inappropriate to describe a large or small ratio as good or bad. The value of examining these ratios is to understand how the different funds may respond to variation in investment return. It should be noted that when a plan is not funded on a payroll basis (such as the TRF Pre-'96 Fund), this ratio is likely to be less meaningful. The following table shows how asset volatility affects contribution rates for the Funds. If the asset return is 10% different from the assumption (so either -3.75% or +16.25%), the actuarial contribution rate changes as a result of the change in the UAAL. The "Without Asset Smoothing" column reflects how the rate would change if asset smoothing were not used, while the "with Asset Smoothing" column indicates the actual first year change in the amortization rate. Note that the actual employer contribution rate or amount may change by a different amount due to additional other factors.

		Change in Actuarial Contribution Rate for a 10% Change in Asset Return	
	Asset Volatility Ratio	Without Asset Smoothing	With Asset Smoothing
PERF	2.36	2.0%	0.4%
TRF '96	1.77	1.5%	0.3%
'77 Fund	7.06	6.1%	1.2%
JRS	8.80	7.6%	1.5%
PARF	2.97	2.6%	0.5%
EG&C	4.98	4.3%	0.9%

TRF Pre-'96 and LE DB are excluded because there is no meaningful actuarial rate calculated.

As can be seen in the table above, the asset volatility ratio for the '77 Fund and JRS are higher than for the other plans. These are Funds where the size of the plan, as determined here by the market value of assets of the plan, are large relative to the size of the active member payroll. A significant factor in this is that the career length of these two groups is shorter because of earlier retirement ('77 Fund) or later entry (JRS).



The historical asset volatility ratio for each plan is shown, along with the projected path assuming current actuarial assumptions are met.

The following pages show the historical trend for the asset volatility ratio for each of the INPRS membership groups based on the market value of assets and payroll used in the valuation. As is evident, the differing demographic characteristics of each group translates to different asset volatility ratios and different contribution rate risk.

Asset Volatility Ratio

Fiscal Year End	Market Value of Assets ($ Millions)			Covered Payroll ($ Millions)			Asset Volatility Ratio		
	PERF	TRF Pre-'96	TRF '96	PERF	TRF Pre-'96	TRF '96	PERF	TRF Pre-'96	TRF '96
6/30/01	$8,355.5	$5,810.8	*	$3,587.1	$2,564.5	$754.4	2.33	1.75	*
6/30/02	7,953.0	5,722.8	*	3,785.2	2,551.2	1,004.5	2.10	1.61	*
6/30/03	8,273.0	6,148.0	*	3,952.2	2,448.3	1,136.9	2.09	1.71	*
6/30/04	9,586.9	6,754.3	*	4,198.9	2,384.5	1,267.2	2.28	1.85	*
6/30/05	10,398.7	7,179.7	*	4,318.5	2,305.7	1,428.6	2.41	1.92	*
6/30/06	11,366.2	7,797.4	*	4,322.2	2,237.4	1,565.3	2.63	2.05	*
6/30/07	13,262.4	6,106.4	2,874.4	4,385.7	2,376.4	1,891.6	3.02	2.57	1.52
6/30/08	12,073.5	5,644.2	2,919.8	4,600.4	2,295.8	2,052.7	2.62	2.46	1.42
6/30/09	9,442.3	4,655.9	2,543.2	4,931.4	2,030.5	2,308.5	1.91	2.29	1.10
6/30/10	10,581.3	5,029.5	3,111.3	4,896.0	1,865.1	2,447.5	2.16	2.70	1.27
6/30/11	12,461.3	3,455.9	3,775.8	4,818.8	1,762.8	2,507.2	2.59	1.96	1.51
6/30/12	12,243.8	5,058.9	4,018.1	4,904.1	1,637.1	2,595.0	2.50	3.09	1.55
6/30/13	12,720.6	5,215.2	4,433.7	4,766.9	1,383.4	2,740.9	2.67	3.77	1.62
6/30/14	14,104.3	5,501.9	5,189.4	5,080.1	1,383.2	2,740.7	2.78	3.98	1.89
6/30/15	13,907.7	5,099.9	5,379.1	4,964.8	1,178.8	2,827.3	2.80	4.33	1.90
6/30/16	13,870.5	4,787.5	5,611.2	5,014.0	1,044.1	3,004.2	2.77	4.59	1.87
6/30/17	14,644.7	4,817.6	6,252.0	5,130.4	933.3	3,032.3	2.85	5.16	2.06
6/30/18	12,694.3	3,711.3	5,452.4	5,210.2	750.7	3,374.9	2.44	4.94	1.62
6/30/19	13,271.0	3,759.1	6,124.1	5,335.4	681.8	3,451.7	2.49	5.51	1.77
6/30/20	13,261.4	3,661.2	6,325.3	5,528.8	627.7	3,552.1	2.40	5.83	1.78
6/30/21	16,247.3	5,074.8	7,987.5	5,627.5	573.2	3,781.1	2.89	8.85	2.11
6/30/22	14,848.4	5,113.1	7,496.5	5,821.0	513.4	3,956.8	2.55	9.96	1.89
6/30/23	14,885.9	8,472.9	7,746.5	6,312.9	459.9	4,386.3	2.36	18.42	1.77

Note: Prior to 6/30/18, member DC account balances are reflected in the assets.

*For historical information from 6/30/2001 through 6/30/2006, Market Value of Assets and Asset Volatility Ratio for TRF Pre-'96 and TRF '96 are combined in TRF Pre-'96.

Asset Volatility Ratio

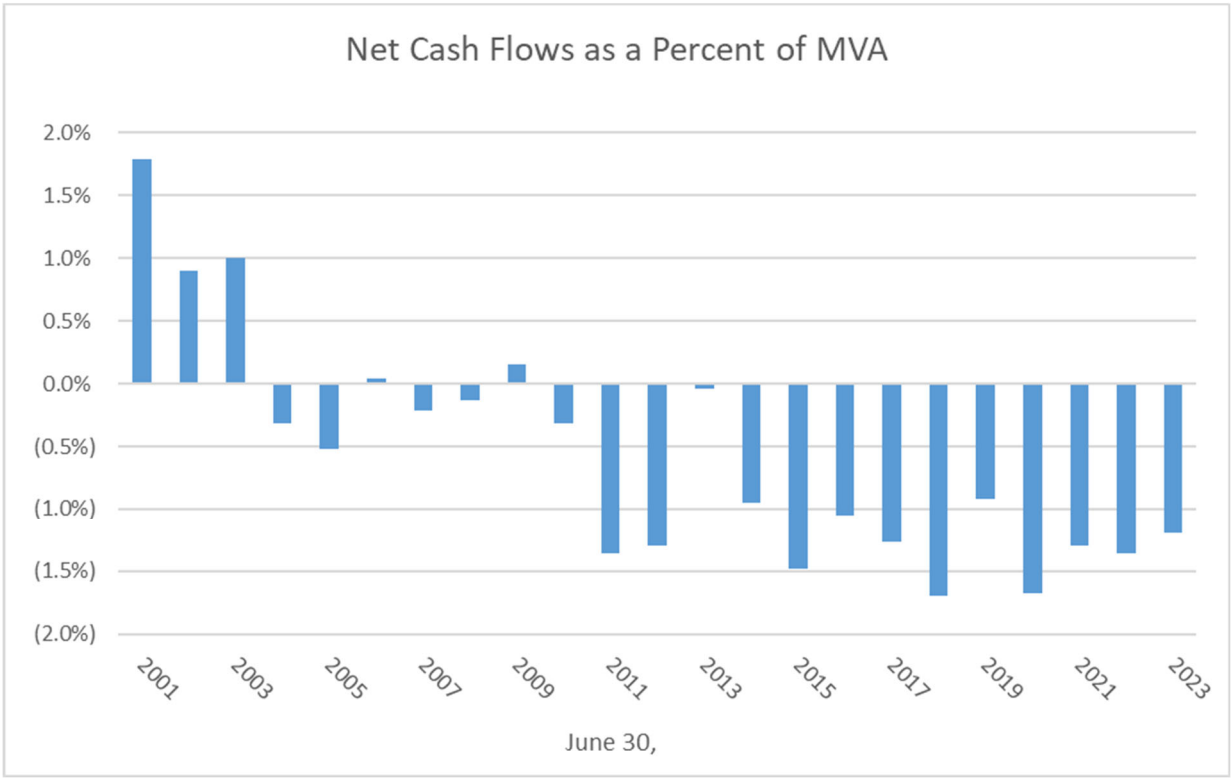
Fiscal Year End	Market Value of Assets ($ Millions)		Covered Payroll ($ Millions)		Asset Volatility Ratio	
	77 Fund	EG&C	77 Fund	EG&C	77 Fund	EG&C
6/30/01	$1,533.3	$36.3	$389.2	$12.5	3.94	2.91
6/30/02	1,537.7	34.8	396.2	12.7	3.88	2.75
6/30/03	1,706.3	36.6	433.0	11.9	3.94	3.07
6/30/04	2,071.6	42.9	469.8	10.2	4.41	4.20
6/30/05	2,381.7	47.3	493.7	13.2	4.82	3.57
6/30/06	2,718.4	52.6	522.2	14.9	5.21	3.53
6/30/07	3,310.2	63.2	557.6	17.7	5.94	3.57
6/30/08	3,148.4	61.1	604.0	21.3	5.21	2.86
6/30/09	2,591.7	51.4	649.0	25.2	3.99	2.04
6/30/10	3,033.3	61.2	675.8	26.7	4.49	2.29
6/30/11	3,721.4	75.3	687.3	24.0	5.41	3.13
6/30/12	3,817.0	76.5	697.1	25.8	5.48	2.97
6/30/13	4,116.9	97.0	706.6	26.2	5.83	3.70
6/30/14	4,758.0	110.7	734.0	26.7	6.48	4.15
6/30/15	4,828.4	110.0	764.2	25.8	6.32	4.27
6/30/16	4,951.0	111.3	791.5	26.2	6.26	4.26
6/30/17	5,401.2	120.0	829.7	28.1	6.51	4.27
6/30/18	5,927.6	131.5	863.2	30.1	6.87	4.37
6/30/19	6,379.8	142.1	888.0	34.1	7.18	4.17
6/30/20	6,542.8	146.4	966.4	33.4	6.77	4.38
6/30/21	8,189.8	184.3	976.5	34.1	8.39	5.41
6/30/22	7,634.0	172.1	1,045.6	33.2	7.30	5.18
6/30/23	7,771.9	176.9	1,100.6	35.5	7.06	4.98

Asset Volatility Ratio

Fiscal Year End	Market Value of Assets ($ Millions)			Covered Payroll ($ Millions)			Asset Volatility Ratio		
	LE DB	JRS	PARF	LE DB	JRS	PARF	LE DB	JRS	PARF
6/30/01	$4.5	$112.2	$10.8	N/A	$29.7	$13.6	N/A	3.77	0.79
6/30/02	4.1	112.5	11.1	N/A	25.8	14.4	N/A	4.36	0.77
6/30/03	4.1	124.8	12.6	N/A	25.4	13.2	N/A	4.91	0.95
6/30/04	4.7	150.8	16.2	N/A	25.7	15.1	N/A	5.87	1.07
6/30/05	5.0	171.0	19.0	N/A	32.2	16.7	N/A	5.31	1.14
6/30/06	5.1	193.3	21.6	N/A	34.1	19.2	N/A	5.67	1.13
6/30/07	5.5	233.4	26.2	N/A	29.7	18.1	N/A	7.85	1.45
6/30/08	4.7	219.4	24.6	N/A	33.7	20.6	N/A	6.51	1.19
6/30/09	3.4	179.4	19.7	N/A	36.2	20.8	N/A	4.96	0.95
6/30/10	3.4	208.4	22.4	N/A	36.7	21.0	N/A	5.67	1.07
6/30/11	3.6	257.0	26.5	N/A	45.8	18.1	N/A	5.62	1.46
6/30/12	3.4	262.3	27.7	N/A	45.1	21.7	N/A	5.81	1.28
6/30/13	3.3	375.8	47.9	N/A	47.0	21.2	N/A	8.00	2.26
6/30/14	3.5	432.7	54.5	N/A	47.9	21.4	N/A	9.04	2.54
6/30/15	3.2	437.4	53.4	N/A	49.7	22.0	N/A	8.81	2.43
6/30/16	2.9	441.8	52.8	N/A	53.0	22.2	N/A	8.34	2.38
6/30/17	2.9	475.1	55.6	N/A	55.9	23.5	N/A	8.51	2.36
6/30/18	2.9	514.0	61.0	N/A	54.5	22.0	N/A	9.44	2.77
6/30/19	3.0	545.3	65.5	N/A	57.9	22.4	N/A	9.42	2.93
6/30/20	2.9	554.1	67.9	N/A	60.1	24.8	N/A	9.22	2.74
6/30/21	3.5	688.0	85.9	N/A	62.7	24.9	N/A	10.97	3.45
6/30/22	3.1	634.9	80.0	N/A	67.3	25.4	N/A	9.43	3.15
6/30/23	3.0	640.2	81.6	N/A	72.7	27.5	N/A	8.80	2.97

Historical Cash Flows

Plans with negative cash flows will experience increased sensitivity to investment return volatility. Cash flows, for this purpose, are measured as contributions less benefit payments and expenses. If the System has negative cash flows and actual returns are below the assumed rate, there are fewer assets to be reinvested to earn the higher returns that typically follow. While any negative cash flow will produce such a result, it is typically a negative cash flow of more than 5% of market value that may cause liquidity concerns. While this is not a concern for INPRS at this time, it is important to monitor this metric so that any trends can be identified. Note that the graph below and the values shown in the table on the following page are for the total System as all benefits are paid from one trust.



Note that the graph above excludes additional appropriations for TRF Pre-'96 in 2021, 2022, and 2023.

Aggregate Cash Flow
($ Millions)

Fiscal Year End	Contributions	Benefit Payments and Expenses	Net Cash Flow	Market Value of Assets (MVA)	Net Cash Flow as a Percent of MVA
6/30/01	$1,241.1	$957.5	$283.6	$15,863.4	1.79%
6/30/02	1,134.5	996.2	138.3	15,375.9	0.90%
6/30/03	1,202.2	1,038.9	163.3	16,305.3	1.00%
6/30/04	1,071.8	1,131.9	(60.1)	18,627.3	(0.32%)
6/30/05	1,116.2	1,220.5	(104.3)	20,202.2	(0.52%)
6/30/06	1,363.9	1,355.8	8.1	22,154.7	0.04%
6/30/07	1,461.3	1,516.7	(55.4)	25,881.6	(0.21%)
6/30/08	1,583.7	1,616.0	(32.3)	24,095.7	(0.13%)
6/30/09	1,660.5	1,630.9	29.7	19,487.0	0.15%
6/30/10	1,700.0	1,770.5	(70.5)	22,050.8	(0.32%)
6/30/11	1,745.9	2,068.6	(322.7)	23,776.8	(1.36%)
6/30/12	1,839.1	2,169.8	(330.7)	25,507.8	(1.30%)
6/30/13	2,262.4	2,272.1	(9.7)	27,010.4	(0.04%)
6/30/14	2,060.6	2,346.1	(285.5)	30,155.0	(0.95%)
6/30/15	2,116.6	2,556.8	(440.1)	29,819.1	(1.48%)
6/30/16	2,232.9	2,547.0	(314.1)	29,829.1	(1.05%)
6/30/17	2,184.0	2,587.4	(403.4)	31,769.0	(1.27%)
6/30/18*	2,099.4	2,583.0	(483.6)	28,495.0	(1.70%)
6/30/19	2,165.2	2,444.8	(279.5)	30,290.0	(0.92%)
6/30/20	2,014.1	2,526.9	(512.8)	30,561.9	(1.68%)
6/30/21**	2,090.5	2,591.6	(501.1)	38,461.0	(1.30%)
6/30/22**	2,120.1	2,608.4	(488.3)	35,982.2	(1.36%)
6/30/23**	2,258.1	2,733.5	(475.4)	39,778.9	(1.20%)

* Excludes asset transfers of Defined Contribution balances to the independent administrator for PERF and TRF funds.

** Excludes additional appropriations for TRF Pre-'96:
2021 excludes one-time additional contributions of $600 million.
2022 excludes one-time additional contributions of $545 million.
2023 excludes one-time additional contributions of $2.5 billion and $700 million.

Liability Maturity Measurements

As discussed earlier, most public sector retirement systems, including INPRS, have been in operation for over 50 years. As a result, they have aging plan populations indicated by a decreasing ratio of active members to retirees and a growing percentage of retiree liability when compared to the total. The retirement of the remaining baby boomers over the next 5-10 years is expected to further exacerbate the aging of the retirement system population. With more of the total liability residing with retirees, investment volatility has a greater impact on the funding of the system since it is more difficult to restore the system financially after losses occur when there is comparatively less payroll over which to spread costs.

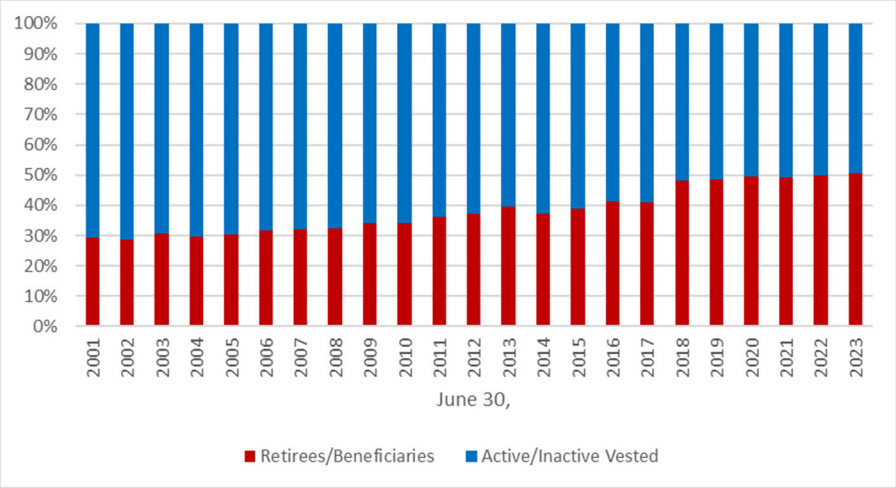
The following pages show how the proportion of retiree liability has increased through time. As would be expected, the proportion is moving toward 100% for the two closed plans, while the proportion still remains low for TRF '96. Among the remaining plans, JRS has a notably higher retiree proportion, partly explained by the fact that judges enter the plan at older ages than active members of other plans and therefore have shorter careers. Further, the PERF and TRF plans have a notable drop in 2018 with the separation of the DC plan assets and obligations.

A related measure is the ratio of the actuarial liability to payroll. This measure reflects both the proportion of liability as well as the value of the benefits for active members. A review of the following pages shows that there is a tendency for both of these measures to move together. One noteworthy comparison is that JRS and PARF are more similar when examining the proportion of retiree liability than when comparing the liability to the payroll. This is because the PARF benefits, which are essentially the difference between the JRS benefits and the PERF benefits, are significantly less valuable than the JRS benefits.

As these two ratios increase, the contributions required to fund the plan also grow relative to payroll if the plan funded ratio is held constant. If the funded ratio improves, the required contributions will be more stable or even decline.

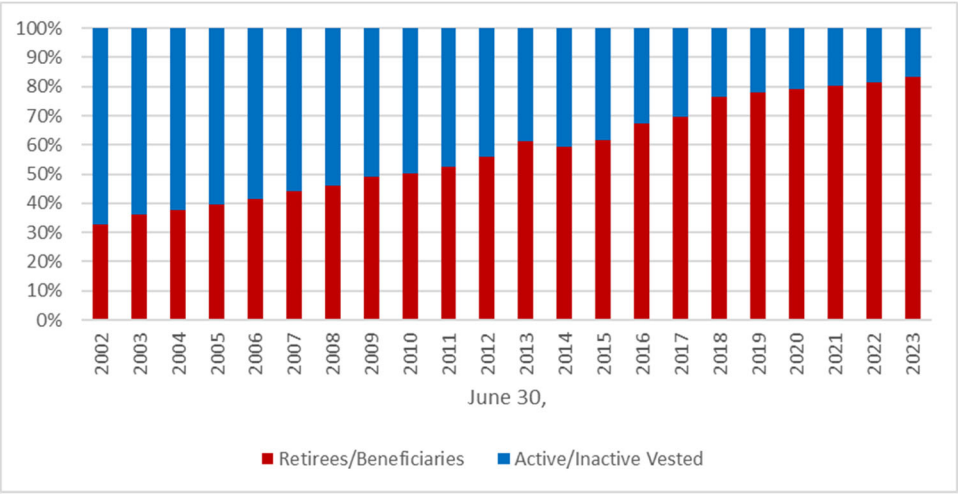
PERF Members
($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$2,426.1	$8,305.7	29.2%	$3,587.1	2.32
6/30/02	2,582.1	9,066.1	28.5%	3,785.2	2.40
6/30/03	2,765.0	9,034.6	30.6%	3,952.2	2.29
6/30/04	2,927.9	9,844.4	29.7%	4,198.9	2.34
6/30/05	3,301.3	10,858.3	30.4%	4,318.5	2.51
6/30/06	3,648.8	11,450.9	31.9%	4,322.2	2.65
6/30/07	4,007.4	12,439.8	32.2%	4,385.7	2.84
6/30/08	4,227.4	13,103.2	32.3%	4,600.4	2.85
6/30/09	4,611.3	13,506.3	34.1%	4,931.4	2.74
6/30/10	4,931.6	14,506.1	34.0%	4,896.0	2.96
6/30/11	5,370.8	14,913.1	36.0%	4,818.8	3.09
6/30/12	5,895.8	15,784.2	37.4%	4,904.1	3.22
6/30/13	6,367.8	16,145.7	39.4%	4,766.9	3.39
6/30/14	6,250.9	16,732.2	37.4%	5,080.1	3.29
6/30/15	6,981.3	17,980.6	38.8%	4,964.8	3.62
6/30/16	7,595.1	18,408.9	41.3%	5,014.0	3.67
6/30/17	7,835.0	19,106.2	41.0%	5,130.4	3.72
6/30/18	7,768.2	16,091.4	48.3%	5,210.2	3.09
6/30/19	8,068.5	16,576.1	48.7%	5,335.4	3.11
6/30/20	8,050.8	16,281.8	49.4%	5,528.8	2.94
6/30/21	8,655.8	17,563.2	49.3%	5,627.5	3.12
6/30/22	8,955.6	18,002.2	49.7%	5,821.0	3.09
6/30/23	9,287.7	18,415.2	50.4%	6,312.9	2.92



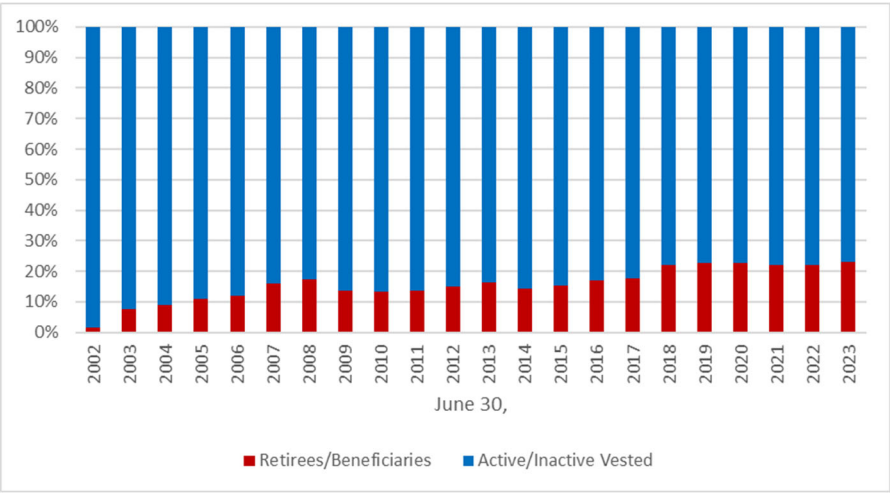
TRF Pre-'96 Members
($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/02	$4,411.7	$13,497.8	32.7%	$2,551.2	5.29
6/30/03	4,832.8	13,354.9	36.2%	2,448.3	5.45
6/30/04	5,116.2	13,548.5	37.8%	2,384.5	5.68
6/30/05	5,653.5	14,254.1	39.7%	2,305.7	6.18
6/30/06	6,238.1	15,002.5	41.6%	2,237.4	6.71
6/30/07	7,063.9	15,988.3	44.2%	2,376.4	6.73
6/30/08	7,244.4	15,792.3	45.9%	2,295.8	6.88
6/30/09	7,891.3	16,027.1	49.2%	2,030.5	7.89
6/30/10	8,153.2	16,282.1	50.1%	1,865.1	8.73
6/30/11	8,556.0	16,318.4	52.4%	1,762.8	9.26
6/30/12	9,260.1	16,522.0	56.0%	1,637.1	10.09
6/30/13	10,079.1	16,462.4	61.2%	1,383.4	11.90
6/30/14	9,686.4	16,355.2	59.2%	1,383.2	11.82
6/30/15	10,488.1	17,017.7	61.6%	1,178.8	14.44
6/30/16	11,358.2	16,840.2	67.4%	1,044.1	16.13
6/30/17	11,653.7	16,736.8	69.6%	933.3	17.93
6/30/18	11,161.0	14,583.2	76.5%	750.7	19.43
6/30/19	11,245.9	14,389.2	78.2%	681.8	21.10
6/30/20	11,053.1	13,968.7	79.1%	627.7	22.25
6/30/21	11,501.5	14,338.2	80.2%	573.2	25.01
6/30/22	11,435.8	14,059.1	81.3%	513.4	27.38
6/30/23	11,434.3	13,703.3	83.4%	459.9	29.80



TRF '96 Members
($ Millions)

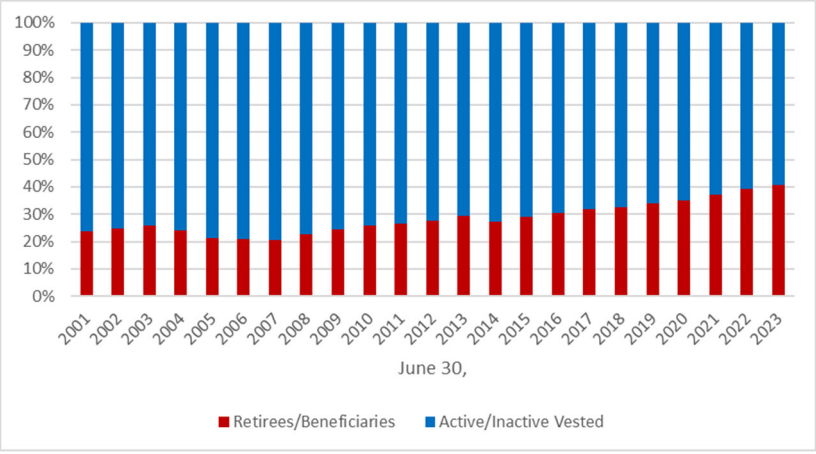
Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/02	$17.3	$1,166.9	1.5%	$1,004.5	1.16
6/30/03	107.7	1,392.5	7.7%	1,136.9	1.22
6/30/04	148.9	1,649.4	9.0%	1,267.2	1.30
6/30/05	219.7	2,010.7	10.9%	1,428.6	1.41
6/30/06	282.6	2,363.1	12.0%	1,565.3	1.51
6/30/07	449.5	2,827.6	15.9%	1,891.6	1.49
6/30/08	514.9	2,957.8	17.4%	2,052.7	1.44
6/30/09	432.9	3,135.4	13.8%	2,308.5	1.36
6/30/10	483.1	3,614.6	13.4%	2,447.5	1.48
6/30/11	544.5	3,996.8	13.6%	2,507.2	1.59
6/30/12	646.2	4,338.3	14.9%	2,595.0	1.67
6/30/13	781.9	4,749.4	16.5%	2,740.9	1.73
6/30/14	759.2	5,237.0	14.5%	2,740.7	1.91
6/30/15	897.0	5,905.7	15.2%	2,827.3	2.09
6/30/16	1,079.3	6,391.8	16.9%	3,004.2	2.13
6/30/17	1,213.8	6,914.2	17.6%	3,032.3	2.28
6/30/18	1,232.1	5,563.3	22.1%	3,374.9	1.65
6/30/19	1,371.7	5,980.4	22.9%	3,451.7	1.73
6/30/20	1,455.0	6,403.3	22.7%	3,552.1	1.80
6/30/21	1,648.1	7,517.7	21.9%	3,781.1	1.99
6/30/22	1,795.3	8,155.0	22.0%	3,956.8	2.06
6/30/23	2,037.5	8,832.8	23.1%	4,386.3	2.01



'77 Fund Members

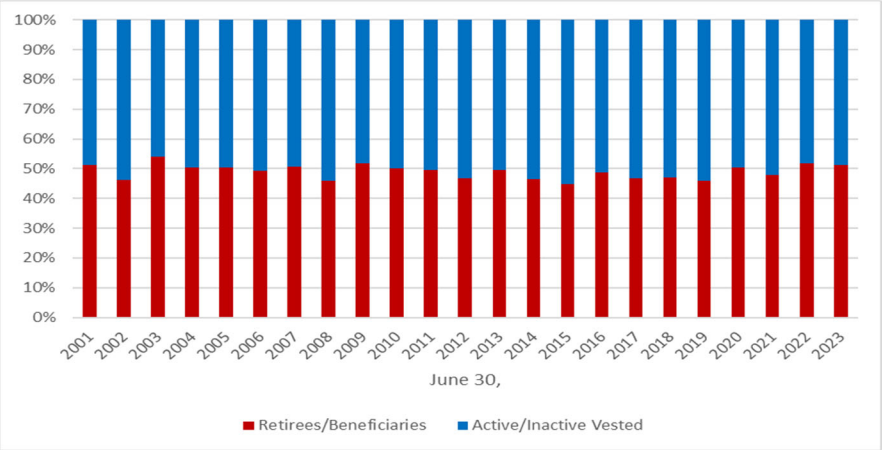
($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$384.1	$1,620.3	23.7%	$389.2	4.16
6/30/02	447.0	1,808.8	24.7%	396.2	4.56
6/30/03	457.8	1,766.8	25.9%	433.0	4.08
6/30/04	452.8	1,875.5	24.1%	469.8	3.99
6/30/05	436.6	2,064.2	21.2%	493.7	4.18
6/30/06	503.5	2,415.1	20.8%	522.2	4.62
6/30/07	546.6	2,649.5	20.6%	557.6	4.75
6/30/08	655.8	2,889.3	22.7%	604.0	4.78
6/30/09	765.9	3,150.8	24.3%	649.0	4.85
6/30/10	859.6	3,332.7	25.8%	675.8	4.93
6/30/11	970.7	3,639.0	26.7%	687.3	5.29
6/30/12	1,135.5	4,122.4	27.5%	697.1	5.91
6/30/13	1,288.5	4,392.9	29.3%	706.6	6.22
6/30/14	1,280.9	4,707.0	27.2%	734.0	6.41
6/30/15	1,362.0	4,680.7	29.1%	764.2	6.12
6/30/16	1,532.9	5,039.8	30.4%	791.5	6.37
6/30/17	1,715.5	5,385.8	31.9%	829.7	6.49
6/30/18	1,910.2	5,839.7	32.7%	863.2	6.76
6/30/19	2,169.7	6,389.0	34.0%	888.0	7.20
6/30/20	2,377.9	6,785.6	35.0%	966.4	7.02
6/30/21	2,816.4	7,598.8	37.1%	976.5	7.78
6/30/22	3,248.4	8,281.9	39.2%	1,045.6	7.92
6/30/23	3,583.0	8,796.3	40.7%	1,100.6	7.99



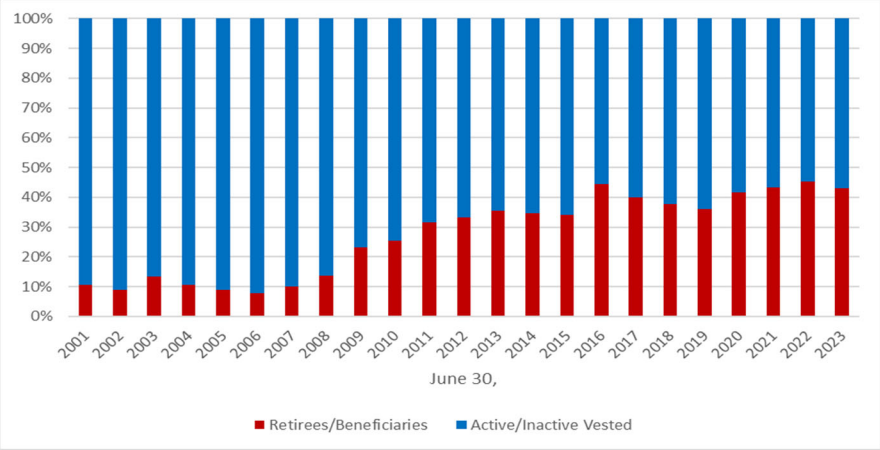
JRS Members
($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$96.9	$188.6	51.4%	$29.7	6.34
6/30/02	87.0	188.4	46.2%	25.8	7.30
6/30/03	111.8	206.8	54.0%	25.4	8.14
6/30/04	105.9	210.0	50.4%	25.7	8.17
6/30/05	137.6	272.9	50.4%	32.2	8.47
6/30/06	134.3	273.0	49.2%	34.1	8.01
6/30/07	143.6	284.0	50.6%	29.7	9.56
6/30/08	155.2	338.7	45.8%	33.7	10.04
6/30/09	171.0	330.6	51.7%	36.2	9.13
6/30/10	182.0	364.1	50.0%	36.7	9.92
6/30/11	198.8	400.3	49.7%	45.8	8.75
6/30/12	205.3	437.9	46.9%	45.1	9.70
6/30/13	224.1	453.1	49.5%	47.0	9.65
6/30/14	216.0	464.9	46.5%	47.9	9.71
6/30/15	210.0	468.9	44.8%	49.7	9.44
6/30/16	244.5	501.1	48.8%	53.0	9.46
6/30/17	245.2	523.7	46.8%	55.9	9.38
6/30/18	258.3	547.7	47.2%	54.5	10.05
6/30/19	269.9	586.5	46.0%	57.9	10.13
6/30/20	299.1	592.5	50.5%	60.1	9.86
6/30/21	308.1	642.2	48.0%	62.7	10.24
6/30/22	351.1	676.9	51.9%	67.3	10.05
6/30/23	372.6	728.1	51.2%	72.7	10.01



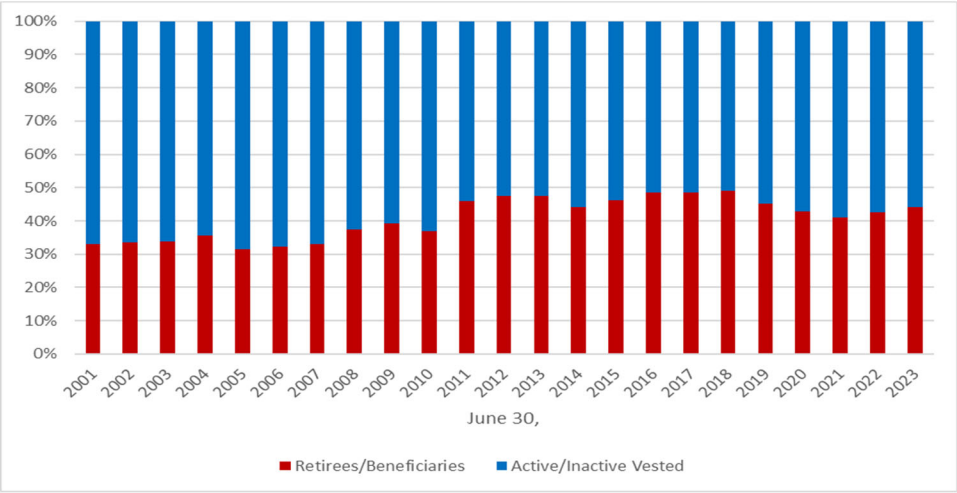
PARF Members
($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$2.2	$20.4	10.6%	$13.6	1.50
6/30/02	2.0	22.4	8.8%	14.4	1.55
6/30/03	2.1	15.7	13.3%	13.2	1.19
6/30/04	2.4	22.6	10.7%	15.1	1.49
6/30/05	2.3	25.7	8.9%	16.7	1.55
6/30/06	2.3	29.2	7.7%	19.2	1.52
6/30/07	3.2	32.1	10.0%	18.1	1.77
6/30/08	5.2	38.1	13.6%	20.6	1.85
6/30/09	10.4	44.6	23.3%	20.8	2.15
6/30/10	12.6	49.2	25.5%	21.0	2.34
6/30/11	16.8	53.3	31.6%	18.1	2.95
6/30/12	18.7	56.1	33.3%	21.7	2.58
6/30/13	22.0	61.9	35.5%	21.2	2.92
6/30/14	22.7	65.3	34.7%	21.4	3.05
6/30/15	26.6	77.9	34.2%	22.0	3.54
6/30/16	37.7	85.0	44.3%	22.2	3.83
6/30/17	38.5	96.7	39.8%	23.5	4.11
6/30/18	39.0	103.3	37.8%	22.0	4.69
6/30/19	39.6	110.1	36.0%	22.4	4.92
6/30/20	44.4	107.0	41.5%	24.8	4.32
6/30/21	50.8	117.0	43.4%	24.9	4.70
6/30/22	55.5	122.5	45.3%	25.4	4.82
6/30/23	54.5	126.7	43.0%	27.5	4.61



EG&C Members
($ Millions)

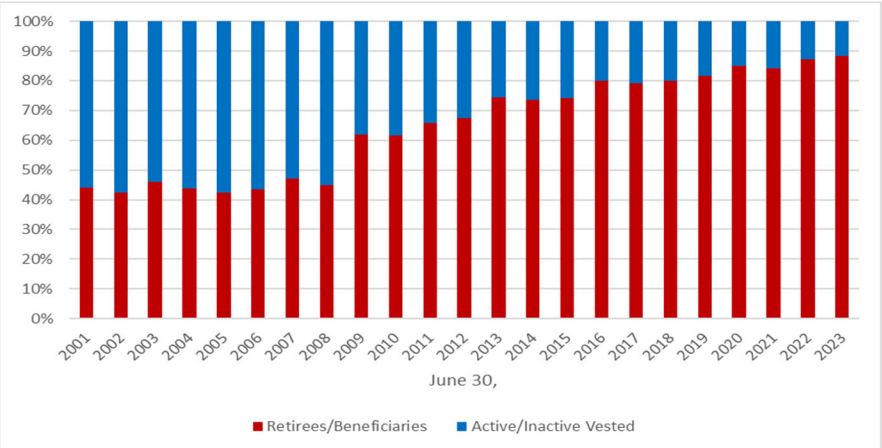
Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$17.1	$52.0	32.9%	$12.5	4.17
6/30/02	18.8	55.9	33.6%	12.7	4.42
6/30/03	17.6	52.0	33.9%	11.9	4.35
6/30/04	17.8	50.0	35.6%	10.2	4.90
6/30/05	18.9	60.0	31.5%	13.2	4.53
6/30/06	20.9	64.8	32.2%	14.9	4.35
6/30/07	24.6	74.5	33.0%	17.7	4.20
6/30/08	28.9	77.2	37.4%	21.3	3.62
6/30/09	35.0	89.3	39.2%	25.2	3.54
6/30/10	36.0	97.9	36.8%	26.7	3.66
6/30/11	46.7	101.5	46.0%	24.0	4.23
6/30/12	53.9	113.3	47.6%	25.8	4.40
6/30/13	56.0	118.1	47.4%	26.2	4.51
6/30/14	54.6	123.6	44.2%	26.7	4.64
6/30/15	61.5	132.8	46.3%	25.8	5.15
6/30/16	67.4	139.0	48.5%	26.2	5.31
6/30/17	69.2	142.6	48.5%	28.1	5.07
6/30/18	68.8	140.1	49.1%	30.1	4.65
6/30/19	68.7	152.2	45.1%	34.1	4.46
6/30/20	70.4	164.0	42.9%	33.4	4.91
6/30/21	74.4	180.8	41.1%	34.1	5.31
6/30/22	79.6	187.5	42.5%	33.2	5.65
6/30/23	85.9	194.8	44.1%	35.5	5.49



LE DB Members

($ Millions)

Fiscal Year End	Retiree Liability (a)	Total Actuarial Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/01	$2.4	$5.5	44.1%	N/A	N/A
6/30/02	2.3	5.5	42.3%	N/A	N/A
6/30/03	2.3	4.9	46.0%	N/A	N/A
6/30/04	2.1	4.9	43.8%	N/A	N/A
6/30/05	2.1	5.0	42.4%	N/A	N/A
6/30/06	2.3	5.2	43.4%	N/A	N/A
6/30/07	2.4	5.2	47.0%	N/A	N/A
6/30/08	2.3	5.0	44.8%	N/A	N/A
6/30/09	3.1	5.1	61.9%	N/A	N/A
6/30/10	3.0	4.9	61.5%	N/A	N/A
6/30/11	3.0	4.6	65.7%	N/A	N/A
6/30/12	3.0	4.5	67.3%	N/A	N/A
6/30/13	3.2	4.3	74.3%	N/A	N/A
6/30/14	3.1	4.2	73.7%	N/A	N/A
6/30/15	3.2	4.3	74.2%	N/A	N/A
6/30/16	3.2	4.0	79.9%	N/A	N/A
6/30/17	3.0	3.8	79.2%	N/A	N/A
6/30/18	2.8	3.5	79.9%	N/A	N/A
6/30/19	2.7	3.4	81.7%	N/A	N/A
6/30/20	2.7	3.1	84.9%	N/A	N/A
6/30/21	2.6	3.0	84.2%	N/A	N/A
6/30/22	2.5	2.8	87.3%	N/A	N/A
6/30/23	2.4	2.7	88.2%	N/A	N/A



QUALITATIVE ANALYSIS

ASOP 51 provides that the assessment of risk does not necessarily have to be quantitative but may be qualitative. This report will provide quantitative analysis in a later section, but first we will discuss the overall assessment of risk for INPRS from a qualitative perspective.

(1) INPRS Funding Policy

INPRS has eight plans, each funded with a separate contribution approach. Some funds receive member contributions as set by legislation. For the state-appropriated funds (TRF Pre-'96 Fund, JRS, PARF, and LE DB), the Board recommends the contribution amounts to the Indiana Legislature. For the remaining funds (PERF, TRF '96, '77 Fund, and EG&C), the Board sets the employer contribution rates.

In broad terms, the first step in determining the contribution rate or amount is based on considering the normal cost plus the amortization of the Unfunded Actuarial Accrued Liability (UAAL). The amortization method creates a new layer of UAAL each year that is amortized over a closed 20-year period (TRF Pre-'96 and LE DB are exceptions since they have no new entrants) as a level dollar amount. Should a plan be over 100% funded, the surplus is amortized over an open 30-year period.

Where the INPRS Board sets the employer contribution rates, the Board Policy Contribution Rate remains unchanged from the prior year unless the actuarial contribution rate is higher, in which case the rate is increased to that level. If the funded ratio exceeds 95%, the Board Contribution Policy Rate is reduced 25% of the way from the current rate to the actuarially determined contribution rate. Once the funded ratio exceeds 110%, the contribution rate will be set at the actuarially determined contribution rate plus the surcharge rate for supplemental benefits.

The basic funding approach adopted by the INPRS' Board has some very positive features. Using level-dollar amortization is more conservative than the level-percent of payroll amortization method used by many public plans. The level-percent amortization method results in amortization payments that increase each year by an expected payroll growth. This results in lower payments initially, but higher payments later when payroll is larger. The level-dollar amortization method pays down the UAAL at a faster rate, partly by being more expensive (as a rate of pay) in the early years. While this is a conservative approach, some would argue that by not funding in a level manner, the current generation of contributors (employers and ultimately taxpayers) are paying more than their share while future generations will pay less. This is a public policy decision, not an actuarial decision. Further discussion of how this reduces risk is contained in later sections of this report.

A second positive feature for the PERF, TRF-'96, '77 Fund, and EG&C is the policy of maintaining the current contribution rate until the Funds have a funded ratio of at least 95%. At 110%, the contribution rate will be reduced completely to the actuarially determined rate for base and supplemental benefits. This approach creates contribution stability and predictability which are often desired by employers, and also serves to accelerate funding progress. As with the level-dollar amortization method, more rapid funding now means that the stakeholders currently contributing are doing so to the benefit of those to come (if all assumptions are met).

TRF Pre-'96 is an exception to the general funding approach. Historically, this Fund was operated as a pay-as-you-go program rather than as a funded plan. With the creation of a new,

funded plan for teachers in 1996, the strategy is to now gradually build up assets that will fund the remaining benefit payments. To meet this goal, annual allocations are currently being increased 3% each year. Once the allocations exceed current benefit payments, the allocations will be reduced to the annual benefit needs until sufficient assets are available to pay the remaining benefits. While the Fund is closed and gradually winding down, there is still a long period during which benefits will be paid. This issue is discussed further later in this report.

(2) Legal Obligation to Make Contributions and Historical Contributions

There is a direct correlation between healthy, well-funded retirement systems and consistent contributions equal to the full actuarial contribution rate each year. Indiana has exhibited a commitment to making the actuarially determined contributions, or, for the TRF Pre-'96 Fund, developed and implemented a strategy to systematically fund the obligations. Part of this commitment is that the majority of employers (in PERF, TRF-'96, and the '77 Fund) are legally obligated to pay the contribution rate set by the INPRS Board. Plan sponsors who have frequently chosen to defer funding are finding themselves facing some very challenging times, with increased risk and uncertainty in the future.

(3) Benefit Design Features

INPRS covers several distinct groups of members, and so it is not surprising that the benefit designs for the various groups have correspondingly distinct features. In this section, we wish to discuss three of these features that are especially interesting from a risk analysis perspective:

- post-retirement benefit adjustments,
- DROP benefits, and
- the options for election within the PERF and TRF hybrid plans.

We stress again that risk is not inherently good or bad, so the presence of a feature that alters a Fund's risk profile does not mean that the feature is good or bad, either.

Post-retirement Adjustments: One of the most significant and fundamental intents of a retirement plan is to provide an income stream for those people who have retired at the end of a career. For purchasing power of that income stream to be maintained throughout a retiree's lifetime, the amount of income must also increase through time to mitigate the impact of inflation. There are various ways in which this can be accomplished, including as an automatic adjustment, as a periodic plan sponsor initiative, or by some other mechanism outside the plan.

The '77 Fund and JRS provide for the impact of inflation by providing an automatic Cost-of-Living-Adjustment (COLA) as part of the benefit structure. The '77 Fund links the increase to actual inflation (not to exceed 3%), while the JRS increase is linked to the increase in the salary for actively employed judges and magistrates. Because these COLAs are set in statute, the contribution rate is calculated reflecting future expected COLAs, i.e., they are pre-funded. Predictable, pre-funded COLAs tend to create less risk than those that are granted on an *ad hoc* basis, particularly if there is no offsetting funding. Further, the 3% cap on the '77 Fund reduces the risk to the Fund that would result from high inflation. Not only do inflation and salary increases tend to move together over the long run, but there is also some tendency for nominal investment returns to also increase with inflation. This means that when inflation is higher and the COLAs are larger, the investment return may also be larger, helping to offset the impact of the larger-than-expected COLAs. Of course, a low-inflation environment will

have lower COLAs, helping mitigate the impact of lower investment returns.

The remaining funds (except PARF which is an "excess" benefit over the PERF benefit) do not have a statutory COLA, but for many years have provided retirees with a "13th check" based on years of service or a one-off COLA. Prior to 2019, this 13th check required legislative approval each biennium, but has not generally separately been funded as part of the legislation, although the use of a post-retirement increase assumption meant that sufficient pre-funding was occurring. In the 2018 legislative session, a new mechanism for providing post-retirement benefits was developed. Funding for these benefits is provided by an allocation of lottery proceeds (to be used for TRF Pre-'96 and the other funds as needed) and by a supplemental benefit funding rate set by the INPRS Board. This supplemental rate was up to 1% of pay and was initially set with an equal reduction in the employer contribution rate so the total employer rate was unchanged. The Legislature may grant post-retirement benefits (such as a 13th check or a permanent increase) to members of all the funds as long as the INPRS Board certifies that each Supplemental Reserve Account (SRA) has sufficient funds to pay the benefit obligation, including future years if a permanent increase is granted. In 2024, HEA 1004 was passed which provided requirements for funding certain benefits along with constraints on the increase in the contribution rate allocated to the SRA, but also removed the 1% of pay cap.

Because SRA funding has just begun, there is minimal history regarding the type of benefits that will be proposed or granted, or how much funding will be accumulated. HEA 1004 provides for funding toward a combination of 13th checks and COLAs but does not actually provide for any benefits yet. However, there are some observations that can be made regarding risk. First, because any additional benefit must be funded from assets already accumulated, the risk of unfunded benefits is reduced. Second, the granting of additional benefits is not currently directly tied to inflation or any other uncontrolled variable, which also limits risk. Finally, depending upon the pattern of benefits granted and because active payroll and lottery funds are being used to fund benefits for current retirees, it is possible that the SRA contributions could vary year to year (there is a cap on increases through 2030), providing a minor source of volatility.

DROP benefits: Under a Deferred Retirement Option Program (DROP), active members may elect to have their retirement benefits commence without actually ending employment. During the time they continue to be actively employed, the benefit payments are accumulated within the trust, and then the accumulation is paid as a lump sum when employment ends. Any additional service and pay during the DROP period do not result in a revision of the retirement benefit. There are additional parameters governing the program, but they are not relevant to this discussion. Within INPRS, the '77 Fund and EG&C have this provision.

Because the DROP benefit is a plan provision, it is anticipated in the funding requirements. Of course, to the extent that actual behavior differs from expected, there could be actuarial gains or losses. A frequent goal of these benefits is to encourage long-time employees to continue to work, especially when there is a service cap in place (as is the case for the '77 Fund, for example). Some of the benefits may be external to the retirement system, including retaining expertise, maintaining staffing levels, non-retirement benefit costs, etc., but there can be a cost impact for retirement systems. In the case of an individual incented to remain in employment rather than retire, the Fund receives additional contributions during the DROP period without any increase in benefits paid. Conversely, consider someone who was intending to retire at a target age past their service cap. If this person enters DROP at the

service maximum and leaves DROP at the target age, the system receives no additional funding compared to the no-DROP option, but still pays more benefits than it would have. Since the behavior in the absence of the DROP is unknowable, the actual cost or savings of a DROP cannot be determined. Because of the uncertainty, DROP, like any retirement assumption, is inherently a risk, and actuarial experience may be either favorable or unfavorable depending upon what individuals choose to do.

Plan Election and Hybrid Features: The PERF and TRF plan designs provide that member contributions are directed into a Defined Contribution (DC) plan and the employer contributions fund a Defined Benefit (DB) plan. New employees may now elect the MyChoice option which is a DC-only benefit structure in which a portion of the employer contribution is allocated to the member DC account and the rest goes to the DB plan to fund the UAAL. (Some employers have elected to offer only the original DB/DC hybrid or only the MyChoice plan.) This choice option has some risk implications.

First, for every person who is in the DC-only plan, the retirement risks (e.g., investment return, longevity, and inflation) have been transferred from the employer to the individual, thus reducing the PERF and TRF plan risks. (While this risk transfer is most likely not a net-zero transaction with the member taking on more risk than the Fund gives up, we are focusing only on the Funds' risk in this report.) Thus, increased DC plan participation will most likely reduce DB plan risk. The funding mechanism, however, is such that the employer will pay the same contribution rate toward the UAAL amortization regardless of the member election. This avoids any incentive for the employer to influence an employee's decision. Nonetheless, some employers have opted to provide some or all employees with only the DB-DC hybrid plan or only the DC plan.

A second consideration is that members may elect the DB or DC plan based partly on their perceived employment patterns. Those who expect to retire at younger ages may find that the DB plan is a better fit, while those who do not expect to remain in covered employment long may choose the DC plan. In this case, the DB plan is selected by those for whom the cost is higher than average, while the DC plan is selected by those for whom the value of the DC contributions upon termination will be more valuable than the DB benefit. This adverse selection could result in an increase in the normal cost rate for the DB plan, which in turn also would increase the contributions to the DC accounts. While this is theoretically a risk, the magnitude of the risk is limited by the fact that most new employees do not know how their career will unfold, nor are most of them likely to perform such a detailed mathematical analysis.

Finally, we note that because MyChoice is still a relatively new feature, the utilization over time is not known. To the extent that it is utilized, the active membership of the DB funds will be lower than it would have been. For many systems, this would be a concern because the UAAL is amortized as a level percentage of payroll which typically requires a constant population for the funding model to work properly. For INPRS, this is not as much of an issue because the UAAL payment is calculated as a level dollar amount and is collected on all payroll (DB and DC plans).

QUANTITATIVE ANALYSIS

There are a number of risks inherent in the funding of a defined benefit plan. These include:

- demographic risks such as mortality, payroll growth, aging population including the impact of baby boomers, and retirement ages;
- economic risks, such as investment return and inflation;
- contribution risk, i.e., the potential for contribution rates to be too high for the plan sponsor/employer to pay; and
- external risks such as the regulatory and political environment.

The various risk factors for a given system can have a significant impact – favorable or unfavorable – on the actuarial projection of liabilities and contribution rates. Under ASOP 51, the actuary is required to include plan-specific commentary regarding the risks that are identified. However, such comments can be qualitative rather than quantitative. In this section of the report, we include quantitative analysis to assist with a deeper understanding of some of the key risks for INPRS.

Demographic Risks

Demographic risks are those arising from the actual behavior of members differing from that expected based on the actuarial assumptions. These changes may arise when a significant portion of members are influenced to take some particular action due to employer or governmental actions, when there are improvements in medicine that affect broad groups of retirees, when societal trends encourage new behavior, or they may simply be random. Examples include early retirement windows, new drugs to treat common diseases, or trends across society to work longer before retiring. Many of these risks are minor in nature since they unfold gradually and generally have a small impact on a retirement system. Some, however, are comparatively more significant and warrant additional discussion.

Mortality Risk

A key demographic risk for all retirement systems, including INPRS, is improvement in mortality (longevity) greater or less than anticipated because benefits are paid for members' lifetimes. While the actuarial assumptions used in the valuation reflect small, continuous improvements in mortality experience each year, and these assumptions are evaluated and refined in every experience study, the risk arises because there is a possibility of some sudden shift, perhaps from a significant medical breakthrough that could quickly impact life expectancy and increase liabilities. Likewise, there is some possibility of a significant public health crisis that could result in a significant number of additional deaths in a short time period, which would also be significant, although more easily absorbed.

To evaluate the impact of such sudden shifts in life expectancy, we calculated Actuarial Accrued Liability (AAL) for all plans based on a ten percent increase or decrease in the base mortality rates in one given year, with the current mortality improvement assumption applying in future years. As we would expect, increasing mortality rates (decreasing life expectancy) results in a decrease in AAL, while decreasing mortality rates (increasing life expectancy) increases AAL, as shown in the following table.

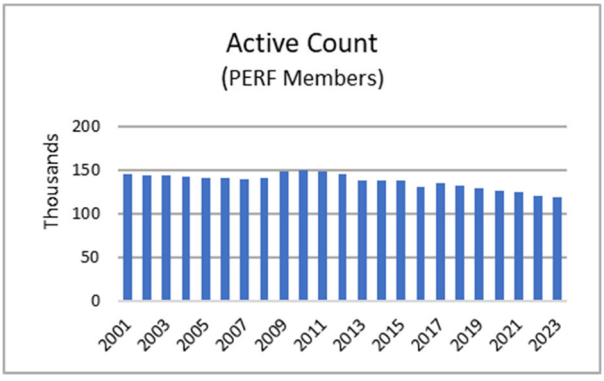
Actuarial Accrued Liability Increase/(Decrease)	Base Rates Down 10%	Base Rates Up 10%
PERF	2.4%	(2.2%)
TRF '96	1.5%	(1.4%)
TRF Pre-'96	2.6%	(2.4%)
'77 Fund	2.0%	(1.8%)
JRS	3.2%	(2.8%)
EG&C	1.8%	(1.7%)
PARF	2.0%	(1.8%)
LE DB	4.4%	(4.0%)

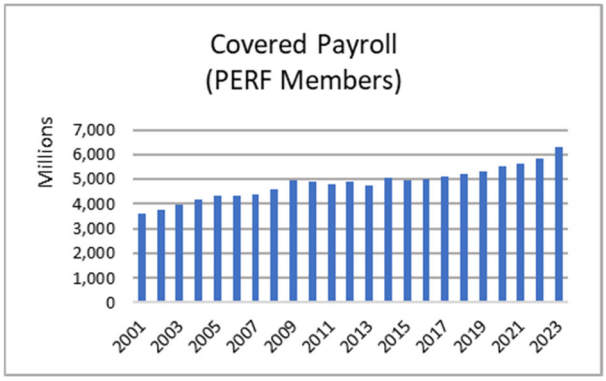
In general, we see that a 10% change in mortality rates, in either direction, has an impact on AAL between 1% to 5%. It should be noted that even if an event occurs that has the potential to significantly shift mortality rates, it can take some time before we know if mortality rates and/or mortality improvements are reflected. For example, the COVID-19 pandemic was a significant cause of death for calendar year 2020 and beyond. As a result, the Society of Actuaries (SOA) has not updated their mortality improvement scale while waiting to see whether there will be permanent changes to mortality patterns.

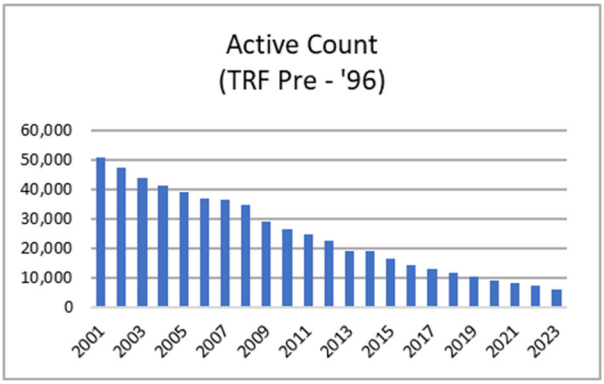
Active Population Growth or Decline Risks

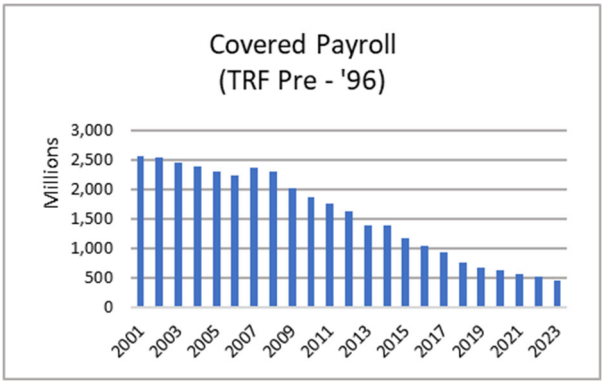
Valuations consider the data on a single date and do not directly reflect future members. However, in reality, if the active membership increases or decreases, it will lead to decreases or increases in the actuarial contribution rate (but not the dollar amount) needed to fund the UAAL. Additionally, as discussed earlier in the report, there could be some implications for PERF and TRF '96 if the population demographics are changing due to selection of the MyChoice option.

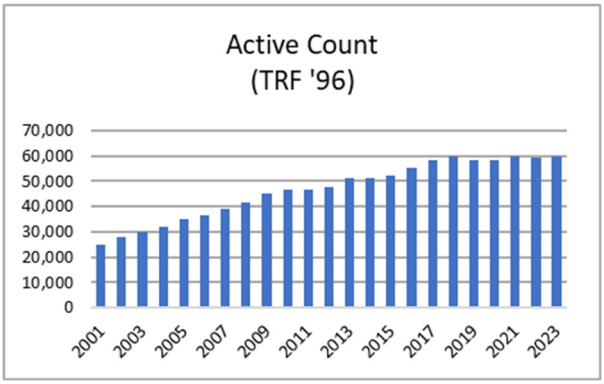
The following graphs show the historical count and covered payroll for active members in each fund. The historical patterns are helpful in evaluating the risk ahead. Where there is relatively stable payroll, for example, we would expect a reasonably stable UAAL contribution rate. TRF '96 has increasing active membership (as TRF Pre-'96 is declining) which should help reduce the likelihood of the UAAL rate increasing (and actually lead to a decreasing rate), independent of other considerations. For plans showing reasonably steady populations and modest payroll growth, we would expect fairly stable contribution rates if all other assumptions are met.

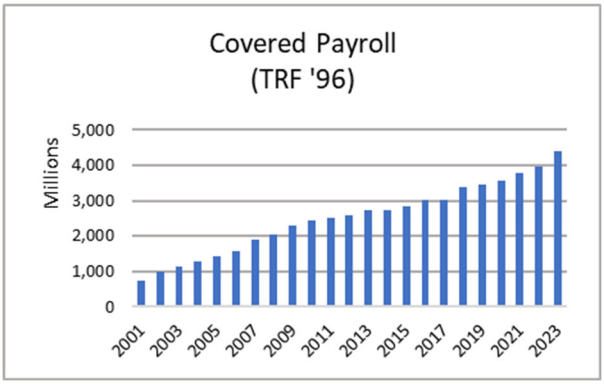


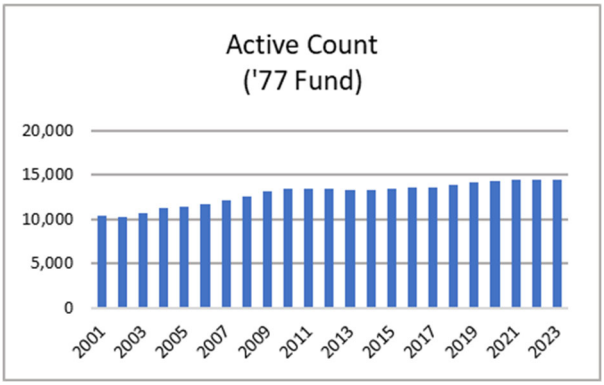


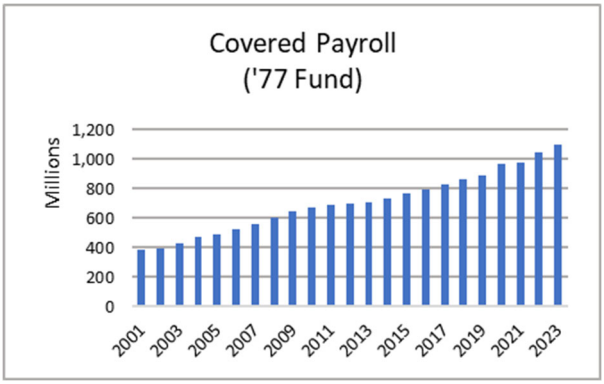

Active Count
(TRF Pre - '96)
60,000
50,000
40,000
30,000
20,000
10,000
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

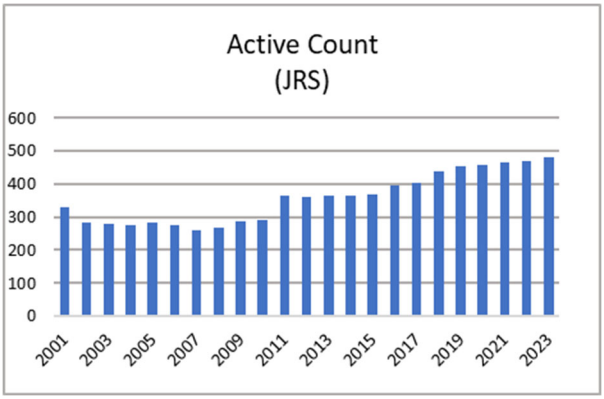

Covered Payroll
(TRF Pre - '96)
Millions
3,000
2,500
2,000
1,500
1,000
500
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

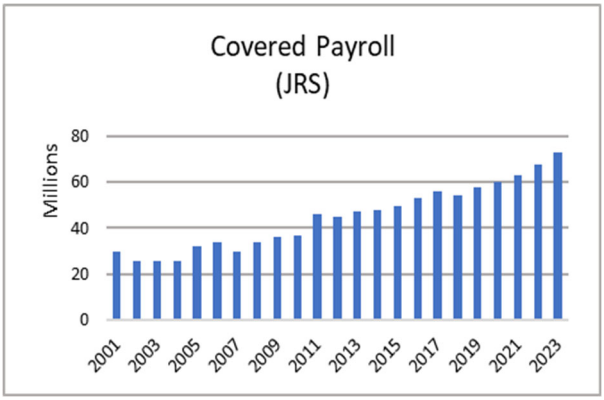

Active Count
(TRF '96)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

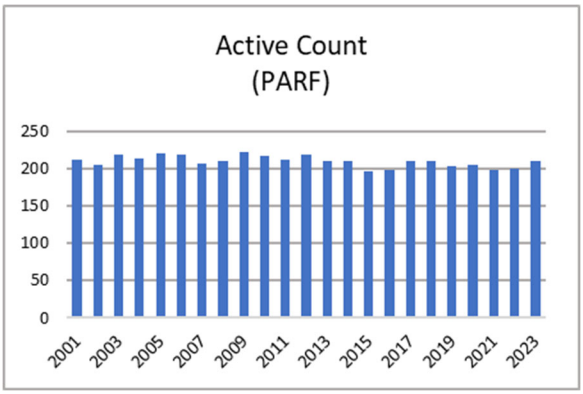

Covered Payroll
(TRF '96)
Millions
5,000
4,000
3,000
2,000
1,000
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

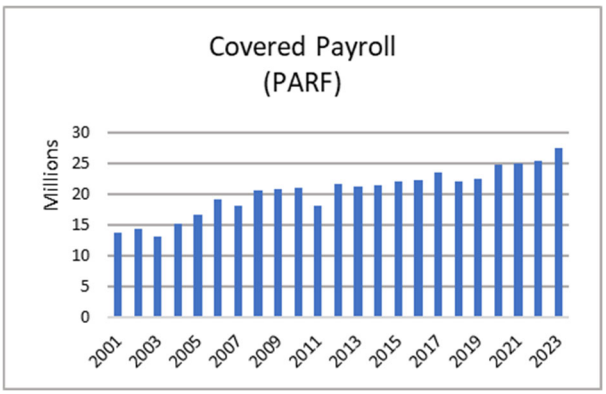

Active Count
('77 Fund)
20,000
15,000
10,000
5,000
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

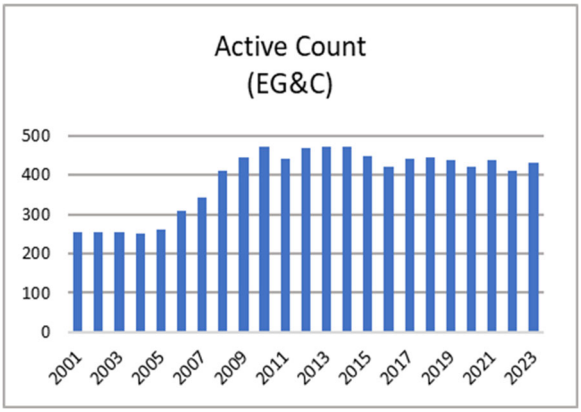

Covered Payroll
('77 Fund)
Millions
1,200
1,000
800
600
400
200
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

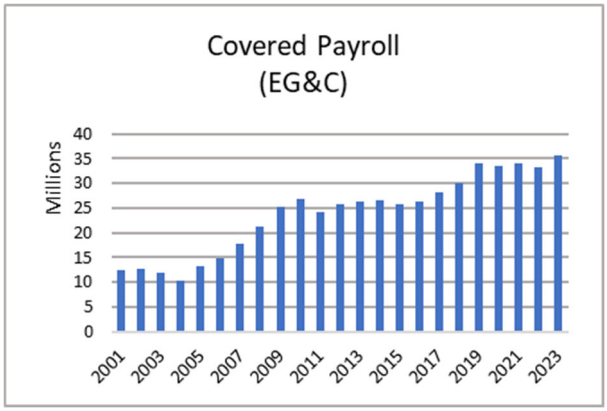

Active Count
(JRS)
600
500
400
300
200
100
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023

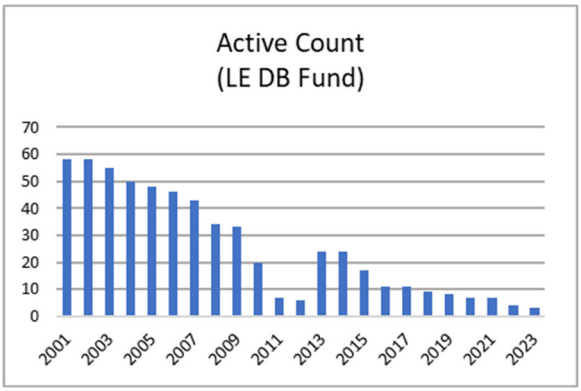

Covered Payroll
(JRS)
Millions
80
60
40
20
0
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021 2023











A decline in INPRS active membership could occur for a number of reasons, but the risk is likely different for each of the eight funds. Of course, a decline is expected for TRF Pre-'96 since it is closed, and new teachers participate in TRF '96. Other events that could arise in the future include such things as the state of Indiana experiencing severe and prolonged fiscal challenges that would lead to a reduction in the number of state PERF employees. Alternatively, if there is a decline in the student population, it could reduce the need to maintain the current level of teachers. Regardless of the cause of the decline, a substantial decrease in the active membership could pose a risk to the stability of contribution rates, even if the contribution dollar amounts are more stable or even declining.

While INPRS avoids some of this risk by amortizing the UAAL as a level dollar amount, declines in active population still lead to higher contribution rates. Referring to the maturity measures shown earlier in the report, it should be evident that lower payroll will increase the Asset Volatility Ratio. Of

course, an increase in active membership would decrease the actuarial contribution rate and Asset Volatility Ratio and reduce the actuarial contribution rate volatility.

Rate of Retirement Risk

Another key demographic risk for retirement systems, including INPRS, is the rate at which members are expected to retire. Here we consider the risk due to a shift in rates that is sustained rather than an isolated year with unusual experience. For example, a significant change in the Social Security or Medicare programs could result in a material change in retirement patterns.

To evaluate the impact of shifts in rates of retirement, we calculated Actuarial Accrued Liability (AAL) for the PERF, TRF and '77 Fund plans based on adjusting the rates of retirement for unreduced benefits by factors of 0.5 (a significant delay in retirement) or 1.5 (a significant acceleration in retirement). As we would expect, increasing rates of retirement result in an increase in AAL, while decreasing rates of retirement decreases AAL, as shown in the following table.

Actuarial Accrued Liability Increase/(Decrease)	**PERF**	**TRF '96**	**TRF Pre-'96**	**'77 Fund**
Unreduced Rates x 1.5	1.4%	2.3%	0.6%	2.9%
Unreduced Rates x 0.5	(2.8%)	(5.1%)	(1.2%)	(5.6%)

Changes to retirement and termination rates are likely to occur through time as the nature of the workforce and societal expectations shift. For instance, over the past decade or so, we have observed a general shift in retirement patterns in which retirements are occurring later. This may be a function of economic considerations, expectations of longer life in retirement, a proportionate decrease in physically-demanding jobs, or changes in family composition. Such changes do affect the funding of the plan, but generally these changes are minor and gradual and are reflected in modified assumptions resulting from regular experience studies.

The issue of retirement patterns deserves some additional comments. Generally speaking, if retirement occurs later, the cost of the benefits decreases. While later retirements may mean an individual's annual benefit is larger due to additional service and higher pay, the individual is also expected to receive the benefit for a shorter period of time, a net reduction in the actuarial liability in most cases. Further, the plan receives additional contributions during the years of additional employment. Thus, delaying retirement has a positive impact from a system funding perspective, while earlier retirement has a negative impact. As noted, there appear to be some broad trends toward later retirements, but there are some risks from retirement changes that might materialize in the shorter term. First, at times states or large political subdivision employers decide to provide some sort of incentive (inside or outside of the retirement plan) for employees to retire during a specified short period of time. These early retirement windows, while less common than they used to be, produce a sudden actuarial loss to the system. A second shock to a system could occur if there were a sudden change in the economic environment. In the years following the 2008 financial crisis, we observed many plans had lower numbers of retirees. For PERF and TRF where there is a significant DC component of the benefits for individuals, an economic downturn is likely to encourage a delay in retirement because the DC accounts are lower than expected, while a surge in the economy might spur earlier retirements. From INPRS perspective, the economic downturn risk is

moderated because the actuarial gain or loss from the retirement patterns would be a partial offset to the actuarial loss or gain on the asset portfolio.

In the same way that changing retirement patterns can affect INPRS as a whole, changes in DROP patterns also affect the '77 Fund and EG&C. Since DROP usually involves a multi-year commitment, behavioral changes will likely be less responsive to economic conditions. Changes in the utilization or the duration of participation in DROP are likely to unfold over time, allowing for gradual changes in assumptions as the trends are detected. Of course, special incentives to adjust behavior by an employer or as part of some change in plan provisions could lead to a short-term change, just as the early retirement windows affect retirement patterns. It is possible the Funds will see this with the new provision as part of the 2024 legislation that extends the DROP period from 3 to 5 years.

More significant changes in demographic assumptions are likely to be influenced by something significant such as a legislative change. Obviously, some changes in INPRS provisions or state employment rules could quickly change behavior patterns, but these would probably be anticipated as part of the legislation. Externally, a significant change in current Social Security or Medicare provisions could change retirement, as discussed earlier. Such changes cannot be easily quantified because the timing of such events, the impact of the event on behavior, and the magnitude of the behavior change cannot be reasonably anticipated.

Salary Risk

Another key demographic risk for retirement systems, including INPRS, is the increase in pensionable compensation year over year. While the salary increase assumptions are evaluated and refined in every experience study, the risk arises because salaries can increase at rates that differ from the stability of the actuarial assumption.

To evaluate the impact of a sudden salary increase, we calculated Actuarial Accrued Liability (AAL) for the PERF, TRF and '77 Fund plans based on a one-time salary increase of an additional 5% of pay. As we would expect, increasing salaries results in an increase in the AAL since future benefits are increased more than had been previously expected. This results in an increase in the Actuarially Determined Contribution Rate, which is slightly offset by an overall increase in covered payroll. Over time, given the same contribution rate, the additional payroll will bring in more contributions, but this is usually insufficient to offset the impact of the increased liability.

The results are shown in the following table:

	PERF	TRF '96	'77 Fund
Actuarial Accrued Liability Increase	1.7%	3.2%	2.5%
Actuarial Contribution Rate Increase	0.3%	0.5%	1.4%

Conversely, if salaries remain stagnant or increase less than expected, we expect to see a gain on the AAL versus expectations. This would result in an overall decrease in the Actuarially Determined Contribution Rate, even though the lower-than-expected covered payroll would push rates upward.

Investment Return Risk

Investment risk volatility is the greatest risk facing INPRS and most public retirement systems today. As the Funds continue to mature and move toward full funding, investment returns will have an increasingly greater impact on the needed contributions. When investment returns are below the expected return (investment return assumption), the unfunded actuarial accrued liability increases and additional contributions may be needed to fund the difference between the actual and expected return. Likewise, returns above the expected return, although easier to absorb, decrease the unfunded actuarial accrued liability and may reduce contributions. Because of the inherent volatility of the investment portfolios of most retirement system, there is, therefore, volatility in the funded status and contribution requirements.

In order to understand the impact of investment volatility, we analyze a series of projections, based upon a model prepared for INPRS as part of the valuation. These "deterministic" projections use one or more selected scenarios to help illustrate certain key concepts. Following these projections, we show a summary of the results of a "stochastic" projection in which 1,000 equally plausible random scenarios are run and summarized. It should be noted that in order to help identify how risk works for the plans with the Supplemental Reserve Accounts, we have assumed that the cost of the benefits provided has not changed. While the most likely scenario is that benefits would change in response to the actual state of events, making such an assumption as to how this would actually be implemented is speculative and will potentially distort the analysis.

Sensitivity Analysis

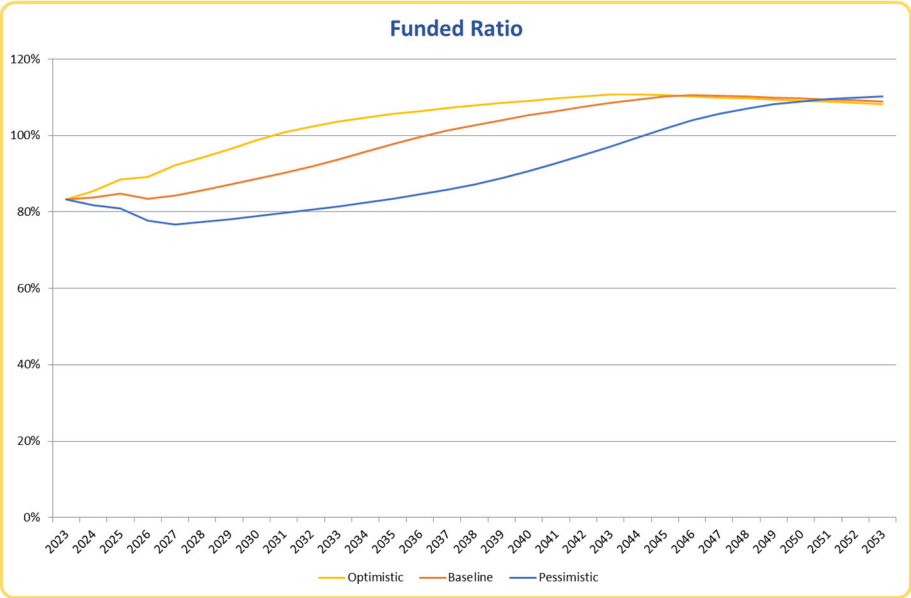
Rather than just changing the investment return assumption, we can analyze the investment risk by changing the entire set of economic assumptions to represent an optimistic or pessimistic outcome (anticipated in advance), similar to the forecasting used by the Social Security Administration. This allows a more complete picture of what might happen, rather than just examining the effects of changing a single variable at a time.

We assume that all assumptions are met in the future for each scenario. In particular, please note that this means that the payroll amounts, benefit payments, and actuarial liabilities are all varying, in contrast with other analyses in this report in which these amounts held constant. For this purpose, the following assumption sets were studied:

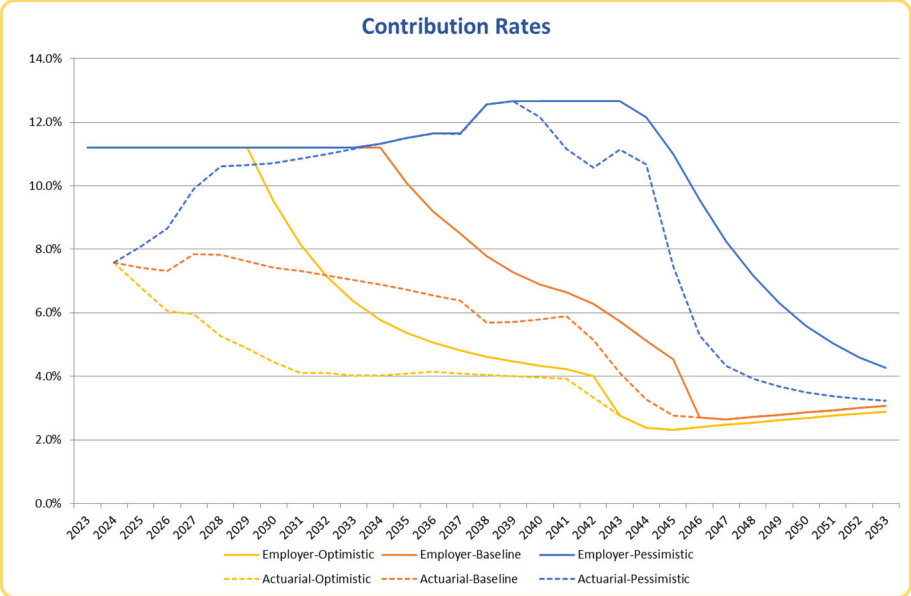
Assumption	Baseline (Valuation)	Pessimistic	Optimistic
Inflation	2.00%	1.50%	2.50%
Investment Return	6.25%	5.75%	6.75%
Wage Inflation	2.65%	2.15%	3.15%
COLA for ’77 Fund/JRS	1.95%/2.65%	1.45%/2.15%	2.45%/3.15%
Mortality	Valuation Basis	Base rates down 10%	Base rates up 10%

The graphs on the following pages compare the funded ratios and contributions for these three scenarios. The graphs for the contribution rate or amount include both the employer contribution rate or amount determined by the funding policy (shown on the solid line) and the actuarially determined contribution rate or amount (shown on the dotted line).

PERF

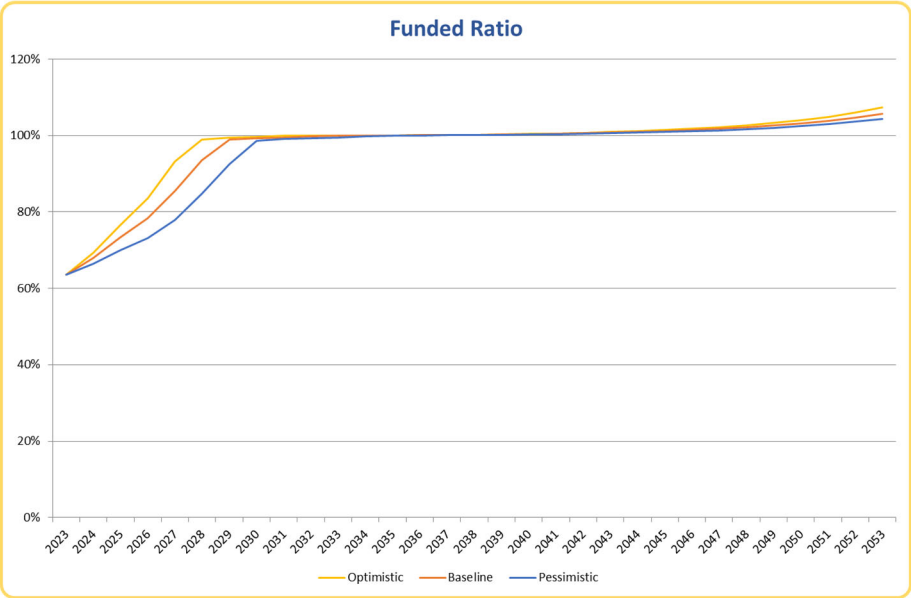


Due to the funding policy and current funded ratio, the funded ratio moves to around 100% over time. The pessimistic scenario takes significantly longer as a result of a higher actuarial liability, lower investment returns, and lower payroll upon which to fund the shortfall.

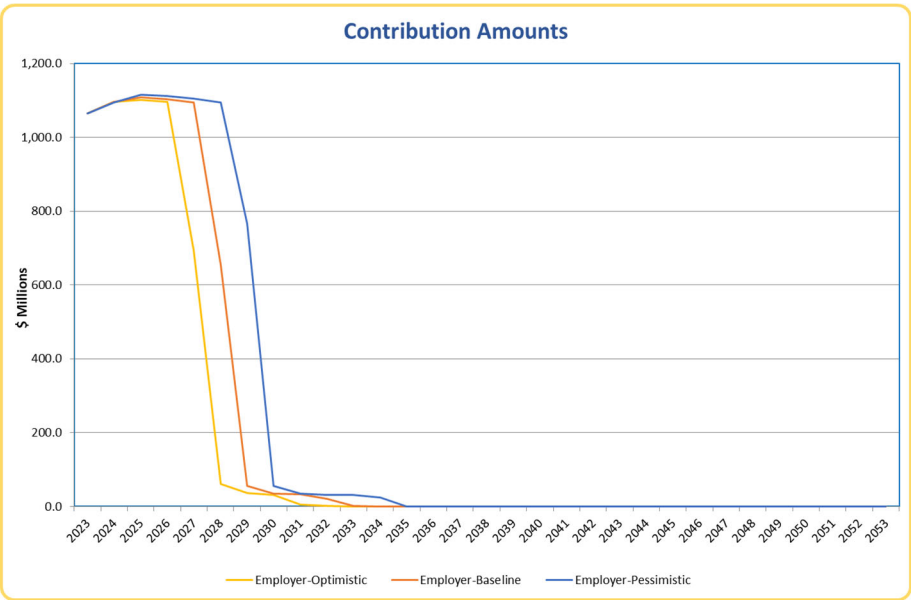


The most notable result is how the optimistic and pessimistic results change the point at which the contribution rates begin to decline. Note that because the payroll amounts are lower in the pessimistic scenario and higher in the optimistic scenario, the total contributions are not as different as the rates alone would suggest.

TRF Pre '96

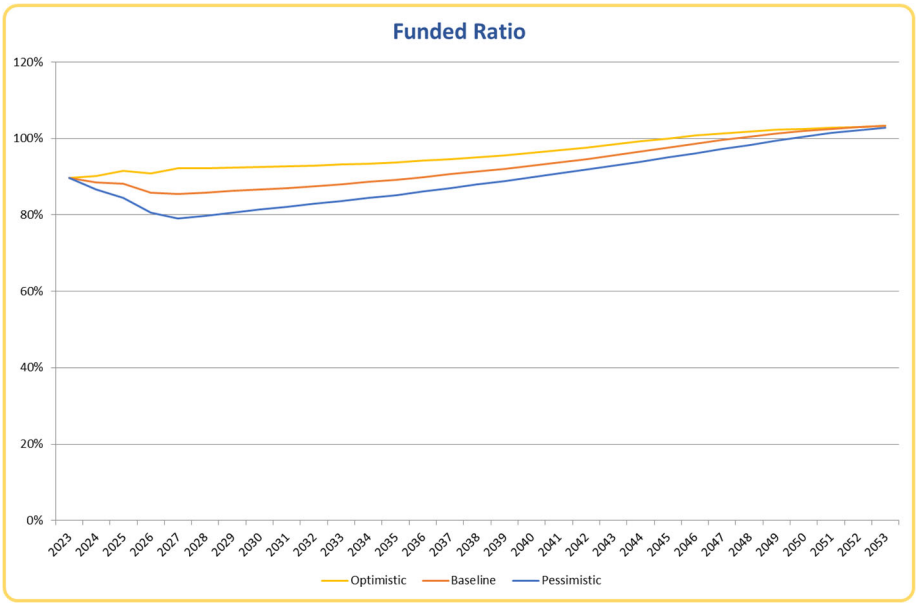


As discussed earlier, the funded ratio for TRF Pre-'96 is not as sensitive to the impact of investment returns. Further, the impact of payroll has limited impact on TRF Pre-'96 because the plan has been closed for over 20 years. These factors mean that the three scenarios are reasonably similar.

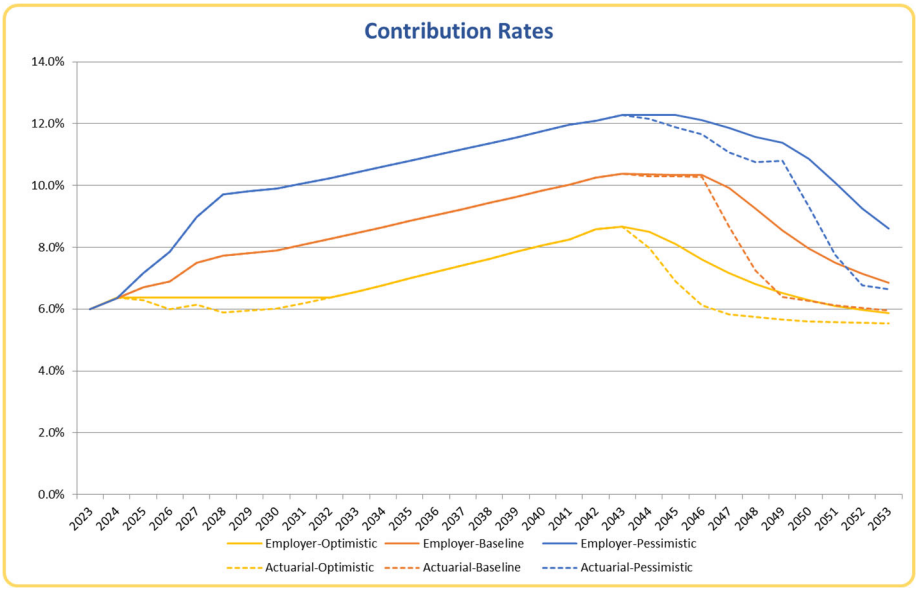


The investment returns over the short term affect by a year or two the point at which the plan is fully funded.

TRF '96

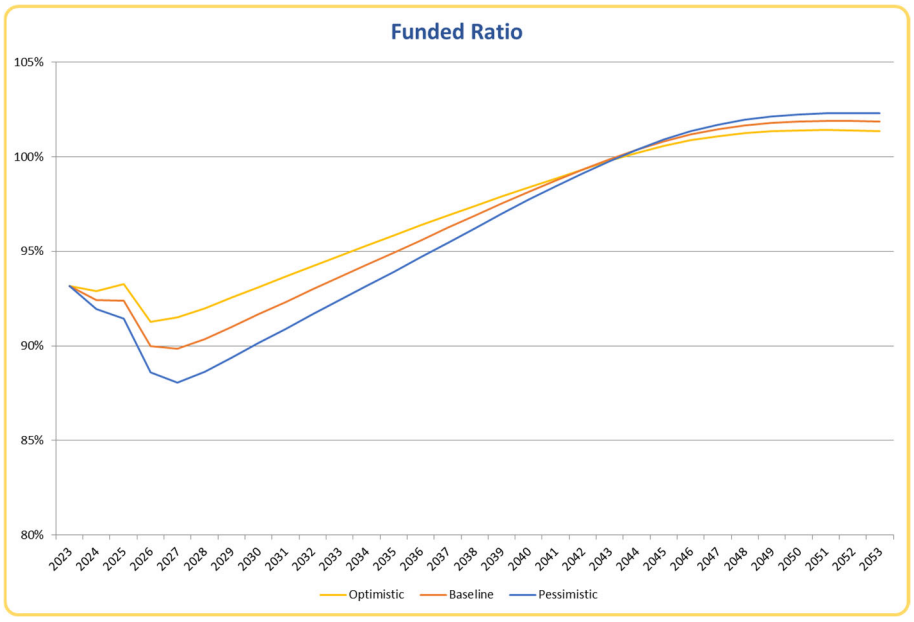


The funded ratio projections of TRF '96 are relatively stable across these scenarios, largely as a result of its currently strong funded status and contribution policy.

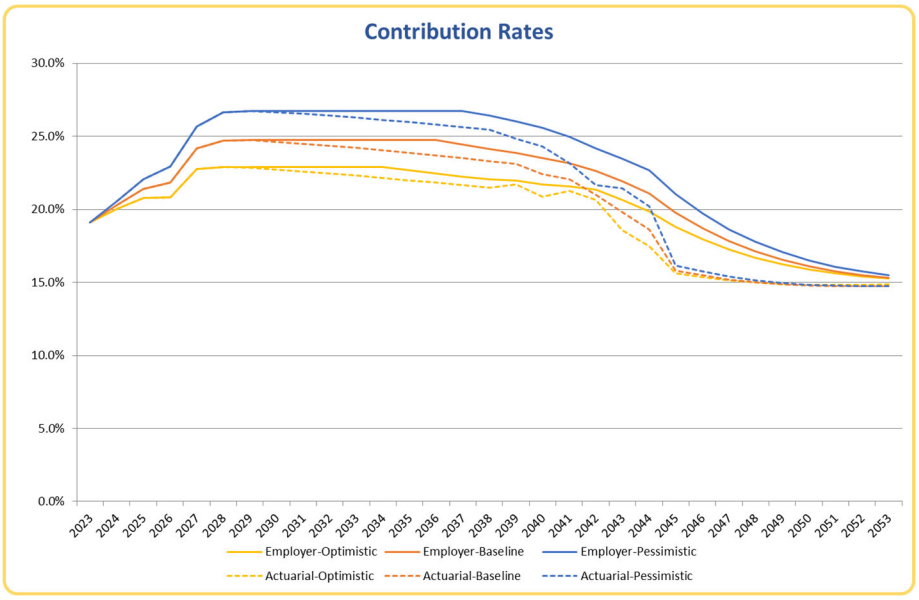


The contribution rates increase in all scenarios, in part due to the funding requirements of future post-retirement increases that are now required under HEA 1004.

’77 Fund

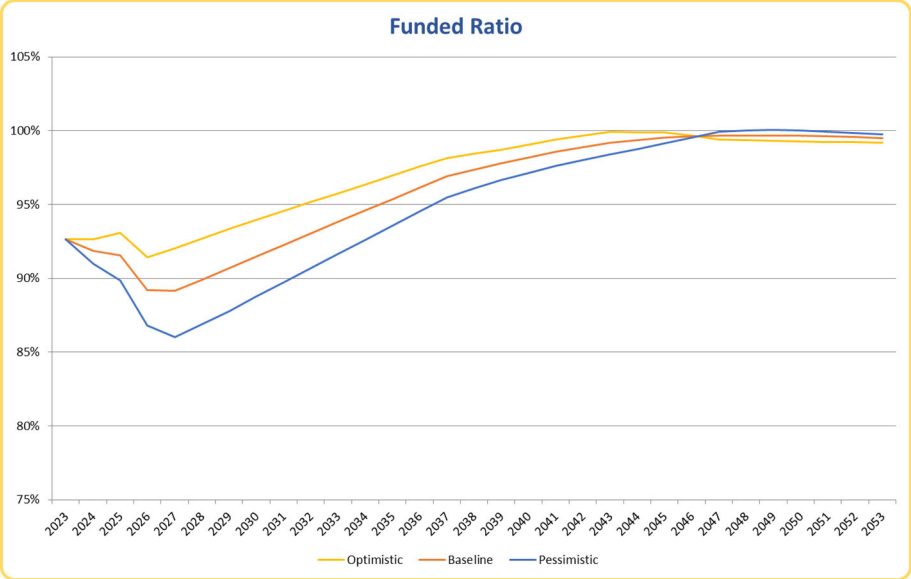


The ’77 Fund funded ratio is fairly robust across the various economic scenarios. The change in the COLA and salary scale assumptions largely offset the change in investment return assumption.

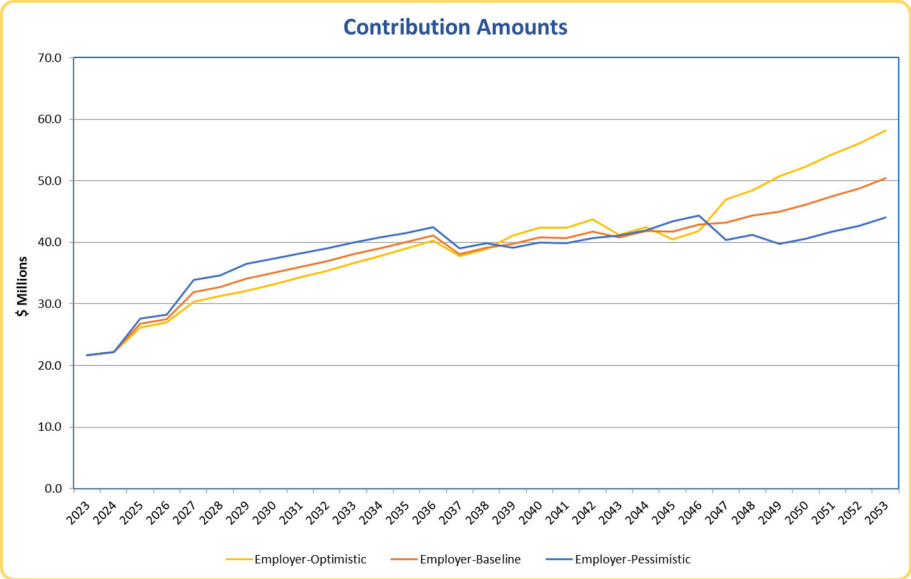


As noted for the funded status, the simultaneous changes of the COLA and salary scale along with the investment return assumption result in reasonably small variation in the contribution rates.

JRS

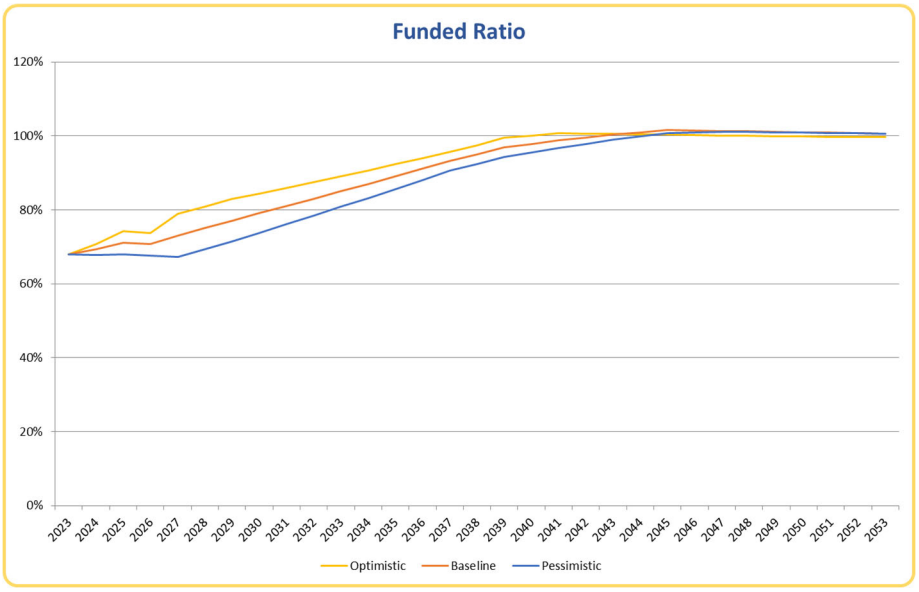


JRS exhibits much of the same stability in the funded ratio as seen in the '77 Fund because of the same impact of offsetting economic assumptions. In fact, the results of the pessimistic and optimistic scenarios actually play out in a partially reversed manner.

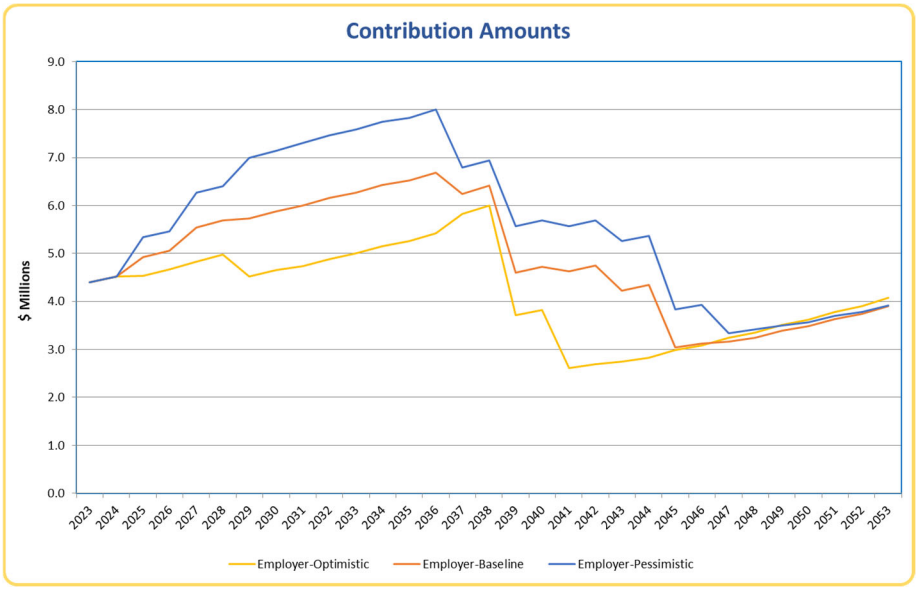


JRS exhibits much of the stability as the '77 Fund because of the offsetting economic assumptions. Over time, the optimistic scenario requires greater contributions because of the greater payroll being received (meaning larger benefits), but the differences as a rate of pay would be less significant.

PARF

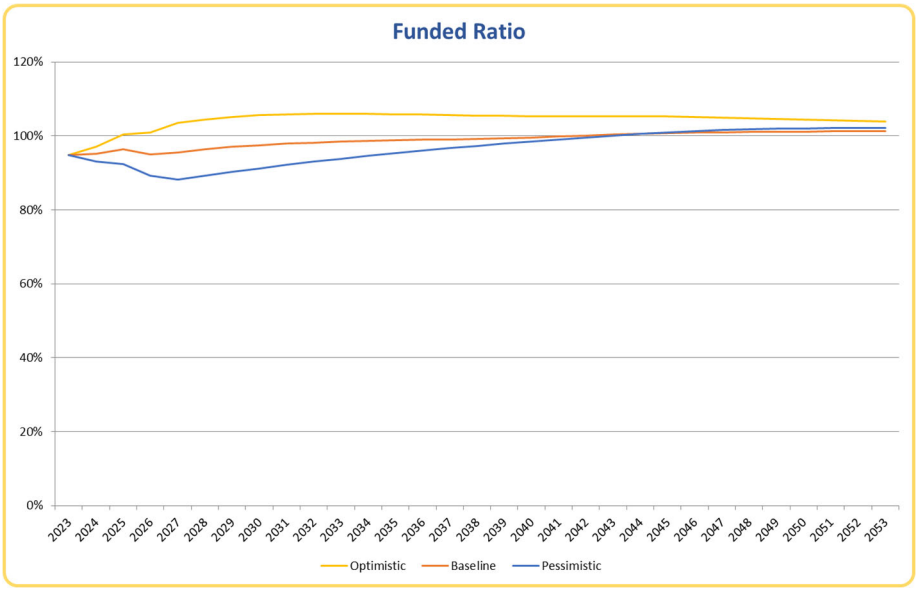


Because the immediate application of the new assumptions increases the contribution amounts for PARF, the funding strategy under all scenarios moves toward 100% funded in a predictable manner, leaving little variation.

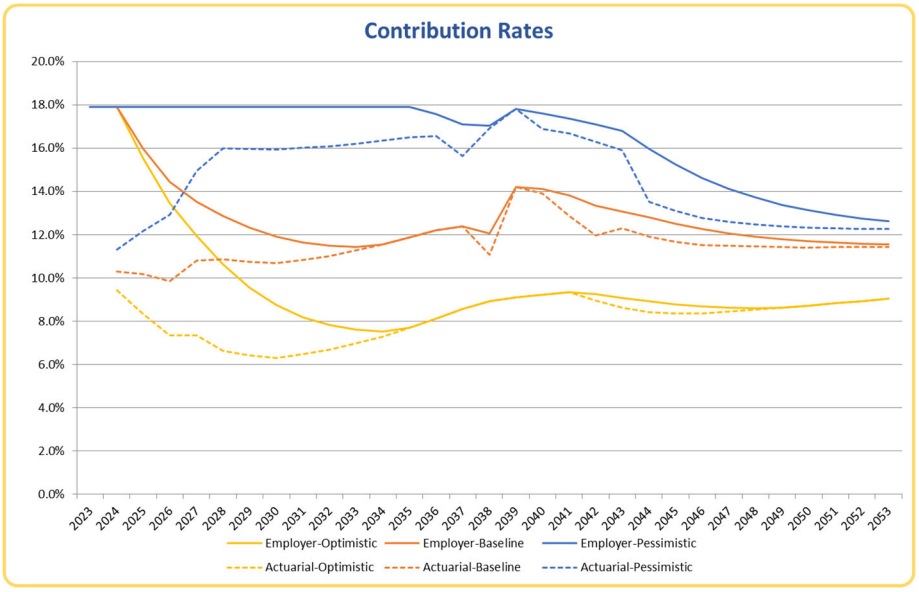


The immediate application of the new pessimistic assumptions leads to increases in contributions above what is expected under the baseline. Even under the optimistic assumptions, there is upward pressure on contributions. The decline midway through the graph is due to amortization bases being completed.

EG&C

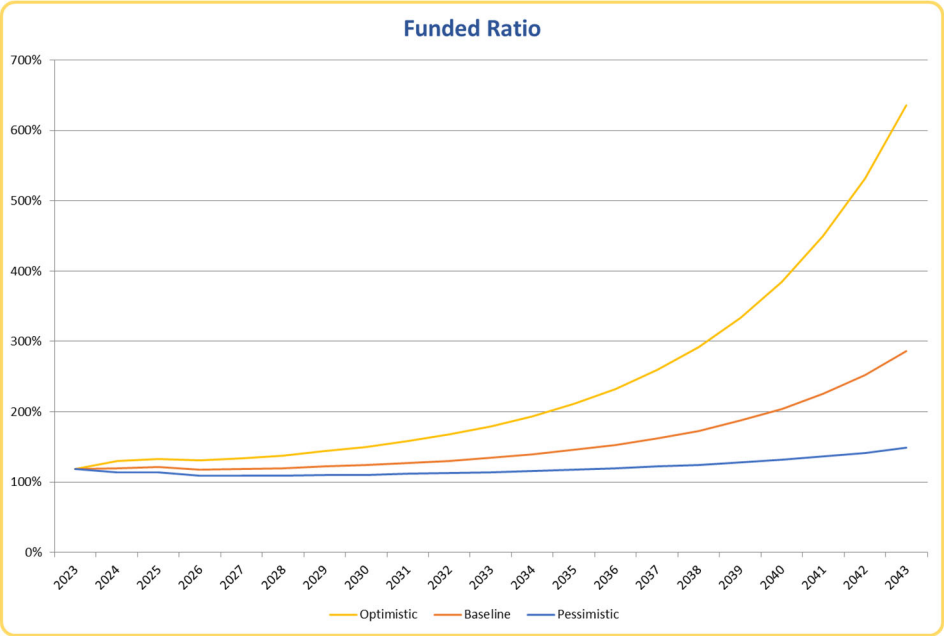


EG&C has a funding policy and benefit structure that are generally similar to PERF and TRF '96. Like them, the funded ratio improves steadily in all scenarios.



Much of the EG&C projection of contribution rates is driven by the substantial current excess of the employer contribution rate over the actuarial contribution rate. Thus, the variation under the scenarios affects when, not if, the contribution rates begin to decline.

LE DB



Because the LE DB plan is winding down, the results are not especially sensitive to outside events. However, a small surplus is expected which will be proportionately large over time, depending upon asset returns.

Another way to perform investment return sensitivity analysis is to look at how results would unfold if the assumptions remain unchanged, but actual experience varies. Of course, in reality, the assumptions would eventually be updated to reflect actual experience, so this type of analysis is useful only when shorter periods of time are considered. In the following charts, actual rates of return from 5.0% to 7.5% are considered for a 10-year period using deterministic modeling. Under the deterministic model, it assumes all actuarial assumptions are met, except for the actual investment return experienced by the plan. The impact is shown using a "heat map" in which the results are color coded from green (most favorable) to red (least favorable) to help visually show trends.

In this analysis, the current investment return assumption of 6.25% is not changed, but the impact of differing actual returns over the next ten years is studied.

PERF

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	84%	84%	82%	82%	82%	82%	83%	83%	83%	83%
5.25%	84%	84%	82%	82%	83%	83%	84%	84%	85%	85%
5.50%	84%	84%	83%	83%	84%	84%	85%	86%	87%	87%
5.75%	84%	85%	83%	83%	84%	85%	86%	87%	88%	89%
6.00%	84%	85%	83%	84%	85%	86%	87%	89%	90%	92%
6.25%	84%	85%	83%	84%	86%	87%	89%	90%	92%	94%
6.50%	84%	85%	84%	85%	86%	88%	90%	92%	94%	96%
6.75%	84%	85%	84%	85%	87%	89%	91%	93%	96%	98%
7.00%	84%	85%	84%	86%	88%	90%	92%	95%	98%	101%
7.25%	84%	85%	84%	86%	88%	91%	94%	97%	100%	102%
7.50%	84%	85%	85%	87%	89%	92%	95%	98%	102%	105%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	7.5%	7.5%	8.2%	8.4%	8.5%	8.7%	8.9%	9.2%	9.4%	9.7%
5.25%	7.5%	7.5%	8.1%	8.3%	8.4%	8.4%	8.6%	8.8%	9.0%	9.2%
5.50%	7.5%	7.4%	8.1%	8.2%	8.2%	8.2%	8.3%	8.4%	8.5%	8.6%
5.75%	7.4%	7.4%	8.0%	8.1%	8.0%	7.9%	8.0%	8.0%	8.0%	8.0%
6.00%	7.4%	7.4%	7.9%	7.9%	7.8%	7.7%	7.6%	7.6%	7.5%	7.5%
6.25%	7.4%	7.3%	7.9%	7.8%	7.6%	7.4%	7.3%	7.2%	7.0%	6.9%
6.50%	7.4%	7.3%	7.8%	7.7%	7.4%	7.2%	7.0%	6.8%	6.5%	6.3%
6.75%	7.4%	7.3%	7.7%	7.6%	7.3%	6.9%	6.6%	6.3%	6.0%	5.7%
7.00%	7.4%	7.2%	7.6%	7.5%	7.1%	6.6%	6.3%	5.9%	5.5%	4.8%
7.25%	7.4%	7.2%	7.6%	7.3%	6.9%	6.4%	6.0%	5.5%	5.0%	4.4%
7.50%	7.4%	7.2%	7.5%	7.2%	6.7%	6.1%	5.6%	5.0%	4.3%	3.9%

Employer Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
5.25%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
5.50%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
5.75%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
6.00%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
6.25%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%
6.50%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	10.0%
6.75%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	9.9%	8.8%
7.00%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	9.8%	8.5%
7.25%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	9.8%	8.6%	7.5%
7.50%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	11.2%	9.7%	8.3%	7.2%

While the actuarial rate declines for most of the alternate return scenarios, the employer contribution rate would not decline since the funded ratio does not reach 95% during this period under most of these returns.

TRF Pre-'96

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	68%	73%	77%	83%	90%	98%	98%	98%	98%	98%
5.25%	68%	73%	77%	84%	91%	98%	98%	98%	98%	99%
5.50%	68%	73%	78%	84%	91%	98%	98%	99%	99%	99%
5.75%	68%	73%	78%	85%	92%	98%	99%	99%	99%	99%
6.00%	68%	73%	78%	85%	93%	99%	99%	99%	99%	100%
6.25%	68%	73%	78%	85%	94%	99%	99%	100%	100%	100%
6.50%	68%	73%	79%	86%	94%	99%	100%	100%	101%	101%
6.75%	68%	73%	79%	86%	95%	99%	100%	101%	102%	103%
7.00%	68%	74%	79%	87%	96%	100%	101%	102%	103%	105%
7.25%	68%	74%	79%	87%	96%	100%	101%	103%	105%	107%
7.50%	68%	74%	80%	88%	97%	100%	102%	104%	106%	109%

This exhibit illustrates that the funded status is expected to improve under a wide range of investment return scenarios. An analysis of the future funding needs for TRF Pre-'96 is provided in a later section of this report.

TRF '96

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	88%	87%	84%	83%	83%	83%	82%	82%	82%	81%
5.25%	88%	88%	85%	84%	84%	83%	83%	83%	83%	83%
5.50%	88%	88%	85%	84%	84%	84%	84%	84%	84%	84%
5.75%	88%	88%	85%	85%	85%	85%	85%	85%	85%	85%
6.00%	88%	88%	85%	85%	85%	85%	86%	86%	86%	87%
6.25%	88%	88%	86%	85%	86%	86%	87%	87%	87%	88%
6.50%	89%	88%	86%	86%	86%	87%	88%	88%	89%	89%
6.75%	89%	88%	86%	86%	87%	88%	89%	89%	90%	91%
7.00%	89%	88%	86%	87%	88%	89%	89%	90%	91%	92%
7.25%	89%	89%	87%	87%	88%	89%	90%	92%	93%	94%
7.50%	89%	89%	87%	88%	89%	90%	91%	93%	94%	96%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	6.7%	7.0%	7.8%	8.2%	8.5%	8.8%	9.2%	9.6%	10.1%	10.5%
5.25%	6.7%	7.0%	7.7%	8.1%	8.3%	8.6%	9.0%	9.4%	9.7%	10.1%
5.50%	6.7%	7.0%	7.7%	8.0%	8.2%	8.4%	8.8%	9.1%	9.4%	9.8%
5.75%	6.7%	6.9%	7.6%	7.9%	8.1%	8.3%	8.5%	8.8%	9.1%	9.4%
6.00%	6.7%	6.9%	7.6%	7.8%	7.9%	8.1%	8.3%	8.5%	8.8%	9.0%
6.25%	6.7%	6.9%	7.5%	7.7%	7.8%	7.9%	8.1%	8.3%	8.5%	8.7%
6.50%	6.7%	6.9%	7.5%	7.6%	7.7%	7.7%	7.9%	8.0%	8.1%	8.3%
6.75%	6.7%	6.8%	7.4%	7.5%	7.5%	7.5%	7.6%	7.7%	7.8%	7.9%
7.00%	6.7%	6.8%	7.3%	7.5%	7.4%	7.3%	7.4%	7.4%	7.4%	7.4%
7.25%	6.7%	6.8%	7.3%	7.4%	7.3%	7.2%	7.1%	7.1%	7.1%	7.0%
7.50%	6.7%	6.8%	7.2%	7.3%	7.1%	7.0%	6.9%	6.8%	6.7%	6.5%

Because the TRF '96 employer rate is close to the actuarial rate, there is no excess rate to bring down over time. Consequently, the employer rates are expected to remain close to the actuarial rates.

’77 Fund

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	92%	92%	89%	88%	87%	87%	87%	86%	86%	86%
5.25%	92%	92%	89%	88%	88%	88%	88%	87%	87%	87%
5.50%	92%	92%	89%	88%	88%	88%	89%	89%	89%	89%
5.75%	92%	92%	89%	89%	89%	89%	90%	90%	90%	90%
6.00%	92%	92%	90%	89%	90%	90%	91%	91%	92%	92%
6.25%	92%	92%	90%	90%	90%	91%	92%	92%	93%	94%
6.50%	92%	93%	90%	90%	91%	92%	93%	94%	94%	95%
6.75%	93%	93%	91%	91%	92%	93%	94%	95%	96%	97%
7.00%	93%	93%	91%	91%	92%	94%	95%	96%	98%	99%
7.25%	93%	93%	91%	92%	93%	95%	96%	98%	99%	101%
7.50%	93%	93%	91%	92%	94%	95%	97%	99%	101%	103%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	21.5%	22.4%	25.3%	26.5%	27.5%	28.3%	29.1%	29.9%	30.7%	31.4%
5.25%	21.5%	22.3%	25.0%	26.2%	26.9%	27.6%	28.2%	28.8%	29.4%	30.0%
5.50%	21.5%	22.2%	24.8%	25.8%	26.4%	26.9%	27.3%	27.7%	28.1%	28.6%
5.75%	21.4%	22.1%	24.6%	25.4%	25.8%	26.1%	26.4%	26.6%	26.9%	27.1%
6.00%	21.4%	21.9%	24.4%	25.1%	25.3%	25.4%	25.4%	25.5%	25.5%	25.6%
6.25%	21.4%	21.8%	24.2%	24.7%	24.7%	24.6%	24.5%	24.3%	24.2%	24.0%
6.50%	21.4%	21.7%	24.0%	24.3%	24.2%	23.9%	23.5%	23.2%	22.8%	22.4%
6.75%	21.3%	21.6%	23.7%	24.0%	23.6%	23.1%	22.6%	22.0%	21.3%	20.7%
7.00%	21.3%	21.5%	23.5%	23.6%	23.0%	22.3%	21.6%	20.8%	19.9%	18.9%
7.25%	21.3%	21.4%	23.3%	23.2%	22.5%	21.6%	20.6%	19.5%	18.4%	15.3%
7.50%	21.2%	21.3%	23.1%	22.8%	21.9%	20.8%	19.6%	18.3%	15.2%	13.9%

Under the funding policy, employer contribution rates align with the actuarial contribution rate, similar to TRF ’96.

JRS

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	92%	91%	88%	87%	87%	86%	86%	86%	86%	86%
5.25%	92%	91%	88%	87%	87%	87%	87%	87%	87%	88%
5.50%	92%	91%	88%	88%	88%	88%	88%	89%	89%	89%
5.75%	92%	91%	89%	88%	89%	89%	89%	90%	90%	91%
6.00%	92%	91%	89%	89%	89%	90%	90%	91%	92%	92%
6.25%	92%	92%	89%	89%	90%	91%	91%	92%	93%	94%
6.50%	92%	92%	89%	90%	91%	92%	93%	94%	94%	95%
6.75%	92%	92%	90%	90%	91%	92%	94%	95%	96%	97%
7.00%	92%	92%	90%	91%	92%	93%	95%	96%	97%	99%
7.25%	92%	92%	90%	91%	93%	94%	96%	97%	99%	101%
7.50%	92%	92%	91%	91%	93%	95%	97%	99%	101%	102%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	37.0%	37.6%	40.8%	42.3%	43.2%	44.3%	45.3%	46.2%	47.0%	48.0%
5.25%	37.0%	37.5%	40.5%	41.9%	42.6%	43.5%	44.3%	45.0%	45.7%	46.4%
5.50%	36.9%	37.4%	40.3%	41.5%	42.0%	42.7%	43.3%	43.8%	44.3%	44.9%
5.75%	36.9%	37.3%	40.0%	41.1%	41.4%	41.9%	42.3%	42.6%	43.0%	43.3%
6.00%	36.8%	37.1%	39.8%	40.7%	40.8%	41.1%	41.3%	41.4%	41.6%	41.7%
6.25%	36.8%	37.0%	39.6%	40.2%	40.2%	40.2%	40.3%	40.2%	40.1%	40.1%
6.50%	36.8%	36.9%	39.3%	39.8%	39.6%	39.4%	39.2%	38.9%	38.7%	38.4%
6.75%	36.7%	36.8%	39.1%	39.4%	39.0%	38.6%	38.2%	37.7%	37.2%	36.7%
7.00%	36.7%	36.7%	38.8%	39.0%	38.4%	37.7%	37.1%	36.4%	35.7%	35.0%
7.25%	36.7%	36.6%	38.6%	38.6%	37.7%	36.9%	36.1%	35.1%	34.2%	28.3%
7.50%	36.6%	36.4%	38.3%	38.2%	37.1%	36.0%	35.0%	33.8%	28.2%	26.9%

While JRS is funded by the State contributing the recommended contribution amount (when approved by the Legislature), the actuarial contribution rate is shown here to illustrate that contributions will increase modestly as a rate of pay if actual returns are as expected, with greater increases or decreases for actual returns below or above the expected return.

PARF

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	69%	71%	70%	71%	72%	74%	75%	76%	77%	78%
5.25%	69%	71%	70%	72%	73%	74%	76%	77%	78%	80%
5.50%	69%	71%	70%	72%	73%	75%	76%	78%	79%	81%
5.75%	69%	71%	70%	72%	74%	76%	77%	79%	81%	82%
6.00%	69%	71%	70%	73%	75%	76%	78%	80%	82%	84%
6.25%	69%	71%	71%	73%	75%	77%	79%	81%	83%	85%
6.50%	69%	71%	71%	73%	76%	78%	80%	82%	84%	86%
6.75%	69%	71%	71%	74%	76%	79%	81%	83%	85%	88%
7.00%	69%	71%	71%	74%	77%	79%	82%	84%	87%	89%
7.25%	69%	71%	72%	75%	77%	80%	83%	85%	88%	91%
7.50%	69%	72%	72%	75%	78%	81%	84%	87%	89%	92%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	18.0%	17.4%	18.4%	18.4%	18.6%	18.8%	19.1%	19.3%	19.6%	19.8%
5.25%	18.0%	17.4%	18.3%	18.2%	18.4%	18.5%	18.7%	18.9%	19.1%	19.3%
5.50%	18.0%	17.3%	18.2%	18.1%	18.2%	18.3%	18.4%	18.5%	18.7%	18.8%
5.75%	18.0%	17.3%	18.1%	18.0%	18.0%	18.0%	18.1%	18.1%	18.2%	18.2%
6.00%	17.9%	17.3%	18.1%	17.8%	17.7%	17.7%	17.7%	17.7%	17.7%	17.7%
6.25%	17.9%	17.2%	18.0%	17.7%	17.5%	17.4%	17.4%	17.3%	17.2%	17.1%
6.50%	17.9%	17.2%	17.9%	17.5%	17.3%	17.1%	17.0%	16.9%	16.7%	16.5%
6.75%	17.9%	17.1%	17.8%	17.4%	17.1%	16.9%	16.7%	16.4%	16.2%	15.9%
7.00%	17.9%	17.1%	17.7%	17.3%	16.9%	16.6%	16.3%	16.0%	15.7%	15.3%
7.25%	17.9%	17.1%	17.7%	17.1%	16.7%	16.3%	15.9%	15.5%	15.1%	14.7%
7.50%	17.9%	17.0%	17.6%	17.0%	16.5%	16.0%	15.6%	15.1%	14.6%	14.1%

PARF, like JRS, is funded by the State contributing the recommended contribution amount as approved by the Legislature. Contributions are shown here as a rate to illustrate that contributions will somewhat increase as a rate of pay if actual returns are as expected, with greater increases or decreases for actual returns below or above the expected return.

EG&C

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	95%	96%	94%	94%	94%	93%	93%	93%	93%	92%
5.25%	95%	96%	94%	94%	94%	93%	93%	93%	93%	92%
5.50%	95%	96%	94%	94%	94%	94%	94%	94%	94%	94%
5.75%	95%	96%	94%	95%	95%	95%	96%	96%	96%	96%
6.00%	95%	96%	95%	95%	96%	96%	97%	97%	97%	97%
6.25%	95%	96%	95%	96%	96%	97%	98%	98%	98%	99%
6.50%	95%	97%	95%	96%	97%	98%	99%	99%	100%	100%
6.75%	95%	97%	96%	97%	98%	99%	100%	101%	102%	102%
7.00%	95%	97%	96%	97%	99%	100%	101%	102%	103%	104%
7.25%	95%	97%	96%	98%	99%	101%	102%	104%	105%	107%
7.50%	95%	97%	97%	98%	100%	102%	104%	105%	107%	109%

Actuarial Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	10.3%	10.2%	11.5%	11.9%	12.3%	12.8%	13.4%	14.0%	14.7%	15.5%
5.25%	10.3%	10.1%	11.4%	11.9%	12.3%	12.7%	13.4%	14.0%	14.7%	15.5%
5.50%	10.3%	10.1%	11.3%	11.6%	11.9%	12.2%	12.7%	13.1%	13.7%	14.3%
5.75%	10.2%	10.0%	11.1%	11.4%	11.5%	11.6%	12.0%	12.3%	12.7%	13.2%
6.00%	10.2%	9.9%	10.9%	11.1%	11.1%	11.1%	11.4%	11.7%	12.0%	12.5%
6.25%	10.2%	9.8%	10.8%	10.9%	10.7%	10.7%	10.8%	11.0%	11.3%	11.5%
6.50%	10.2%	9.8%	10.6%	10.6%	10.3%	10.1%	10.1%	10.2%	10.2%	10.7%
6.75%	10.1%	9.7%	10.5%	10.3%	9.9%	9.6%	9.4%	9.7%	9.7%	9.7%
7.00%	10.1%	9.6%	10.3%	10.1%	9.5%	9.0%	9.2%	9.0%	8.9%	8.8%
7.25%	10.1%	9.6%	10.2%	9.8%	9.1%	8.9%	8.6%	8.3%	8.1%	7.8%
7.50%	10.1%	9.5%	10.0%	9.5%	9.0%	8.4%	8.0%	7.6%	7.2%	6.8%

Employer Contribution Rate for FYE

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5.00%	17.9%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%
5.25%	16.0%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%	14.7%	15.5%
5.50%	16.0%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%	14.5%
5.75%	16.0%	14.5%	14.5%	14.5%	14.5%	13.8%	13.3%	13.1%	13.0%	13.2%
6.00%	16.0%	14.5%	14.5%	13.6%	13.0%	12.5%	12.2%	12.1%	12.1%	12.5%
6.25%	16.0%	14.4%	13.5%	12.9%	12.3%	11.9%	11.7%	11.5%	11.4%	11.5%
6.50%	16.0%	14.4%	13.5%	12.8%	12.1%	11.6%	11.3%	11.0%	10.8%	10.8%
6.75%	16.0%	14.4%	13.4%	12.6%	12.0%	11.4%	10.9%	10.6%	10.4%	10.2%
7.00%	16.0%	14.4%	13.4%	12.5%	11.8%	11.1%	10.6%	10.2%	9.9%	9.6%
7.25%	15.9%	14.4%	13.3%	12.4%	11.6%	10.9%	10.3%	9.8%	9.4%	9.0%
7.50%	15.9%	14.3%	13.2%	12.3%	11.5%	10.7%	10.0%	9.4%	8.9%	8.3%

The funded ratio exceeded 95% in the June 30, 2023 actuarial valuation, and thus, the employer contribution rate has already begun to drop towards the actuarially determined rate.

LE DB

Funded Ratio at June 30 Valuation

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
5.00%	119%	120%	115%	114%	113%	113%	112%	112%	111%	111%
5.25%	119%	121%	116%	115%	114%	115%	114%	115%	114%	115%
5.50%	119%	121%	116%	116%	116%	116%	117%	118%	118%	120%
5.75%	120%	121%	117%	116%	117%	118%	119%	121%	122%	124%
6.00%	120%	121%	117%	117%	118%	120%	121%	124%	126%	129%
6.25%	120%	121%	118%	118%	120%	122%	124%	127%	130%	135%
6.50%	120%	122%	118%	119%	121%	124%	127%	131%	135%	140%
6.75%	120%	122%	118%	120%	122%	126%	129%	134%	139%	147%
7.00%	120%	122%	119%	121%	124%	128%	132%	138%	144%	153%
7.25%	120%	122%	119%	121%	125%	130%	135%	142%	149%	159%
7.50%	120%	122%	120%	122%	126%	132%	138%	146%	154%	166%

The contributions are not significantly affected by the return, so the resulting chart is not insightful and has been omitted. Now that the plan is over 100% funded, minimal contributions are expected outside of potential funding of supplemental benefits.

Variability of Returns – Stochastic Modeling

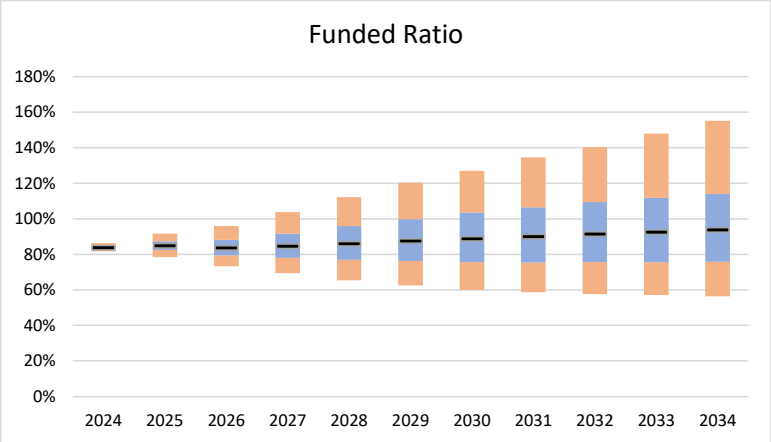
Deterministic modeling is helpful to compare different scenarios, which can lead to a better understanding of the funding dynamics of the system. Missing in this analysis is an understanding of the likelihood of various scenarios and the plausible range of outcomes from the anticipated volatility associated with the asset allocation. These issues are handled with the more robust approach of stochastic modeling, in which investment performance is varied, based on the expected distribution of portfolio returns. Rather than obtaining a single result, this approach develops the results for many plausible scenarios, so that the distribution of outcomes can be considered.

For this modeling, we used 5,000 20-year scenarios prepared by Verus. These scenarios were based on the current Verus capital market assumptions which result in an effective portfolio return of 7.43% with a standard deviation of 9%. Since the valuation results and models are based upon a 6.25% assumed return, using the Verus scenarios would lead to results that reflect not only the impact of volatility, but also the mismatch in the expected return. We reduced each of the simulated returns by 1.18% so as to preserve the volatility but eliminate the return difference. For each simulation, the assets, liabilities, actuarial contribution rates and employer contribution rates (or amounts) were modeled for the next 20 years, although not all years are shown in the graphs.

Distributions of Outcomes

It can be useful to examine the distribution of outcomes for insight into the risk associated with investment returns. The following charts show the distribution of the funded ratio for the next 10 years for each Fund. In each chart, the blue portion of the bar represents the range between the 25th and 75th percentiles, or the middle 50% of results. A black line in the middle of the blue portion indicates the median (50th percentile) result. The tan portion of the bars extend to show the 5th and 95th percentiles. For JRS and PARF, the distribution of employer contribution amounts is also included because they provide insight into the funding process. (The other funds have contribution rates that are less related to funded status, and so they are not very helpful in explaining the fund dynamics.)

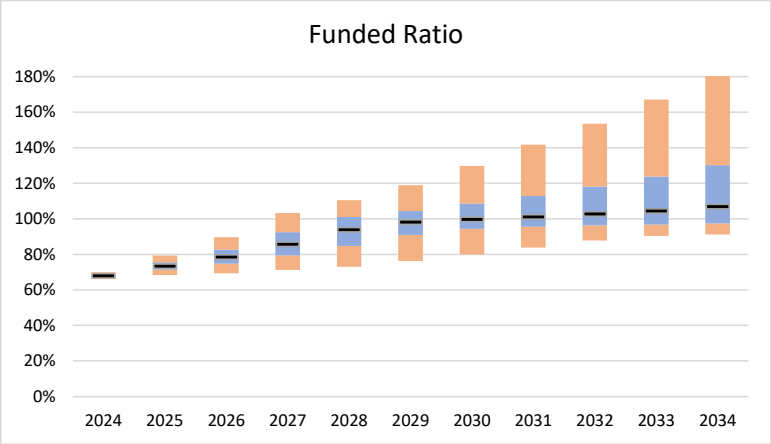
PERF – Funded Ratio



With future 13th checks and COLAs now being anticipated, the funded ratio will improve slowly over the next 10 years.

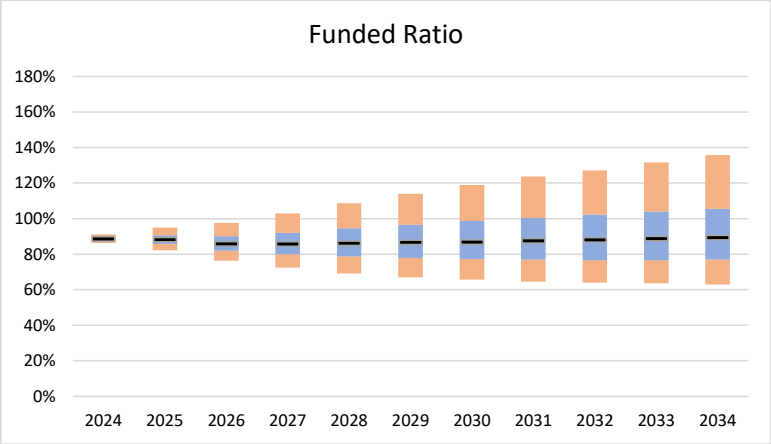
The median funded ratio in 2034 is 94%. Half of all results are between 76% funded and 114% funded. This range of outcomes might be wider than expected, largely because there is little contribution rate responsiveness to actual investment experience for several years.

TRF Pre '96 – Funded Ratio



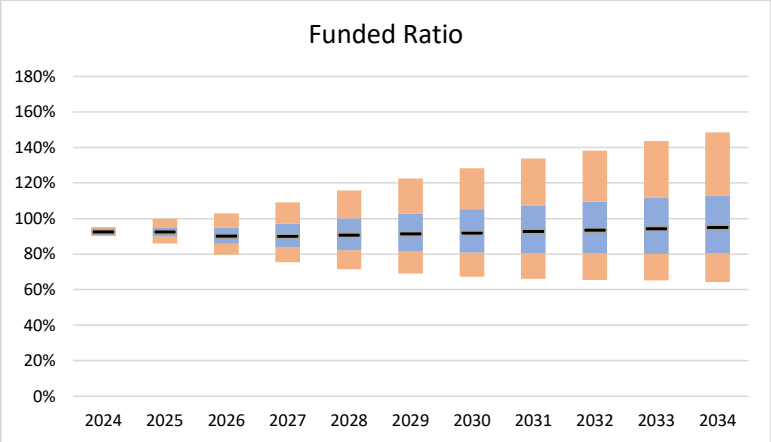
Over the next six or seven years, the funding mechanism pushes the funded ratio towards 100%. Once that is reached, additional contributions are made when needed, preventing significant declines. If there are generally favorable returns, however, the funded ratio will grow since contributions cannot be reduced below $0.

TRF '96 – Funded Ratio



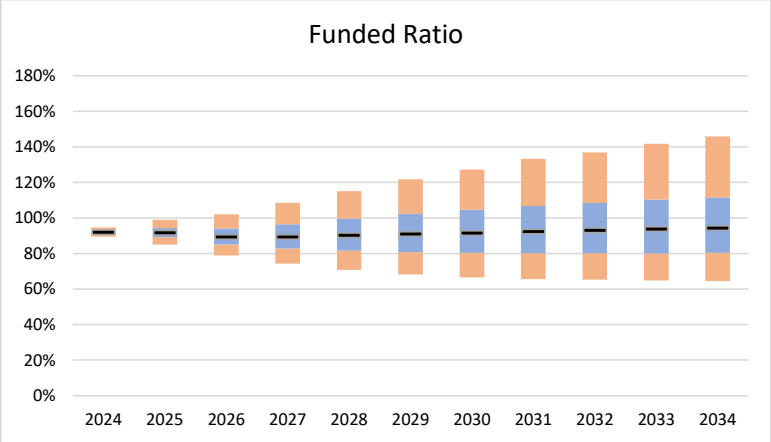
The range of potential results for TRF '96 is more compact than PERF (the blue bars represent a smaller range) primarily because the difference between the TRF '96 employer contribution rate and the actuarial contribution rate are closer to each other, reducing the impact of extra contributions in favorable scenarios.

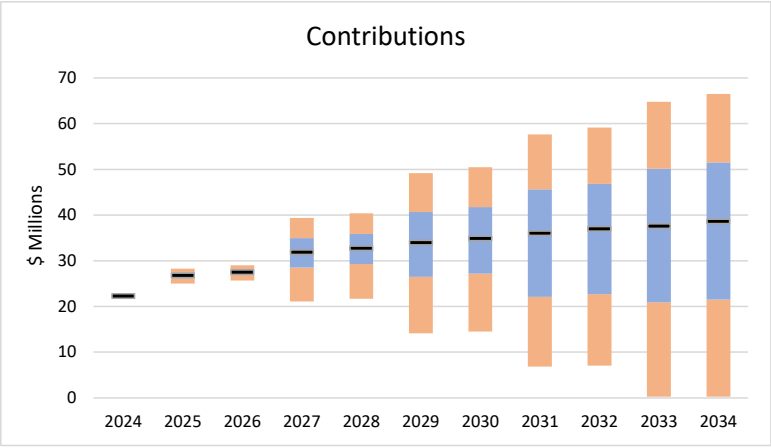
’77 Fund – Funded Ratio



The ’77 Fund exhibits a pattern similar to PERF, although without the upward trend since the Fund is already somewhat closer to 100% funded.

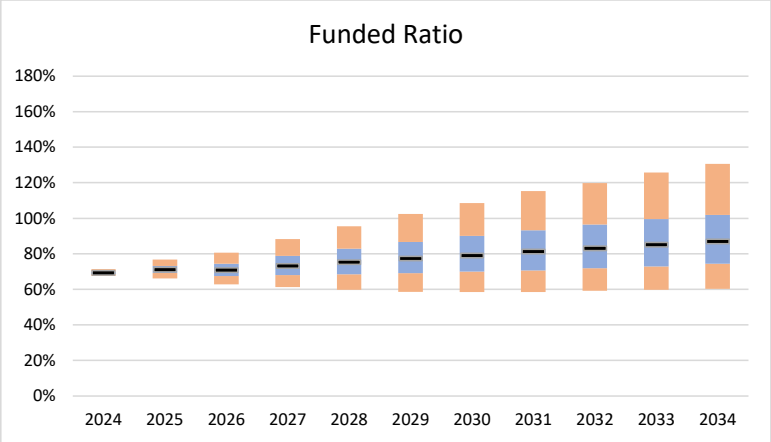
JRS – Funded Ratio and Contributions



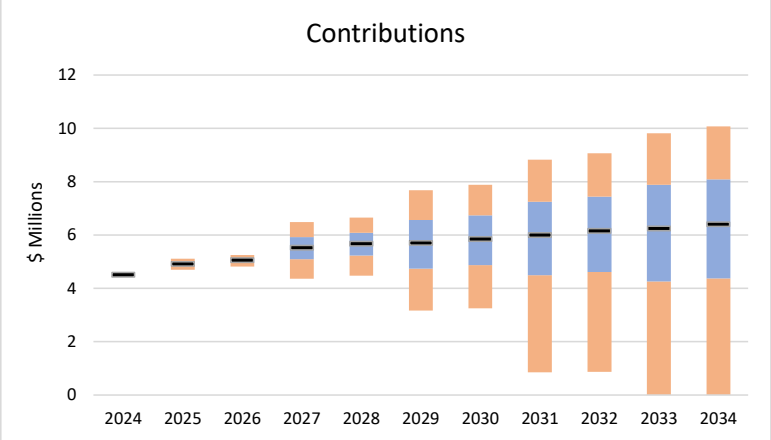


The funded ratio for JRS is expected to trend upward gradually over the next ten years as the median moves from 92% to 94%. Because the contributions for JRS are the actuarial rate each year regardless of funded ratio, the range of results is tighter than some funds. However, as the contribution graph indicates, there is a correspondingly wide range of employer contributions. This illustrates a fundamental aspect of funding pensions: Stable contributions will result in more variability in funded ratios, while variable contributions generally lead to a more stable funded status.

PARF – Funded Ratio and Contributions

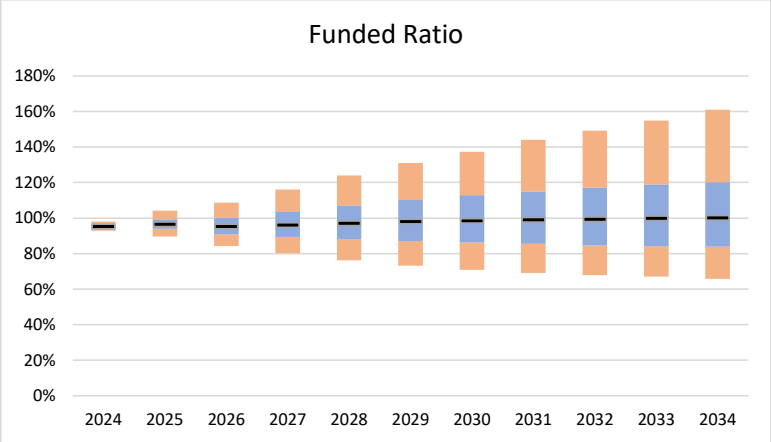


As would be expected from the funding policy similarity, PARF has similar patterns to JRS. However, PARF is currently at a lower funded ratio, but still on a similar timeframe to reach full funding, so there is a more rapid increase in the funded ratio.



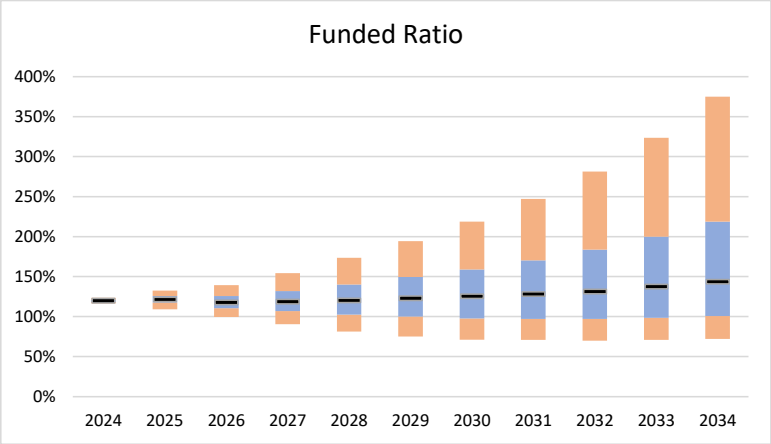
The contribution amounts show a two-year pattern because the contributions are approved as part of the biennial budget process.

EG&C – Funded Ratio



The upper range of possible funded ratios for EG&C is higher than many of the other Funds (although similar to the '77 Fund) since the funding policy limits how quickly contributions can decrease.

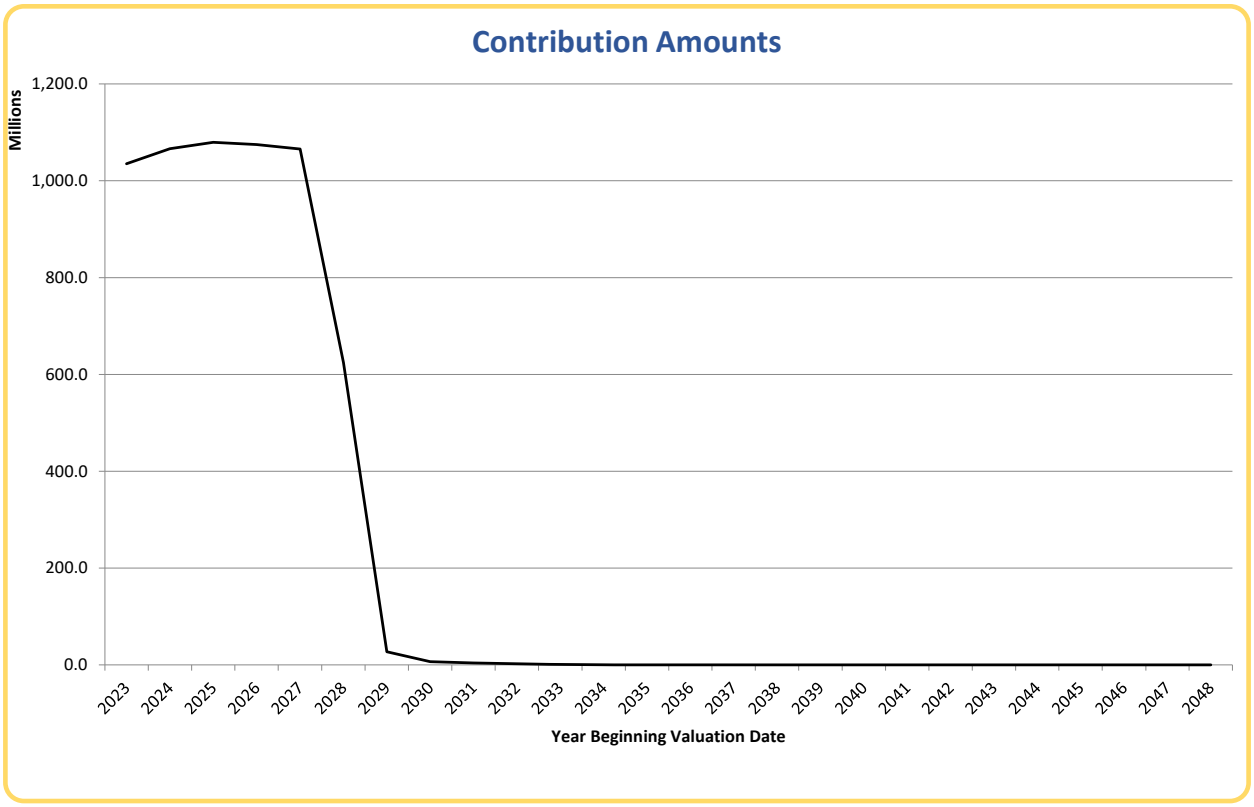
LE DB – Funded Ratio



Because the LE DB Fund is currently very well-funded, closed, and not likely to need contributions, favorable scenarios can push the funded ratio up with little opportunity to reduce it by contribution reduction. This leads to a very wide range of possible outcomes compared to the other funds.

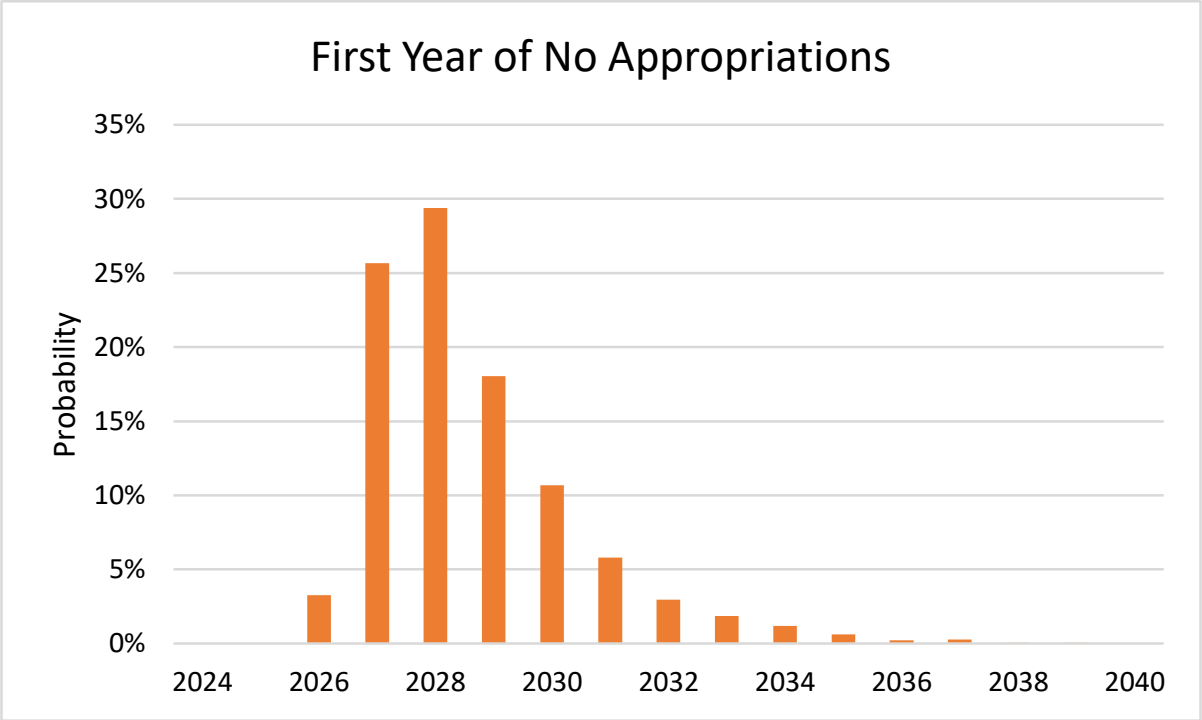
TRF Pre-1996 Contribution Requirements

Over the past few years, significant legislative allocations to the TRF Pre-'96 Fund have positioned it such that standard deterministic modelling shows it reaching the point where it contains the full Present Value of Future Benefits (PVFB). Should all assumptions be met in the future, this would allow for the complete cessation of contributions to the Fund. This simplistic situation is exhibited in the following graph:



However, a very significant assumption underlying this chart is that the fund returns 6.25% each and every year. Of course, this is almost certainly not what will play out. This section of the report is intended to help explain some of the funding risks associated with the TRF Pre-'96 Fund. It should be noted that the need for this discussion is a testimony to the significant efforts to transform what was essentially a pay-as-you-go program to one that is nearly fully funded on a PVFB basis in under 30 years.

The first aspect to consider is when contributions can be expected to stop for the TRF Pre-'96 Fund. Contributions are provided by legislative appropriation based on increasing the prior year's appropriation by 3%, but not exceeding that year's expected payments. There is also a cap on appropriations such that the Fund will not have surplus assets on the base plan benefits. Reflecting the variation in investment returns that was used in the stochastic returns section, we can estimate when the first year will be in which no appropriations are needed. This is shown in the graph below:



This exhibit indicates that there is more than a 70% probability that this first year of no appropriations will be 2027, 2028, or 2029. Note that the amount in the year before could (but might not be) substantially less than the roughly $1 billion appropriation which has been the norm recently. It should also be noted that these results assume that the appropriation amount is determined instantly at the end of the June 30 Fund Fiscal Year. In practice, this appropriation is determined earlier in the year during the state budget setting process before the year-end asset return is known.

Subsequent to the first year in which no appropriation is needed, the assets in the Fund will earn more or less than the assumed rate. If actual returns exceed the expected return, we would expect the Fund to develop a surplus. However, if the actual returns are less than the expected return, a shortfall will once again develop. Currently, there is not a clear policy for what would happen should a funding shortfall exist, so in consultation with INPRS staff, we have developed three possible approaches that could be considered. Then the funding needs are modelled under these three approaches with the stochastic returns used earlier.

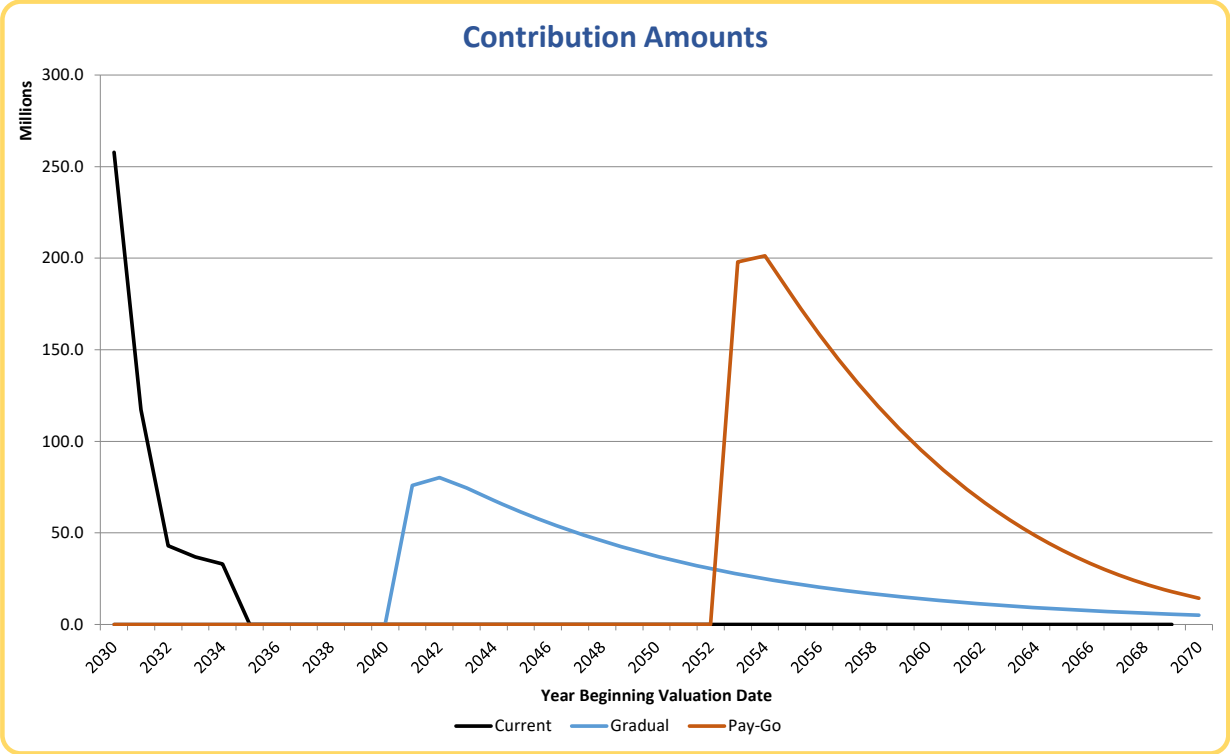
Approach 1 (Current) – With this approach, the needed contribution is determined each year as the lesser of the expected benefit payments in the coming year and the unfunded PVFB. This is slightly different from the actual current approach in that the appropriation could be more than 3% larger than the appropriation in the prior year.

Approach 2 (Gradual) – For this approach, funding does not resume until the funding PVFB level has dropped to 90%. At that point, the allocation is the amount required to amortize the shortfall with level payments over 10 years. If the fund returns to 90% funded, contributions stop, but if it remains below, the payment is calculated from the current position. There is also a floor of the amount needed to make benefit payments in the following year.

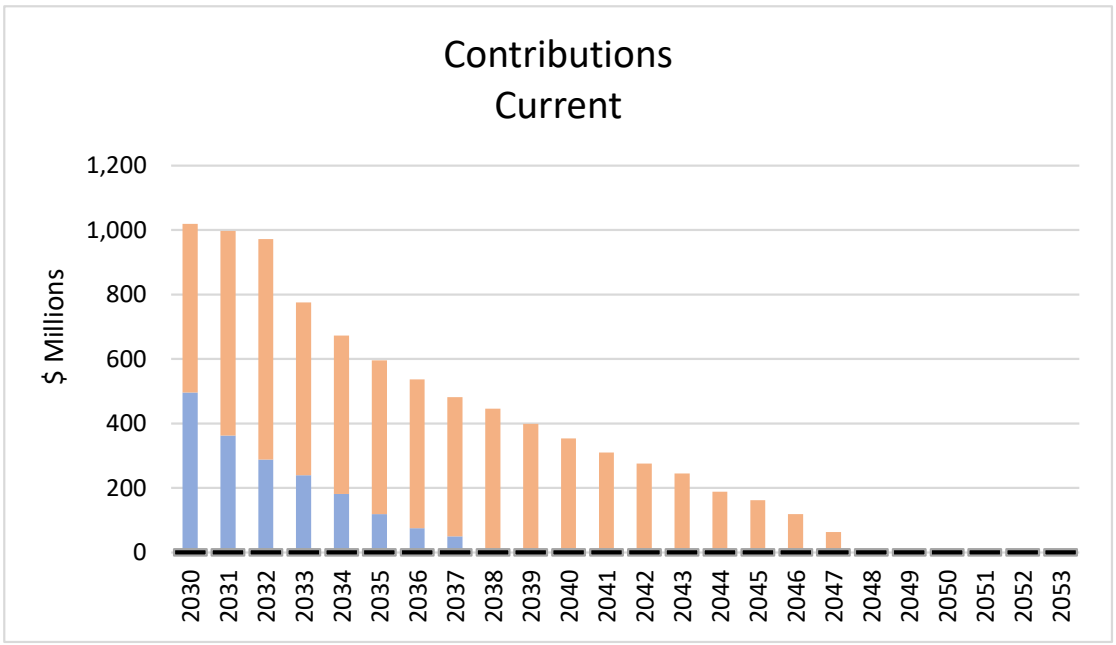
Approach 3 (Pay-Go) – The final option pushes off the need for additional funds until absolutely necessary to make benefit payments. Once the Fund nears depletion, this approach reverts to a pay-as-you-go plan. To the extent this does not happen for many years, the annual benefit payments will be significantly less than they are today, especially as a proportion of the total state budget.

There are other options, of course, including beginning to ramp down contributions gradually even before reaching a fully-funded situation. These methods are not considered for this study, but could be considered in future analyses.

To help illustrate how these three approaches work, the following is a simplified example in which all years return 6.25%, except for a -7% return in 2031 followed by a 19.5% return in 2032. The Current approach has an immediate contribution of just over $250 million which then drops back to $0 over a few years. The Gradual approach does not require contributions for 10 years, at which point they resume and generally decrease over time. The Pay-Go approach does not require any contributions for about 20 years, at which point assets are depleted and the declining benefit payments must be met by allocations for the remaining lives of Fund members.



To see how these three approaches compare through time, consider the following graphs showing the range of contributions under stochastic modelling. It is worth noting that the median requirement is $0, meaning that in over half of the cases, no contribution is required in a given year. Also, it should be noted that some of the contribution requirements in the earliest years are a result of not yet having reached the point of stopping contributions in the first place.


Contributions
Current
$ Millions
1,200
1,000
800
600
400
200
0
2030
2031
2032
2033
2034
2035
2036
2037
2038
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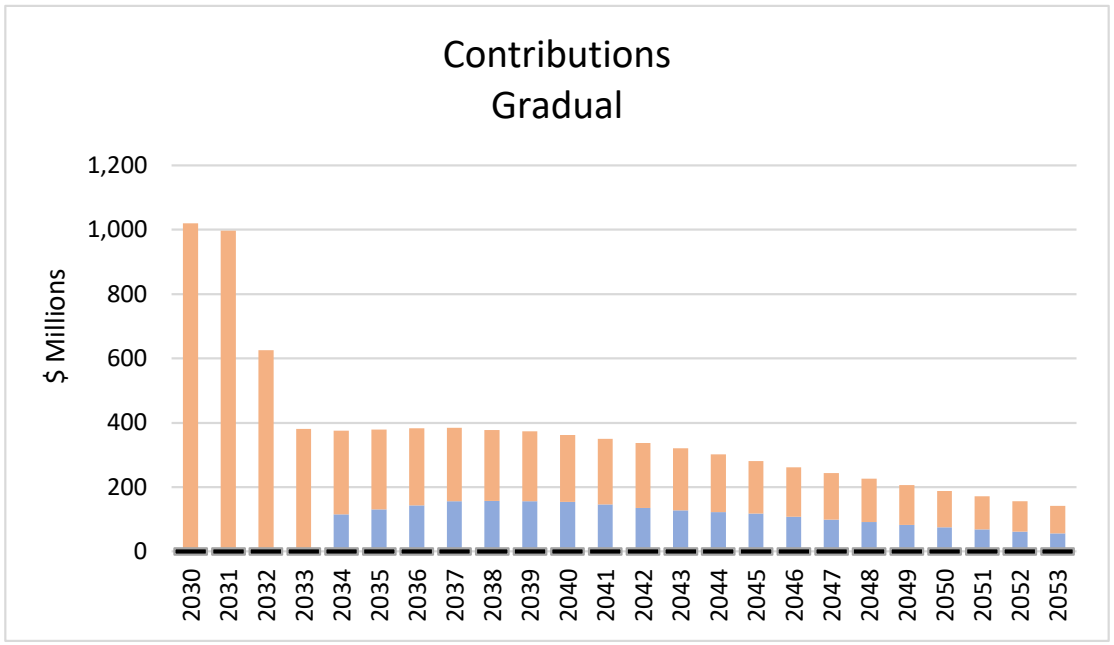
Contributions
Gradual
$ Millions
1,200
1,000
800
600
400
200
0
2030
2031
2032
2033
2034
2035
2036
2037
2038
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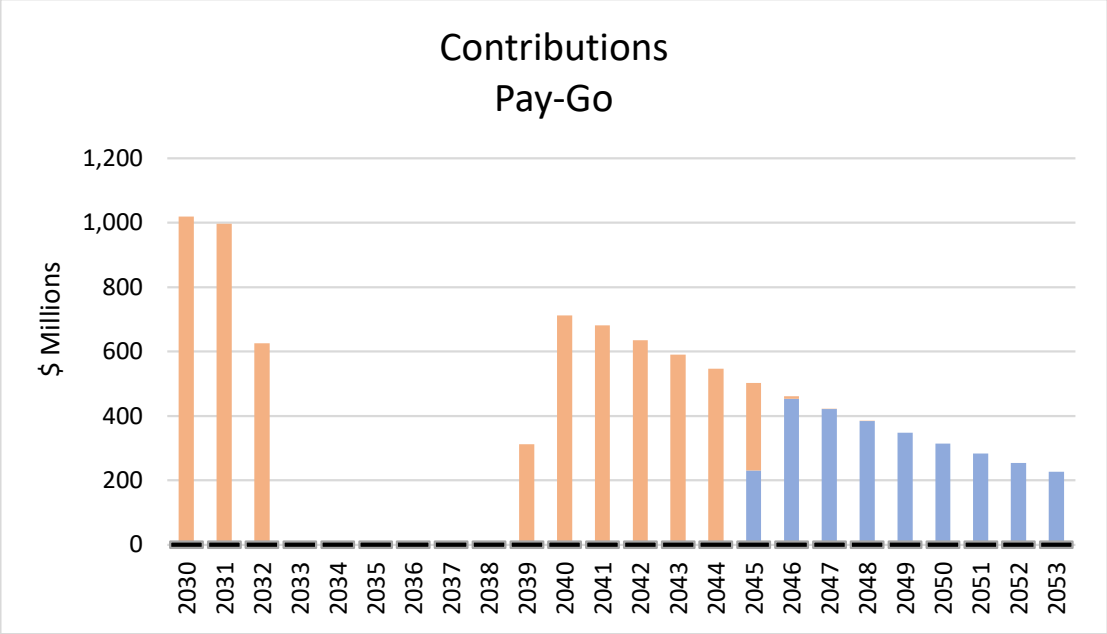
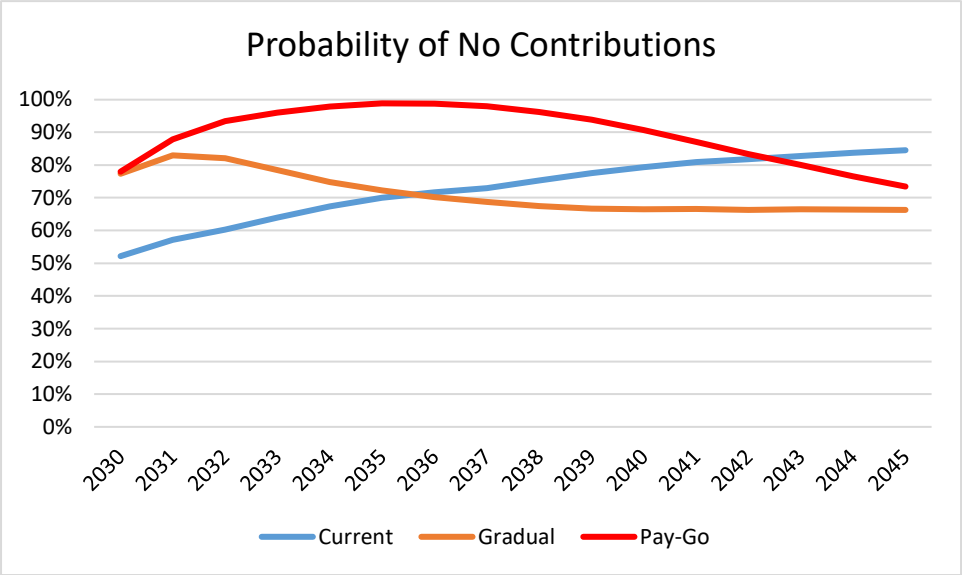


The three funding policies considered here have very different patterns of possible contribution needs. There are, of course, possible combinations or variations that could be considered. One approach would be to match expected benefit payments with bond coupons and maturities, thereby significantly reducing, or even eliminating, the investment risk. Such a strategy would require additional initial appropriations, with amounts depending upon the bond market at the time the matching was implemented. There would still be some potential risk of future funding being needed due to mortality changes or possible COLA variations.

As noted earlier, the median contribution in all cases is $0. The following graph shows the likelihood of no contributions in a given year under the three methods considered. Again, note that the in the early years, some of the probability of contributions is actually related to never having reached a $0 contribution in the first place. Under the Pay-Go approach, there is a virtually 100% probability of no contributions for a number of years because the threshold for resuming contributions is that the fund is nearly out of money.



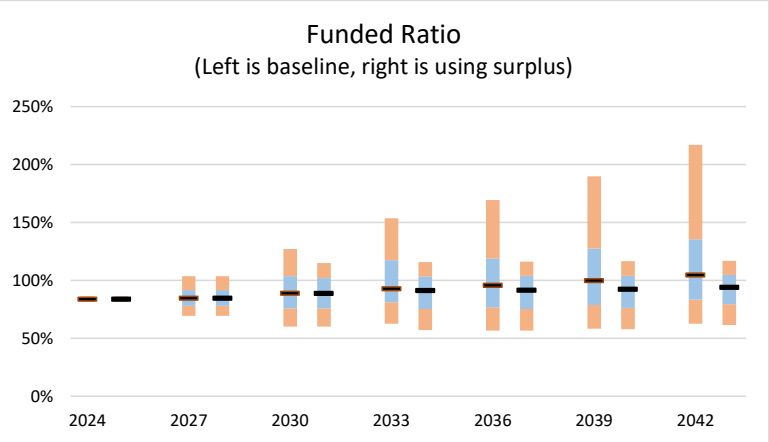
We do not expect that the brief overview of the TRF Pre-'96 funding risk presented in this report will be sufficient for policymakers to reach a final plan, but we do believe it can be useful in understanding the need for such a discussion and developing some sense of the potential trade-offs of different funding approaches.

Risk of Benefit Improvements

One consideration in anticipating the future of a fund is whether or not the benefit provisions remain stable. Throughout this report, the basic premise is that benefits remain unchanged, and yet it takes only a brief reflection to determine that historically this is not the case. While benefit improvements occur periodically throughout time for any number of reasons, many practitioners in the field observe that when a plan is well-funded the consideration of benefit improvements is a common occurrence. In this section, we will examine the impact of improving benefits whenever assets exceed liabilities. For simplicity, this was modeled by assuming that when the funded ratio (on an Actuarial Value of Assets basis) exceeded 100%, half of this excess would be removed from the assets to simulate a benefit improvement.

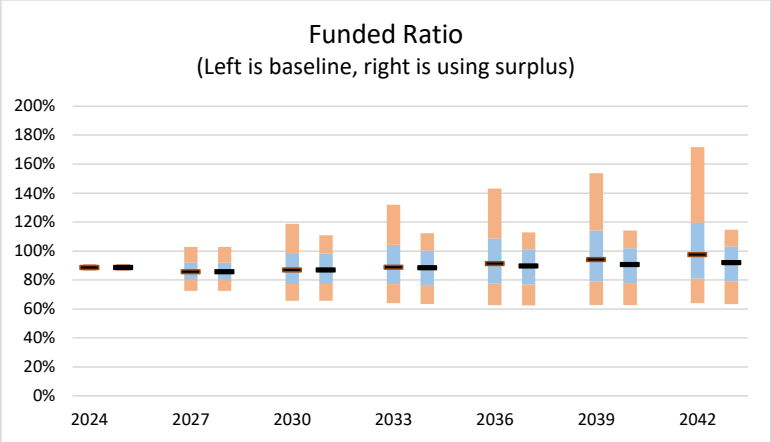
The following graphs show a comparison of the funded ratio or contribution amounts for selected future years for the baseline situation (no benefit improvements) versus using half of the excess. Results are shown for PERF, TRF '96 and the '77 Fund, but similar results could be reasonably anticipated for the other funds. In each chart, the blue portion of the bar represents the range between the 25th and 75th percentiles, or the middle 50% of results. A black line in the middle of the blue portion indicates the median (50th percentile) result. The tan portion of the bars extend to show the 5th and 95th percentiles.

PERF – Funded Ratio



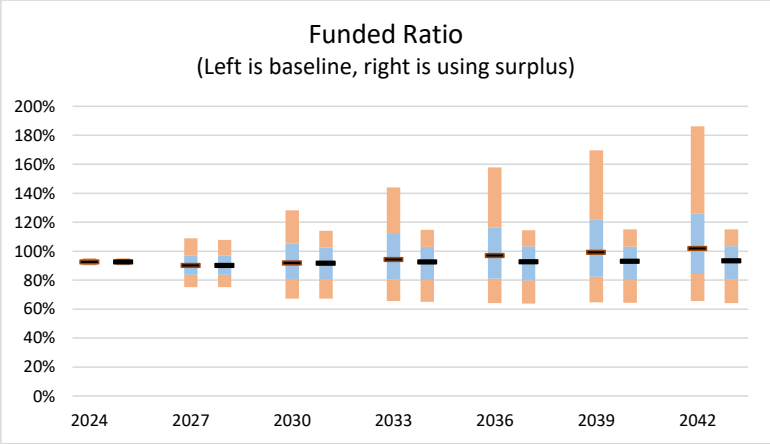
As would be expected from improving benefits whenever surplus exists, the build-up of surplus that is possible under the baseline scenario is almost entirely eliminated. However, because there are scenarios when improvements are made in earlier years and poor returns follow, the median return is also decreased, reaching 94% with improvements rather than 105% in the baseline.

TRF '96 – Funded Ratio

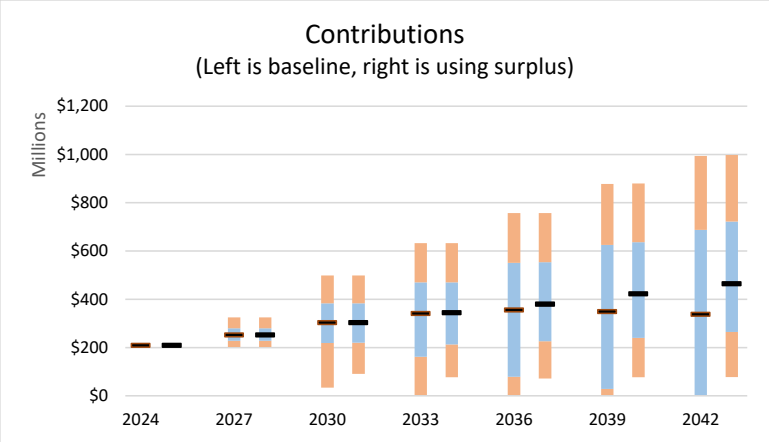


The results for TRF '96 are similar to PERF, reflecting the similarities of the two funds.

'77 Fund – Funded Ratio and Contributions



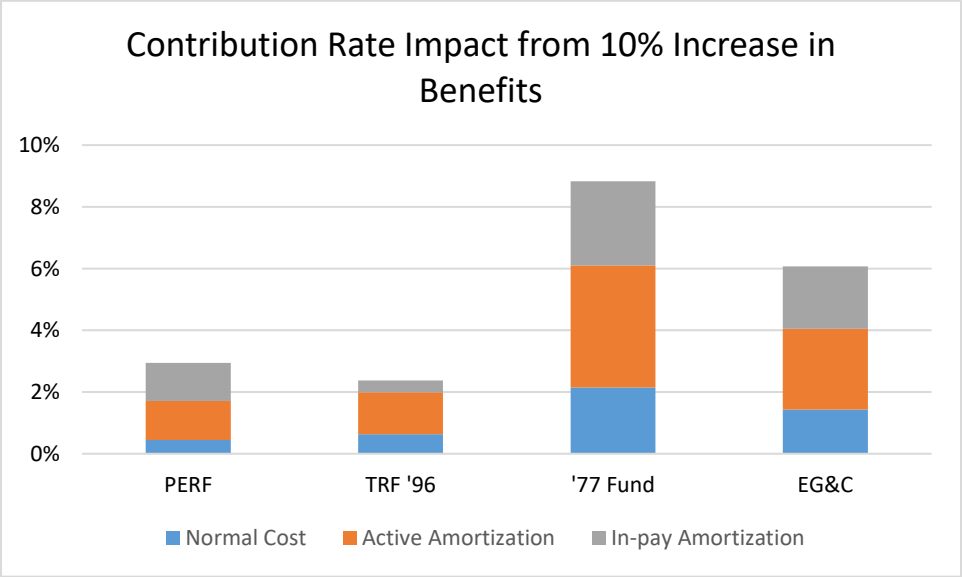
The results for '77 Fund are once again similar to PERF and TRF '96.



While the baseline scenario leads to higher funded ratios, it also leads to lower contributions. This is because more benefits are granted in the "use surplus" case and those additional benefits require funding. Results for PERF and TRF '96 are similar.

The fact that benefit improvements reduce the funded status and increase costs is not a surprise, of course. However, when a fund is over 100% funded, it is tempting to think that an improvement might be "free" since there is no need initially to increase contributions. As the graphs above indicate, using surplus for benefit improvements means that it cannot be used to offset poor asset returns. This is not to suggest that benefit improvements are never appropriate. The whole point of these funds are to pay benefits and if it is appropriate to increase (and pay for) benefits from a policy or human resources perspective, then such changes can certainly be considered.

When contemplating benefit improvements it may also help to understand how the improvements affect contribution increases. For the plans that are funded by contribution rates, the following chart shows how a 10% improvement in benefits affects the contribution requirements. Note that this is based on a 10% improvement for in-pay members (such as a 10% *ad hoc* COLA) and a 10% improvement for past and future benefits for active members (such as an increase in the multiplier).



As would be expected, TRF '96 does not increase as much for in-pay improvements since it is a newer plan with few retirees.