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January 29, 2021

Ms. Erin Leonard
Executive Director
Minnesota State Retirement System
60 Empire Drive, Suite 300
St. Paul, MN 55103

Re: Projection of Contributions and Funding Status – Judges Retirement Fund

Dear Erin:

Attached are 30-year projections of estimated funded status, required contributions, and statutory contributions under three asset return scenarios for the Judges Retirement Fund (JRF). These projections, including the underlying investment return assumptions, are required by the Minnesota Standards for Actuarial Work. Unless noted otherwise, the estimates are based on participant data, assumptions, methods, and plan provisions as detailed in the Judges Retirement Fund Actuarial Valuation Report for funding purposes as of July 1, 2020.

Basis for Projections

For all enclosed projections, liabilities are determined using the statutory investment return assumption of 7.5%. As required by the Minnesota Standards for Actuarial Work, the projections reflect three asset return scenarios (7.5%, 6.0% and 9.0%). Note that we believe the 9.0% rate of return assumption is outside of the range of reasonable expected returns for this plan.

The estimates are based on the market value of assets with five year smoothing of investment gains or losses. Payroll is assumed to increase approximately 2.5% per year over the long-term, consistent with the valuation assumption for total payroll growth.

The projection is an open group projection; meaning, active members projected to retire or otherwise terminate in the future are replaced with new active members so that the total active membership of the fund remains at 322 members. The profile of these new members is the same as new members hired between July 1, 2014 and June 30, 2019:

- Average age at hire is 47.9
- Average salary at hire is $161,500
- Approximately 57% female, 43% male

If actuarial accrued liability exceeds assets, the unfunded actuarial accrued liability is amortized through June 30, 2048 per Minnesota Statute 356.215, Subdivision 11. Per Minnesota Statute 356.215, Subdivision 11 (l), a negative unfunded actuarial accrued liability (i.e., when assets exceed liability) is amortized over a rolling 30-year period.

The State of Minnesota provides supplemental contributions to the fund equal to $6.0 million annually until the plan reaches 100% funding (on an Actuarial Value of Assets basis), or July 1, 2048, if earlier. This supplemental contribution is projected to end July 1, 2048 in the 6.0% and 7.5% investment return scenarios and July 1, 2041 in the 9.0% investment return scenario.

Post-Retirement Benefit Increases

A very significant assumption affecting the projected estimates is the expectation of annual increases in the benefits being paid to retirees and beneficiaries. The current benefit increase rate is 1.75%. If the plan reaches a funding ratio of 70% (based on a 2.0% post-retirement benefit increase assumption) on a market value of assets basis for two consecutive years in the future, post-retirement increases will increase from 1.75% to 2.0%. Similarly, if the plan reaches a funding ratio of 90% (based on a 2.5% post-retirement benefit increase assumption) on a market value of assets basis for two consecutive years in the future, post-retirement increases will increase from 2.0% to 2.5%.

For the 7.5% scenario, an actuarial projection was performed to estimate when this plan is expected to attain the threshold required to pay a 2.0% or 2.5% post-retirement benefit increase. The projection indicated that if all assumptions were met, the thresholds are expected to be attained in the years 2041 and 2058, and that the plan would begin paying 2.0% benefit increases on January 1, 2042 and 2.5% benefit increases on January 1, 2059. This assumption is reflected in the 7.5% rate of return projection scenario.

Under the 9.0% rate of return scenario, the funded status of the plan is expected to improve. As the plan experiences greater than expected investment return each year, the assumed 2.0%/2.5% benefit increase dates are accelerated. We performed a projection to estimate when the plan is expected to attain the threshold required to pay a 2.0% or 2.5% post-retirement benefit increase if future investment returns are 9.0%. This projection indicated the plan would begin paying a 2.0% benefit increase on January 1, 2031 and a 2.5% benefit increase on January 1, 2040. To approximate the acceleration of the assumed 2.0%/2.5% benefit increase dates from 2042 to 2031 and from 2059 to 2040, we assumed the accrued liability and normal cost would increase by a proportionate amount between 2020 and 2031. Based on present expectations, the 9.0% rate of return scenario is a very low probability outcome.

Under the 6.0% rate of return scenario, the funded status of the plan is expected to deteriorate. As the plan experiences lower than expected investment return each year, the assumed 2.0%/2.5% benefit increase dates become later each year until they are no longer projected to be attained. We assumed for purposes of this projection that this transition from the current assumption (benefit increases change from 1.75% to 2.0% on January 1, 2042 and from 2.0% to 2.5% on January 1, 2059) to an assumption that benefit increases remain at 1.75% for all years would occur by 2029.

Comments
The reader should keep the following in mind when reviewing these results:

- Statutory contributions are defined in statutes as a fixed percentage of payroll plus any supplemental contributions and represent the amount that is actually contributed to the plan. Required contributions are defined in statutes and the LCPR Standard for Actuarial Work and represent the amount needed to fully fund the plan by June 30, 2048 (normal cost, expenses and a payment to amortize the unfunded liability).

- Investment experience that has occurred since the measurement date is not reflected in this report.

- The 7.5% investment return scenario projects that the plan will not attain full funding within the 30-year period. Over the next 30 years, as payroll grows, the $6.0 million annual supplemental contribution remains level as a dollar amount, but declines as a percentage of payroll from 11.3% of pay to less than 5.8% of pay for the fiscal year ending June 30, 2048. A contribution deficiency persists through the statutory amortization date of June 30, 2048. The plan is projected to achieve full funding under the 7.5% investment return scenario in approximately 43 years.

- The enclosed projections are based on assumptions as outlined in the JRF actuarial funding valuation as of July 1, 2020. Please see that report for comments regarding the 7.5% statutory investment return assumption, and sensitivity test results based on alternate assumptions.

- A 2019 analysis of long-term rate of investment return and inflation assumptions concluded that the probability of exceeding the current 7.5% assumption over 20 years is less than 50%. The statutory requirement for projections that are 1.5% above and 1.5% below the assumed rate may give the reader the impression that the 7.5% projection is an accurate (middle of the road) representation of the expected future results. Based on our modeling, the 7.5% scenario is optimistic and not representative of the expected (median) result. We caution against adjusting contribution rates without full consideration of the median results.

- In the 9% investment return scenario, surplus assets reduce the projected required contributions to amounts less than normal cost. We typically recommend the contribution be at least equal to the normal cost of the plan and suggest that plans with considerable surplus assets investigate the pros and cons of reducing the risk of the plan’s investment allocation to preserve surplus assets.

- Note that as funding ratios decline, as they are expected to in one of the investment return scenarios shown in this letter, it will be increasingly difficult for the plan to attain the assumed scenario investment return. Each year, a larger proportion of assets is paid out in benefits, and less capital is available to invest.

Disclosures

The purpose of this report is to estimate the Fund's funding progress and required contribution rates over a 30-year period according to prescribed assumptions and the Minnesota Standards for Actuarial Work. To the best of our knowledge and belief, the calculations were completed in accordance with the requirements of Minnesota Statutes, Section 356.215, and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement.

This report should not be relied upon for any purpose other than the purpose described herein. Determinations of the financial results associated with the benefits described in this report in a manner other than the intended purpose may produce significantly different results. GRS is not responsible for the consequences of any unauthorized use.

Actuarial assumptions, including discount rates, mortality tables and others identified in this report, are prescribed by Minnesota Statutes Section 356.215, the Legislative Commission on Pensions and Retirement (LCPR), and the Board of Trustees. These parties are responsible for selecting the plan's funding policy, actuarial valuation methods, asset valuation methods, and assumptions. The policies, methods and assumptions used in this valuation are those that have been so prescribed and are described in the Actuarial Basis section of the valuation report. The Minnesota State Retirement System (MSRS) is solely responsible for communicating to GRS any changes required thereto.

In a 2019 analysis of long-term rate of investment return and inflation assumptions, GRS determined that an investment return assumption of 7.5% was reasonable. Please see our experience study report dated June 27, 2019 for additional information. This report also concluded that the probability of exceeding the current 7.50% assumption over 10 years is 44%. If capital market assumptions decline from present levels, the 7.50% return assumption might not comply with the actuarial standards for the July 1, 2021 valuation. For informational purposes, results based on a 6.5% discount rate are shown on page 5 of the July 1, 2020 valuation report.

The projections assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

The contribution rates shown in this report have been determined using the actuarial assumptions and methods disclosed in the Actuarial Basis section of the July 1, 2020 valuation report. That valuation report includes risk metrics on page 9 but does not include a robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment.

The valuation was based upon data and information through June 30, 2020 furnished by the MSRS staff concerning Retirement Fund benefits, financial transactions, plan provisions and active members, terminated members, retirees and beneficiaries. We checked for internal and year-to-year consistency but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

This report was prepared using our proprietary valuation model and related software which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation and has no material limitations or known weaknesses. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

This report does not fully reflect the recent and still developing impact of COVID-19, which is likely to influence demographic and investment experience, at least in the short term. We will continue to monitor these developments and their impact on the plan.

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. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of such future measurements.

Professional Qualifications

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief the information contained in this report is accurate and fairly presents the actuarial position of the Judges Retirement Fund as of the valuation date and was performed in accordance with the requirements of Minnesota Statutes Section 356.215, and the requirements of the Standards for Actuarial Work established by the LCPR. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board and with applicable statutes.

Bonita J. Wurst and Brian B. Murphy are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

Sincerely,

Bonita J. Wurst

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

Brian B. Murphy

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

BJW/JDA/SLC:bd

Other Observations

General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if there are no changes in benefits or contributions and all actuarial assumptions are met (including the assumption of the plan earning 7.5%), it is expected that:

1) The normal cost of the plan is expected to remain approximately level as a percent of pay,
2) The funded status of the plan is expected to gradually improve and is expected to be 100% funded within the next 43 years, and
3) The unfunded liability will grow initially as a dollar amount before beginning to decline.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations; in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. The amounts of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon the actuarial assumptions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets.

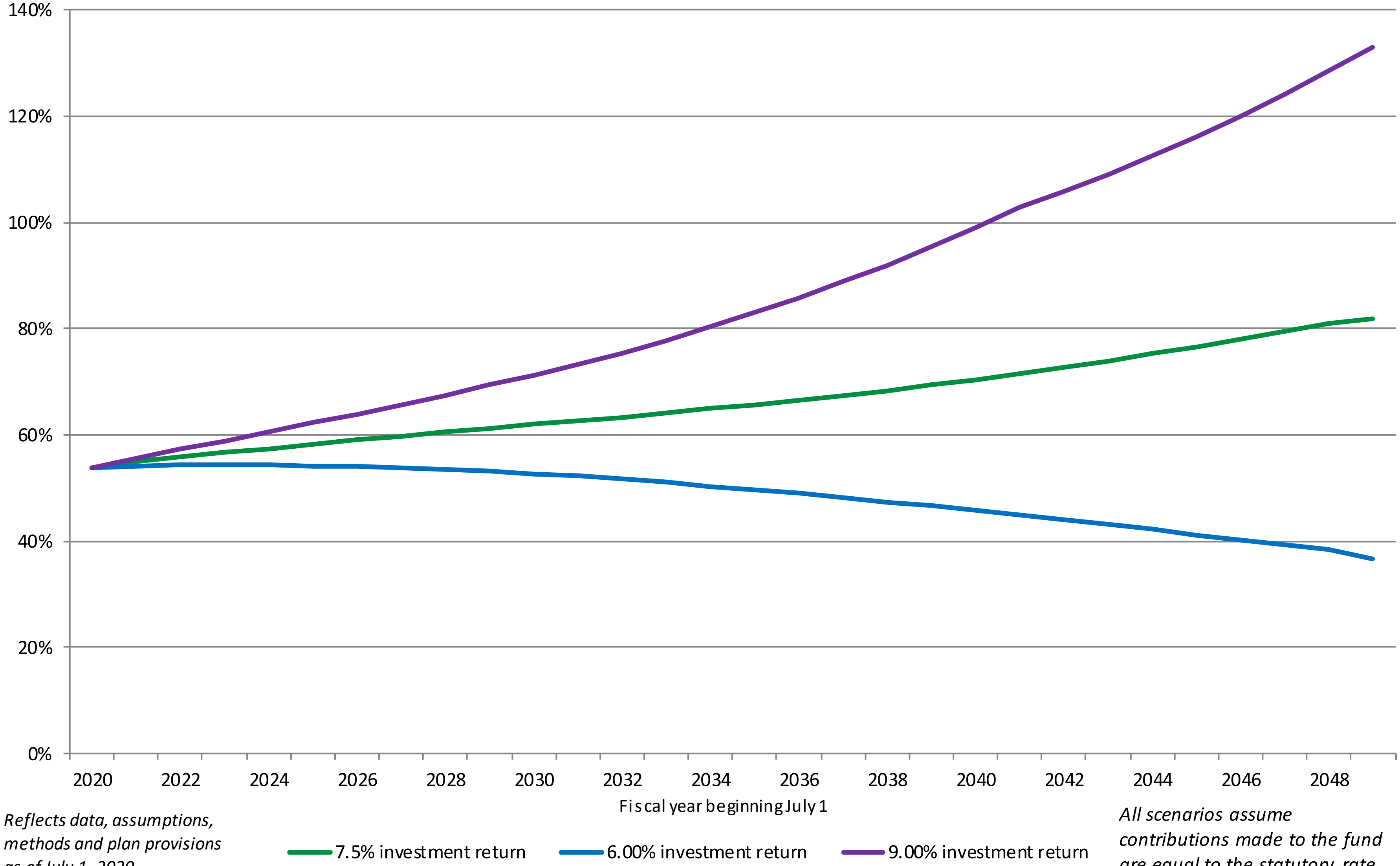
Limitations of Project Scope

Actuarial standards to not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

This exhibit should only be viewed in conjunction with GRS' January 29, 2021 letter to MSRS.

MSRS Judges Retirement Fund
Estimated Funded Ratio

In all scenarios, the interest rate used to discount liabilites was 7.5%.



Reflects data, assumptions, methods and plan provisions as of July 1, 2020.

All scenarios assume contributions made to the fund are equal to the statutory rate.

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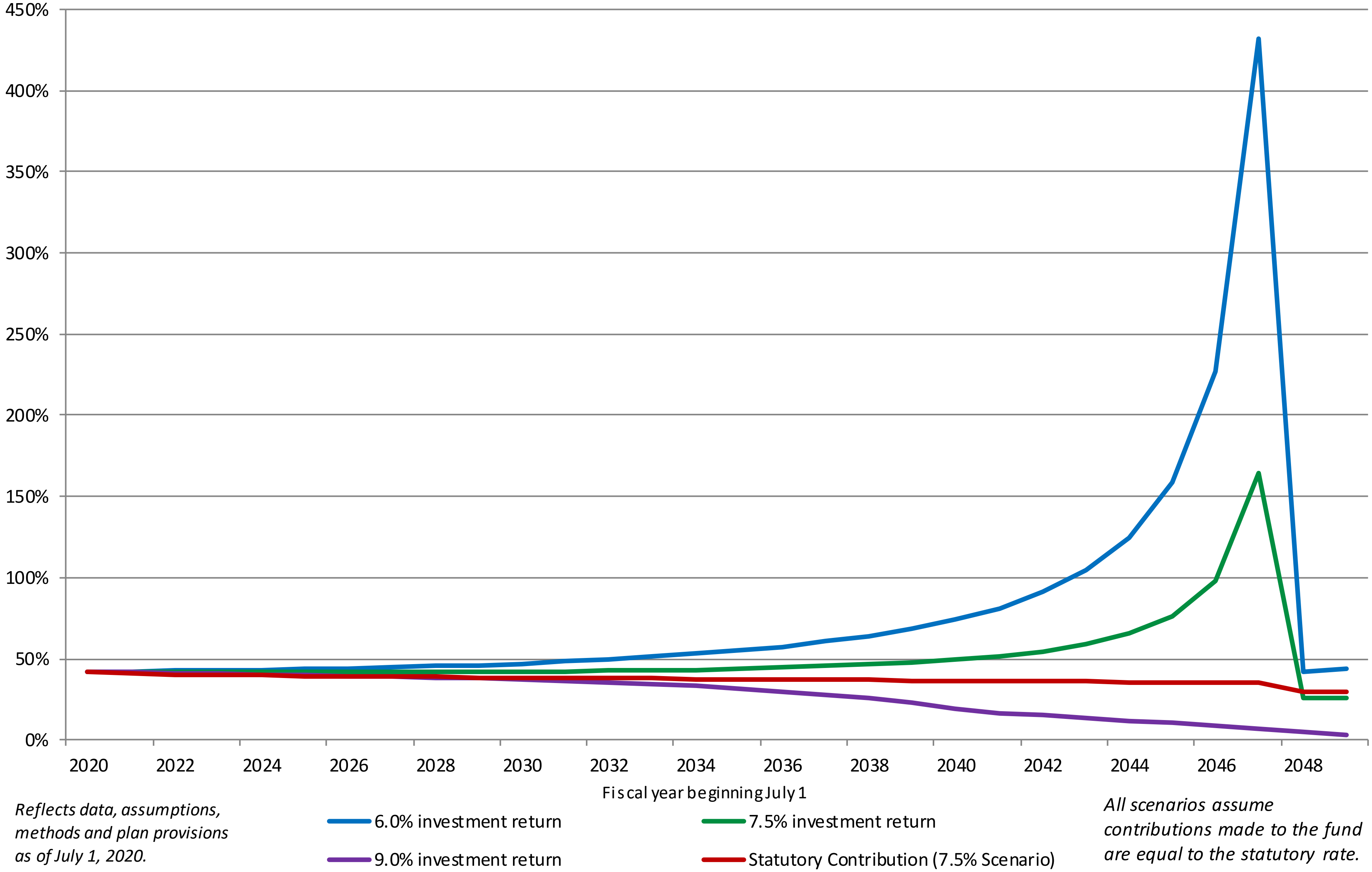
MSRS Judges Retirement Fund
Estimated Required Contribution Rates (% of Pay)

In all scenarios, the interest rate used to discount liabilites was 7.5%.



Reflects data, assumptions, methods and plan provisions as of July 1, 2020.

All scenarios assume contributions made to the fund are equal to the statutory rate.

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Judges Retirement Fund

Scenario: 7.5% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Contributions (% of Payroll)										
Statutory - Chapter 490	41.70%	40.60%	40.34%	40.07%	39.82%	39.56%	39.32%	39.08%	38.84%	38.61%
Required - Chapter 356 (MVA)	42.37%	41.89%	41.77%	41.66%	41.60%	41.61%	41.62%	41.67%	41.71%	41.82%
Sufficiency / (Deficiency)	(0.67)%	(1.29)%	(1.43)%	(1.59)%	(1.78)%	(2.05)%	(2.30)%	(2.59)%	(2.87)%	(3.21)%
Contributions										
Statutory - Chapter 490	22,173	22,118	22,507	22,908	23,320	23,748	24,185	24,632	25,093	25,567
Required - Chapter 356 (MVA)	22,526	22,821	23,310	23,818	24,364	24,977	25,603	26,266	26,947	27,694
Sufficiency / (Deficiency)	(353)	(703)	(803)	(910)	(1,044)	(1,229)	(1,418)	(1,634)	(1,854)	(2,127)
Funding Ratios										
Current Assets (MVA)	216,737	227,985	238,829	249,382	259,733	269,944	280,127	290,291	300,420	310,583
Actuarial Accrued Liability (AAL)	402,660	415,405	428,001	440,134	451,894	463,356	474,636	485,728	496,603	507,304
Unfunded AAL	185,923	187,420	189,172	190,752	192,161	193,412	194,509	195,437	196,183	196,721
Funding Ratio	53.8%	54.9%	55.8%	56.7%	57.5%	58.3%	59.0%	59.8%	60.5%	61.2%
Benefit Payments	26,883	28,027	29,478	30,834	32,125	33,314	34,504	35,715	36,873	38,174
Ratio of Assets to Benefit Payments	8.06	8.13	8.10	8.09	8.09	8.10	8.12	8.13	8.15	8.14

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed in conjunction with GRS' January 29, 2021 letter to MSRS.

Judges Retirement Fund

Scenario: 7.5% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Contributions (% of Payroll)										
Statutory - Chapter 490	38.39%	38.17%	37.95%	37.74%	37.54%	37.34%	37.14%	36.96%	36.77%	36.59%
Required - Chapter 356 (MVA)	42.02%	42.21%	42.51%	42.88%	43.35%	43.84%	44.52%	45.39%	46.46%	47.77%
Sufficiency / (Deficiency)	(3.63)%	(4.04)%	(4.56)%	(5.14)%	(5.81)%	(6.50)%	(7.38)%	(8.43)%	(9.69)%	(11.18)%
Contributions										
Statutory - Chapter 490	26,052	26,551	27,060	27,590	28,126	28,676	29,242	29,820	30,418	31,032
Required - Chapter 356 (MVA)	28,521	29,366	30,309	31,345	32,477	33,670	35,051	36,627	38,433	40,512
Sufficiency / (Deficiency)	(2,469)	(2,815)	(3,249)	(3,755)	(4,351)	(4,994)	(5,809)	(6,807)	(8,015)	(9,480)
Funding Ratios										
Current Assets (MVA)	320,646	330,763	340,985	351,335	362,015	373,176	384,850	396,949	409,621	423,065
Actuarial Accrued Liability (AAL)	517,684	527,883	537,925	547,825	557,757	567,861	578,129	588,453	598,963	609,822
Unfunded AAL	197,038	197,120	196,940	196,490	195,742	194,685	193,279	191,504	189,342	186,757
Funding Ratio	61.9%	62.7%	63.4%	64.1%	64.9%	65.7%	66.6%	67.5%	68.4%	69.4%
Benefit Payments	39,331	40,457	41,576	42,533	43,373	44,232	45,229	46,123	46,890	47,663
Ratio of Assets to Benefit Payments	8.15	8.18	8.20	8.26	8.35	8.44	8.51	8.61	8.74	8.88

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

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Judges Retirement Fund

Scenario: 7.5% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Contributions (% of Payroll)										
Statutory - Chapter 490	36.41%	36.24%	36.07%	35.91%	35.75%	35.59%	35.44%	35.29%	29.50%	29.50%
Required - Chapter 356 (MVA)	49.46%	51.72%	54.71%	59.02%	65.50%	76.37%	98.26%	164.08%	25.64%	25.39%
Sufficiency / (Deficiency)	(13.05)%	(15.48)%	(18.64)%	(23.11)%	(29.75)%	(40.78)%	(62.82)%	(128.79)%	3.86%	4.11%
Contributions										
Statutory - Chapter 490	31,663	32,310	32,972	33,654	34,357	35,075	35,809	36,562	31,337	32,128
Required - Chapter 356 (MVA)	43,011	46,108	50,009	55,312	62,953	75,263	99,278	169,978	27,237	27,651
Sufficiency / (Deficiency)	(11,348)	(13,798)	(17,037)	(21,658)	(28,596)	(40,188)	(63,469)	(133,416)	4,100	4,477
Funding Ratios										
Current Assets (MVA)	437,346	452,552	468,776	486,029	504,386	524,050	545,101	567,624	591,782	611,508
Actuarial Accrued Liability (AAL)	621,059	632,726	644,888	657,503	670,606	684,343	698,744	713,833	729,705	746,435
Unfunded AAL	183,713	180,174	176,112	171,474	166,220	160,293	153,643	146,209	137,923	134,927
Funding Ratio	70.4%	71.5%	72.7%	73.9%	75.2%	76.6%	78.0%	79.5%	81.1%	81.9%
Benefit Payments	48,431	49,191	50,028	50,890	51,654	52,450	53,284	54,082	54,871	55,714
Ratio of Assets to Benefit Payments	9.03	9.20	9.37	9.55	9.76	9.99	10.23	10.50	10.78	10.98

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed in conjunction with GRS' January 29, 2021 letter to MSRS.

Judges Retirement Fund

Scenario: 6.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Contributions (% of Payroll)										
Statutory - Chapter 490	41.70%	40.60%	40.34%	40.07%	39.82%	39.56%	39.32%	39.08%	38.84%	38.61%
Required - Chapter 356 (MVA)	42.37%	42.25%	42.51%	42.81%	43.18%	43.66%	44.17%	44.76%	45.39%	46.14%
Sufficiency / (Deficiency)	(0.67)%	(1.65)%	(2.17)%	(2.74)%	(3.36)%	(4.10)%	(4.85)%	(5.68)%	(6.55)%	(7.53)%
Contributions										
Statutory - Chapter 490	22,173	22,118	22,507	22,908	23,320	23,748	24,185	24,632	25,093	25,567
Required - Chapter 356 (MVA)	22,526	23,016	23,721	24,472	25,288	26,204	27,170	28,214	29,324	30,553
Sufficiency / (Deficiency)	(353)	(898)	(1,214)	(1,564)	(1,968)	(2,456)	(2,985)	(3,582)	(4,231)	(4,986)
Funding Ratios										
Current Assets (MVA)	216,737	224,770	232,047	238,664	244,691	250,170	255,191	259,735	263,761	267,307
Actuarial Accrued Liability (AAL)	402,660	415,288	427,720	439,628	451,089	462,160	472,938	483,399	493,488	503,227
Unfunded AAL	185,923	190,518	195,673	200,964	206,398	211,990	217,747	223,664	229,727	235,920
Funding Ratio	53.8%	54.1%	54.3%	54.3%	54.2%	54.1%	54.0%	53.7%	53.4%	53.1%
Benefit Payments	26,883	28,027	29,478	30,834	32,125	33,314	34,504	35,715	36,873	38,174
Ratio of Assets to Benefit Payments	8.06	8.02	7.87	7.74	7.62	7.51	7.40	7.27	7.15	7.00

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

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Judges Retirement Fund

Scenario: 6.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Contributions (% of Payroll)										
Statutory - Chapter 490	38.39%	38.17%	37.95%	37.74%	37.54%	37.34%	37.14%	36.96%	36.77%	36.59%
Required - Chapter 356 (MVA)	47.16%	48.27%	49.60%	51.14%	52.95%	54.99%	57.48%	60.47%	64.09%	68.50%
Sufficiency / (Deficiency)	(8.77)%	(10.10)%	(11.65)%	(13.40)%	(15.41)%	(17.65)%	(20.34)%	(23.51)%	(27.32)%	(31.91)%
Contributions										
Statutory - Chapter 490	26,052	26,551	27,060	27,590	28,126	28,676	29,242	29,820	30,418	31,032
Required - Chapter 356 (MVA)	32,008	33,580	35,366	37,386	39,674	42,235	45,248	48,794	53,014	58,099
Sufficiency / (Deficiency)	(5,956)	(7,029)	(8,306)	(9,796)	(11,548)	(13,559)	(16,006)	(18,974)	(22,596)	(27,067)
Funding Ratios										
Current Assets (MVA)	270,210	272,593	274,467	275,823	276,815	277,551	278,011	278,053	277,769	277,294
Actuarial Accrued Liability (AAL)	512,961	522,438	531,676	540,683	549,629	558,646	567,720	576,735	585,814	595,112
Unfunded AAL	242,751	249,845	257,209	264,860	272,814	281,095	289,709	298,682	308,045	317,818
Funding Ratio	52.7%	52.2%	51.6%	51.0%	50.4%	49.7%	49.0%	48.2%	47.4%	46.6%
Benefit Payments	39,331	40,457	41,576	42,533	43,373	44,232	45,229	46,123	46,890	47,663
Ratio of Assets to Benefit Payments	6.87	6.74	6.60	6.48	6.38	6.27	6.15	6.03	5.92	5.82

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed in conjunction with GRS' January 29, 2021 letter to MSRS.

Judges Retirement Fund

Scenario: 6.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Contributions (% of Payroll)										
Statutory - Chapter 490	36.41%	36.24%	36.07%	35.91%	35.75%	35.59%	35.44%	35.29%	29.50%	29.50%
Required - Chapter 356 (MVA)	74.08%	81.32%	90.96%	104.56%	124.97%	159.06%	227.37%	432.45%	42.33%	43.39%
Sufficiency / (Deficiency)	(37.67)%	(45.08)%	(54.89)%	(68.65)%	(89.22)%	(123.47)%	(191.93)%	(397.16)%	(12.83)%	(13.89)%
Contributions										
Statutory - Chapter 490	31,663	32,310	32,972	33,654	34,357	35,075	35,809	36,562	31,337	32,128
Required - Chapter 356 (MVA)	64,419	72,502	83,145	97,997	120,111	156,747	229,731	447,999	44,966	47,253
Sufficiency / (Deficiency)	(32,756)	(40,192)	(50,173)	(64,343)	(85,754)	(121,672)	(193,922)	(411,437)	(13,629)	(15,125)
Funding Ratios										
Current Assets (MVA)	276,629	275,785	274,836	273,763	272,552	271,315	270,030	268,670	267,282	259,716
Actuarial Accrued Liability (AAL)	604,652	614,478	624,701	635,328	646,387	658,019	670,245	683,084	696,620	710,922
Unfunded AAL	328,023	338,693	349,865	361,565	373,835	386,704	400,215	414,414	429,338	451,206
Funding Ratio	45.8%	44.9%	44.0%	43.1%	42.2%	41.2%	40.3%	39.3%	38.4%	36.5%
Benefit Payments	48,431	49,191	49,823	50,571	51,224	51,911	52,638	53,332	54,019	54,760
Ratio of Assets to Benefit Payments	5.71	5.61	5.52	5.41	5.32	5.23	5.13	5.04	4.95	4.74

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.

This exhibit should only be viewed in conjunction with GRS' January 29, 2021 letter to MSRS.

Judges Retirement Fund

Scenario: 9.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Contributions (% of Payroll)										
Statutory - Chapter 490	41.70%	40.60%	40.34%	40.07%	39.82%	39.56%	39.32%	39.08%	38.84%	38.61%
Required - Chapter 356 (MVA)	42.37%	41.61%	41.18%	40.71%	40.26%	39.83%	39.35%	38.85%	38.28%	37.70%
Sufficiency / (Deficiency)	(0.67)%	(1.01)%	(0.84)%	(0.64)%	(0.44)%	(0.27)%	(0.03)%	0.23%	0.56%	0.91%
Contributions										
Statutory - Chapter 490	22,173	22,118	22,507	22,908	23,320	23,748	24,185	24,632	25,093	25,567
Required - Chapter 356 (MVA)	22,526	22,667	22,976	23,275	23,578	23,909	24,208	24,491	24,729	24,961
Sufficiency / (Deficiency)	(353)	(549)	(469)	(367)	(258)	(161)	(23)	141	364	606
Funding Ratios										
Current Assets (MVA)	216,737	231,200	245,708	260,409	275,433	290,886	306,930	323,630	341,029	359,264
Actuarial Accrued Liability (AAL)	402,660	415,903	429,128	442,040	454,751	467,357	480,000	492,698	505,450	518,332
Unfunded AAL	185,923	184,703	183,420	181,631	179,318	176,471	173,070	169,068	164,421	159,068
Funding Ratio	53.8%	55.6%	57.3%	58.9%	60.6%	62.2%	63.9%	65.7%	67.5%	69.3%
Benefit Payments	26,883	28,027	29,478	30,834	32,125	33,314	34,504	35,715	36,873	38,174
Ratio of Assets to Benefit Payments	8.06	8.25	8.34	8.45	8.57	8.73	8.90	9.06	9.25	9.41

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Judges Retirement Fund

Scenario: 9.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Contributions (% of Payroll)										
Statutory - Chapter 490	38.39%	38.17%	37.95%	37.74%	37.54%	37.34%	37.14%	36.96%	36.77%	36.59%
Required - Chapter 356 (MVA)	37.11%	36.40%	35.42%	34.30%	33.04%	31.52%	29.83%	27.86%	25.50%	22.57%
Sufficiency / (Deficiency)	1.28%	1.77%	2.53%	3.44%	4.50%	5.82%	7.31%	9.10%	11.27%	14.02%
Contributions										
Statutory - Chapter 490	26,052	26,551	27,060	27,590	28,126	28,676	29,242	29,820	30,418	31,032
Required - Chapter 356 (MVA)	25,187	25,326	25,252	25,074	24,758	24,210	23,485	22,484	21,093	19,138
Sufficiency / (Deficiency)	865	1,225	1,808	2,516	3,368	4,466	5,757	7,336	9,325	11,894
Funding Ratios										
Current Assets (MVA)	378,270	398,232	419,230	441,375	464,907	490,031	516,886	545,500	576,154	609,188
Actuarial Accrued Liability (AAL)	531,229	544,267	555,811	567,231	578,699	590,356	602,193	614,105	626,224	638,715
Unfunded AAL	152,959	146,035	136,581	125,856	113,792	100,325	85,307	68,605	50,070	29,527
Funding Ratio	71.2%	73.2%	75.4%	77.8%	80.3%	83.0%	85.8%	88.8%	92.0%	95.4%
Benefit Payments	39,331	40,602	41,818	42,924	43,959	45,012	46,204	47,289	48,246	49,324
Ratio of Assets to Benefit Payments	9.62	9.81	10.03	10.28	10.58	10.89	11.19	11.54	11.94	12.35

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Judges Retirement Fund

Scenario: 9.0% investment return for all years

Fiscal year beginning July 1

$ in Thousands	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Contributions (% of Payroll)										
Statutory - Chapter 490	36.41%	29.51%	29.51%	29.51%	29.51%	29.50%	29.50%	29.50%	29.50%	29.50%
Required - Chapter 356 (MVA)	18.92%	16.44%	14.96%	13.48%	11.91%	10.25%	8.53%	6.72%	4.80%	2.77%
Sufficiency / (Deficiency)	17.49%	13.07%	14.55%	16.03%	17.60%	19.25%	20.97%	22.78%	24.70%	26.73%
Contributions										
Statutory - Chapter 490	31,663	26,310	26,972	27,654	28,357	29,075	29,809	30,562	31,337	32,128
Required - Chapter 356 (MVA)	16,450	14,657	13,675	12,631	11,444	10,101	8,621	6,961	5,101	3,012
Sufficiency / (Deficiency)	15,213	11,653	13,297	15,023	16,913	18,974	21,188	23,601	26,236	29,116
Funding Ratios										
Current Assets (MVA)	644,704	682,845	717,542	754,632	794,339	837,026	882,958	932,413	985,762	1,043,406
Actuarial Accrued Liability (AAL)	651,494	664,504	677,858	691,565	705,658	720,284	735,470	751,242	767,692	784,894
Unfunded AAL	6,790	(18,341)	(39,684)	(63,067)	(88,681)	(116,742)	(147,488)	(181,171)	(218,070)	(258,512)
Funding Ratio	99.0%	102.8%	105.9%	109.1%	112.6%	116.2%	120.1%	124.1%	128.4%	132.9%
Benefit Payments	50,498	51,720	53,076	54,443	55,708	56,993	58,306	59,586	60,840	62,133
Ratio of Assets to Benefit Payments	12.77	13.20	13.52	13.86	14.26	14.69	15.14	15.65	16.20	16.79

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.