| P: 800.521.0498 | www.grsconsulting.com

January 31, 2023

CONFIDENTIAL

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 – State Patrol Retirement Fund

Dear Ms. Leonard:

Attached are 30-year projections of estimated funded status, required contributions, and statutory contributions under three asset return scenarios for the State Patrol Retirement Fund. 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, assets, and plan provisions as outlined in the State Patrol Retirement Fund actuarial funding valuation as of July 1, 2022.

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 7.5% and 9.0% rate of return assumptions are outside of the range of reasonable expected returns for this plan.

The estimates are based on the market value of assets with no smoothing of investment gains or losses. Consequently, the required contributions for the fiscal year will not match the figures based on the actuarial value of assets shown in our valuation report. Payroll is assumed to increase approximately 3.00% 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 937 members. The profile of these new members is the same as new members hired between July 1, 2016 and June 30, 2021. Average salary at hire increases at the assumed payroll growth rate.

- Average age at hire is 31.9
- Average salary at hire is $85,400
- Approximately 21% female, 79% male

277 Coon Rapids Boulevard | Suite 212 | Coon Rapids, Minnesota 55433-2629

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 a $1.0 million contribution to the fund each October 1 until both the MSRS State Patrol Fund and the PERA Police and Fire Plan become 90% funded (on an Actuarial Value of Assets basis) or July 1, 2048 if earlier. For purposes of the enclosed projections, this state contribution is projected to be eliminated in fiscal years ending 2026 for both the 9.0% and 7.5% investment return scenarios and in fiscal year ending 2049 for the 6.0% investment return scenario, based on the combined projected funded status of the MSRS State Patrol Fund and the PERA Police and Fire Plan.

The plan receives supplemental employer contributions of 7.0% of payroll until the plan reaches 100% funding (on a Market Value basis). These supplemental employer contributions are projected to be eliminated in fiscal years ending 2029 and 2033 in the 9.0% and 7.5% investment return scenarios, respectively.

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 statutory 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 enclosed projections are based on assumptions as outlined in the State Patrol Retirement Fund actuarial funding valuation as of July 1, 2022. Please see that report for comments regarding the 7.5% statutory investment return assumption, and sensitivity test results based on alternate assumptions.

- Note that plan changes may result in behavior changes that are not anticipated in the current assumptions.

- In the 7.5% and 9.0% investment return scenarios, 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.

- A 2022 analysis of long-term rate of investment return and inflation assumptions concluded that the probability of exceeding the current 7.5% assumption over 10 years is only 34%. 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.

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 Directors. 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, except as noted. MSRS is solely responsible for communicating to GRS any changes required thereto.

In a 2022 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 5.64% to 6.84% would be reasonable for this valuation. This implies that the 7.5% and 9.0% rate of return assumptions would be outside the range of reasonable returns for this plan. Please see our letter dated July 12, 2022 for additional information. For informational purposes, results based on a 6.5% discount rate are shown on page 4 of the July 1, 2022 valuation report.

The projections assume 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, 2022 valuation report. This valuation report includes risk metrics on pages 5-8, 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 information furnished by the Minnesota State Retirement System (MSRS), concerning 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 judgement, 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 reflects the impact of COVID-19 through June 30, 2022. It does not reflect the ongoing 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.

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 State Patrol 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.

Brian B. Murphy, Bonita J. Wurst and Sheryl L. Christensen 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.

Respectfully submitted,

Gabriel, Roeder, Smith & Company

Brian B. Murphy

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

Bonita J. Wurst

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

Sheryl Christensen

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

BBM/BJW/SLC:dj
Enclosures

Other Observations

General Implications of the 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, Chapter 356 required contributions are made, and all actuarial assumptions are met (including the assumption of the plan earning 7.50% on the market value of assets, as prescribed by statutes), 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 26 years; and
(3) The unfunded liability is expected to 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 market 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 actuarial value of assets were used instead of the market value of assets.

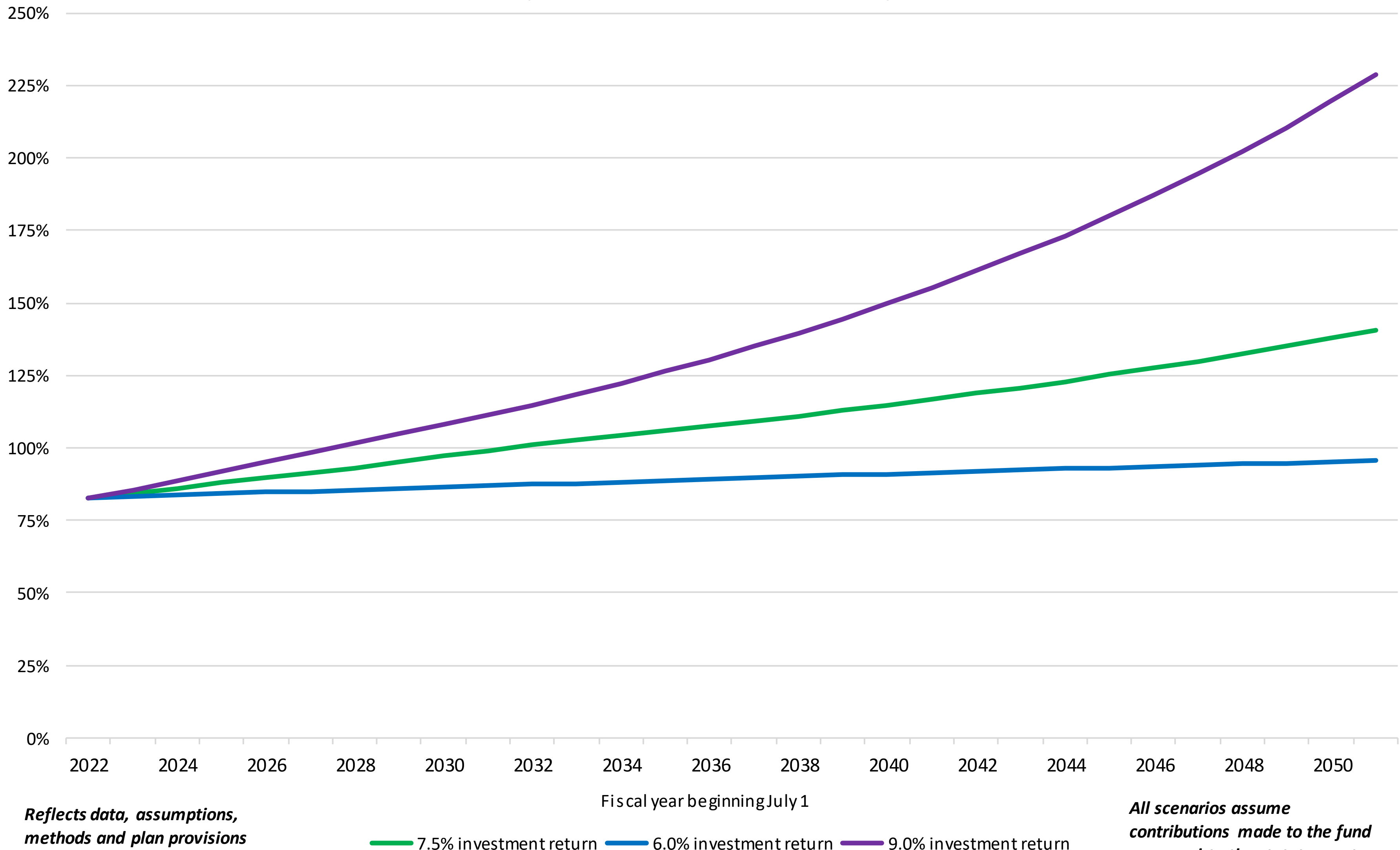
Limitations of Project Scope

Actuarial standards do 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 31, 2023 letter to MSRS.

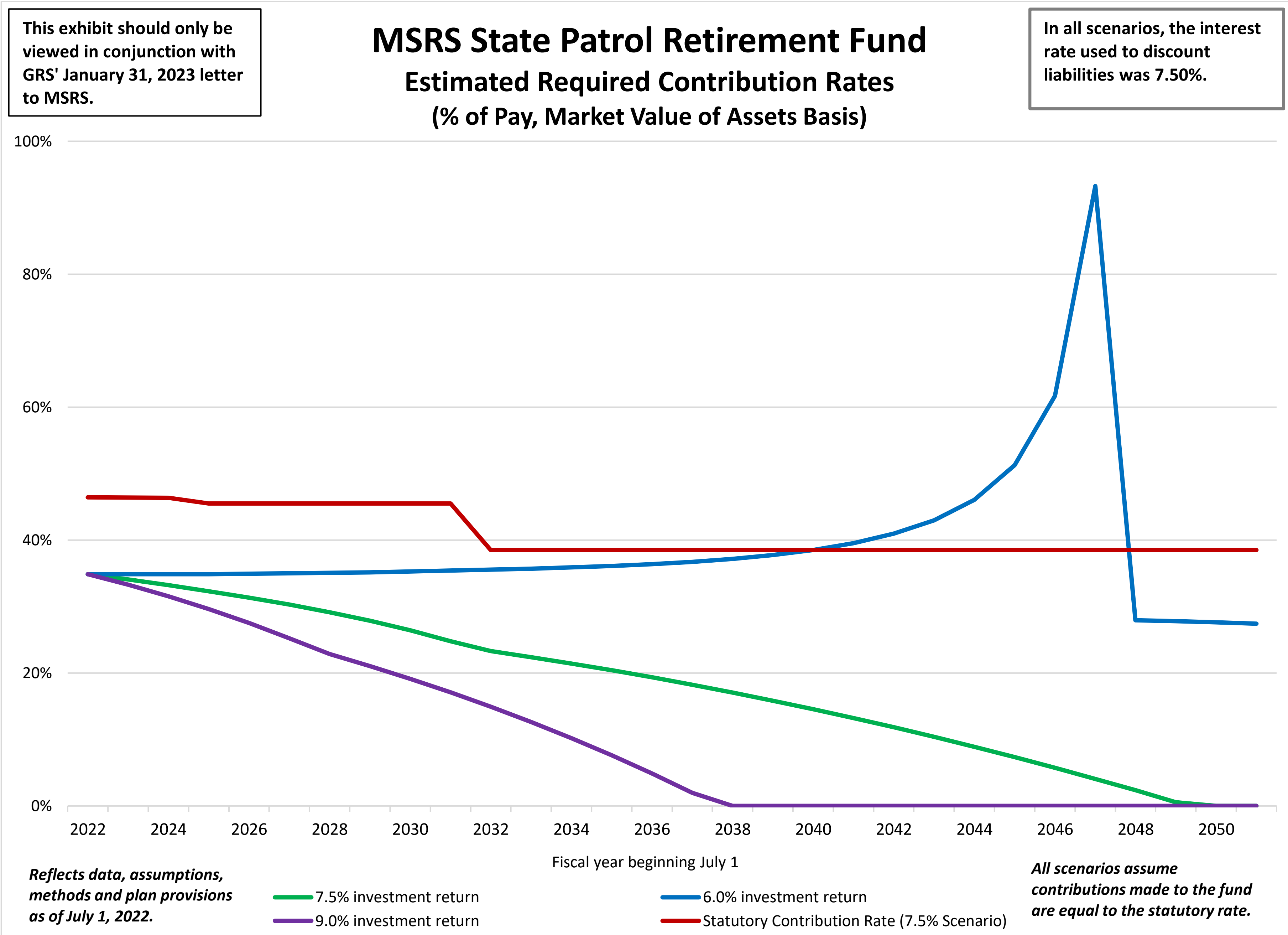
MSRS State Patrol Retirement Fund
Estimated Accrued Liabiltiy Funded Ratio
(Market Value of Assets Basis)

In all scenarios, the interest rate used to discount liabilities was 7.50%.



Reflects data, assumptions, methods and plan provisions as of July 1, 2022.

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



This exhibit should only be viewed in conjunction with GRS' January 31, 2023 letter to MSRS.
MSRS State Patrol Retirement Fund
Estimated Required Contribution Rates
(% of Pay, Market Value of Assets Basis)
In all scenarios, the interest rate used to discount liabilities was 7.50%.
100%
80%
60%
40%
20%
0%
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
2050
Fiscal year beginning July 1
Reflects data, assumptions, methods and plan provisions as of July 1, 2022.
7.5% investment return
9.0% investment return
6.0% investment return
Statutory Contribution Rate (7.5% Scenario)
All scenarios assume contributions made to the fund are equal to the statutory rate.

This exhibit should only be viewed in conjunction with GRS' January 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 7.5% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Contributions (% of Payroll)										
Statutory - Chapter 352B	46.43%	46.41%	46.38%	45.50%	45.50%	45.50%	45.50%	45.50%	45.50%	45.50%
Required - Chapter 356 (MVA)	34.87%	34.09%	33.22%	32.28%	31.34%	30.31%	29.15%	27.86%	26.42%	24.80%
Sufficiency / (Deficiency)	11.56%	12.32%	13.16%	13.22%	14.16%	15.19%	16.35%	17.64%	19.08%	20.70%
Contributions										
Statutory - Chapter 352	$ 49,722	$ 51,244	$ 52,781	$ 53,550	$ 55,317	$ 57,000	$ 58,788	$ 60,662	$ 62,505	$ 64,338
Required - Chapter 356 (MVA)	37,343	37,649	37,807	37,993	38,099	37,971	37,663	37,142	36,290	35,061
Sufficiency / (Deficiency)	12,379	13,595	14,974	15,557	17,219	19,029	21,125	23,520	26,215	29,277
Funding Ratios										
Current Assets (MVA)	$ 883,581	$ 932,342	$ 984,346	$1,039,532	$1,097,295	$1,158,682	$1,223,678	$1,292,620	$1,365,794	$1,443,254
Actuarial Accrued Liability (AAL)	1,067,605	1,104,532	1,143,096	1,183,057	1,224,611	1,267,746	1,312,353	1,358,511	1,406,291	1,455,570
Unfunded AAL	184,024	172,190	158,750	143,525	127,316	109,064	88,675	65,891	40,497	12,316
Funding Ratio	82.8%	84.4%	86.1%	87.9%	89.6%	91.4%	93.2%	95.2%	97.1%	99.2%
Benefit Payments	$ 66,372	$ 68,286	$ 70,507	$ 72,775	$ 75,216	$ 77,850	$ 80,526	$ 83,295	$ 86,288	$ 89,596
Ratio of Assets to Benefit Payments	13.31	13.65	13.96	14.28	14.59	14.88	15.20	15.52	15.83	16.11

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 7.5% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Contributions (% of Payroll)										
Statutory - Chapter 352B	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%
Required - Chapter 356 (MVA)	23.31%	22.39%	21.43%	20.41%	19.35%	18.24%	17.06%	15.84%	14.56%	13.21%
Sufficiency / (Deficiency)	15.19%	16.11%	17.07%	18.09%	19.15%	20.26%	21.44%	22.66%	23.94%	25.29%
Contributions										
Statutory - Chapter 352	$ 56,136	$ 57,997	$ 59,845	$ 61,703	$ 63,627	$ 65,663	$ 67,574	$ 69,562	$ 71,579	$ 73,516
Required - Chapter 356 (MVA)	33,991	33,732	33,309	32,714	31,979	31,116	29,942	28,611	27,067	25,230
Sufficiency / (Deficiency)	22,144	24,265	26,536	28,989	31,649	34,548	37,632	40,951	44,512	48,286
Funding Ratios										
Current Assets (MVA)	$1,524,984	$1,601,005	$1,681,705	$1,767,519	$1,858,600	$1,955,286	$2,058,133	$2,167,358	$2,283,113	$2,405,570
Actuarial Accrued Liability (AAL)	1,506,127	1,558,236	1,612,471	1,669,112	1,728,091	1,789,485	1,853,527	1,920,269	1,989,554	2,061,247
Unfunded AAL	(18,857)	(42,768)	(69,234)	(98,406)	(130,510)	(165,801)	(204,605)	(247,089)	(293,559)	(344,322)
Funding Ratio	101.3%	102.7%	104.3%	105.9%	107.6%	109.3%	111.0%	112.9%	114.8%	116.7%
Benefit Payments	$ 92,797	$ 95,632	$ 98,376	$ 101,349	$ 104,446	$ 107,522	$ 110,709	$ 114,287	$ 118,202	$ 122,668
Ratio of Assets to Benefit Payments	16.43	16.74	17.09	17.44	17.79	18.18	18.59	18.96	19.32	19.61

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 7.5% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
Contributions (% of Payroll)										
Statutory - Chapter 352B	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%
Required - Chapter 356 (MVA)	11.84%	10.41%	8.90%	7.34%	5.75%	4.05%	2.38%	0.57%	0.00%	0.00%
Sufficiency / (Deficiency)	26.66%	28.09%	29.60%	31.16%	32.75%	34.45%	36.12%	37.93%	38.50%	38.50%
Contributions										
Statutory - Chapter 352	$ 75,672	$ 77,918	$ 80,132	$ 82,443	$ 85,011	$ 87,466	$ 90,358	$ 93,101	$ 96,162	$ 99,095
Required - Chapter 356 (MVA)	23,279	21,069	18,518	15,710	12,694	9,212	5,591	1,370	-	-
Sufficiency / (Deficiency)	52,393	56,850	61,614	66,733	72,317	78,254	84,768	91,731	96,162	99,095
Funding Ratios										
Current Assets (MVA)	$2,534,576	$2,670,635	$2,814,470	$2,966,271	$3,126,120	$3,294,838	$3,472,674	$3,660,666	$3,859,308	$4,069,663
Actuarial Accrued Liability (AAL)	2,134,950	2,210,707	2,288,832	2,369,171	2,451,341	2,535,559	2,621,702	2,710,011	2,800,505	2,893,412
Unfunded AAL	(399,626)	(459,928)	(525,637)	(597,101)	(674,779)	(759,279)	(850,973)	(950,654)	(1,058,803)	(1,176,251)
Funding Ratio	118.7%	120.8%	123.0%	125.2%	127.5%	130.0%	132.5%	135.1%	137.8%	140.7%
Benefit Payments	$ 127,340	$ 131,915	$ 136,836	$ 142,352	$ 147,912	$ 153,762	$ 159,706	$ 165,757	$ 171,872	$ 178,005
Ratio of Assets to Benefit Payments	19.90	20.25	20.57	20.84	21.13	21.43	21.74	22.08	22.45	22.86

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund
Scenario: 6.0% Investment Return for All Years
Fiscal Year Beginning July 1

$ in Thousands	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Contributions (% of Payroll)										
Statutory - Chapter 352B	46.43%	46.41%	46.38%	46.35%	46.32%	46.30%	46.27%	46.25%	46.23%	46.21%
Required - Chapter 356 (MVA)	34.87%	34.88%	34.88%	34.88%	34.93%	35.00%	35.07%	35.15%	35.26%	35.41%
Sufficiency / (Deficiency)	11.56%	11.53%	11.50%	11.47%	11.39%	11.30%	11.20%	11.10%	10.97%	10.80%
Contributions										
Statutory - Chapter 352	$ 49,722	$ 51,244	$ 52,781	$ 54,550	$ 56,317	$ 58,000	$ 59,788	$ 61,662	$ 63,505	$ 65,338
Required - Chapter 356 (MVA)	37,343	38,519	39,690	41,056	42,462	43,850	45,314	46,865	48,443	50,071
Sufficiency / (Deficiency)	12,379	12,725	13,091	13,494	13,856	14,149	14,474	14,796	15,062	15,266
Funding Ratios										
Current Assets (MVA)	$ 883,581	$ 919,215	$ 956,576	$ 995,465	$1,036,167	$1,078,608	$1,122,608	$1,168,325	$1,215,854	$1,265,041
Actuarial Accrued Liability (AAL)	1,067,605	1,104,532	1,143,096	1,183,057	1,224,611	1,267,746	1,312,353	1,358,511	1,406,291	1,455,570
Unfunded AAL	184,024	185,317	186,521	187,592	188,444	189,138	189,745	190,186	190,437	190,529
Funding Ratio	82.8%	83.2%	83.7%	84.1%	84.6%	85.1%	85.5%	86.0%	86.5%	86.9%
Benefit Payments	$ 66,372	$ 68,286	$ 70,507	$ 72,775	$ 75,216	$ 77,850	$ 80,526	$ 83,295	$ 86,288	$ 89,596
Ratio of Assets to Benefit Payments	13.31	13.46	13.57	13.68	13.78	13.85	13.94	14.03	14.09	14.12

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 6.0% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Contributions (% of Payroll)										
Statutory - Chapter 352B	46.19%	46.16%	46.14%	46.12%	46.11%	46.09%	46.07%	46.05%	46.04%	46.02%
Required - Chapter 356 (MVA)	35.56%	35.70%	35.89%	36.12%	36.39%	36.72%	37.17%	37.74%	38.50%	39.55%
Sufficiency / (Deficiency)	10.63%	10.46%	10.25%	10.00%	9.72%	9.37%	8.90%	8.31%	7.54%	6.47%
Contributions										
Statutory - Chapter 352	$ 67,342	$ 69,542	$ 71,726	$ 73,922	$ 76,196	$ 78,602	$ 80,861	$ 83,209	$ 85,594	$ 87,883
Required - Chapter 356 (MVA)	51,854	53,785	55,786	57,881	60,143	62,635	65,234	68,193	71,585	75,525
Sufficiency / (Deficiency)	15,488	15,757	15,941	16,041	16,053	15,967	15,627	15,016	14,009	12,358
Funding Ratios										
Current Assets (MVA)	$1,315,652	$1,368,058	$1,422,942	$1,480,533	$1,540,768	$1,603,759	$1,669,828	$1,738,894	$1,810,826	$1,885,487
Actuarial Accrued Liability (AAL)	1,506,127	1,558,236	1,612,471	1,669,112	1,728,091	1,789,485	1,853,527	1,920,269	1,989,554	2,061,247
Unfunded AAL	190,475	190,179	189,529	188,579	187,323	185,726	183,699	181,375	178,728	175,761
Funding Ratio	87.4%	87.8%	88.3%	88.7%	89.2%	89.6%	90.1%	90.6%	91.0%	91.5%
Benefit Payments	$ 92,797	$ 95,632	$ 98,376	$ 101,349	$ 104,446	$ 107,522	$ 110,709	$ 114,287	$ 118,202	$ 122,668
Ratio of Assets to Benefit Payments	14.18	14.31	14.46	14.61	14.75	14.92	15.08	15.22	15.32	15.37

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 6.0% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
Contributions (% of Payroll)										
Statutory - Chapter 352B	46.01%	45.99%	45.98%	45.97%	45.95%	45.94%	45.50%	45.50%	45.50%	45.50%
Required - Chapter 356 (MVA)	40.97%	42.97%	46.06%	51.27%	61.70%	93.28%	27.94%	27.78%	27.61%	27.43%
Sufficiency / (Deficiency)	5.04%	3.02%	(0.08)%	(5.30)%	(15.75)%	(47.34)%	17.56%	17.72%	17.89%	18.07%
Contributions										
Statutory - Chapter 352	$ 90,430	$ 93,085	$ 95,702	$ 98,433	$ 101,468	$ 104,369	$ 106,787	$ 110,028	$ 113,646	$ 117,112
Required - Chapter 356 (MVA)	80,522	86,969	95,858	109,783	136,236	211,908	65,581	67,190	68,974	70,605
Sufficiency / (Deficiency)	9,908	6,117	(156)	(11,350)	(34,768)	(107,538)	41,206	42,839	44,672	46,507
Funding Ratios										
Current Assets (MVA)	$1,962,374	$2,041,674	$2,123,741	$2,208,348	$2,295,149	$2,384,542	$2,476,249	$2,569,810	$2,666,075	$2,765,527
Actuarial Accrued Liability (AAL)	2,134,950	2,210,707	2,288,832	2,369,171	2,451,341	2,535,559	2,621,702	2,710,011	2,800,505	2,893,412
Unfunded AAL	172,576	169,033	165,091	160,823	156,192	151,017	145,453	140,201	134,430	127,885
Funding Ratio	91.9%	92.4%	92.8%	93.2%	93.6%	94.0%	94.5%	94.8%	95.2%	95.6%
Benefit Payments	$ 127,340	$ 131,915	$ 136,836	$ 142,352	$ 147,912	$ 153,762	$ 159,706	$ 165,757	$ 171,872	$ 178,005
Ratio of Assets to Benefit Payments	15.41	15.48	15.52	15.51	15.52	15.51	15.51	15.50	15.51	15.54

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 9.0% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Contributions (% of Payroll)										
Statutory - Chapter 352B	46.43%	46.41%	46.38%	45.50%	45.50%	45.50%	38.50%	38.50%	38.50%	38.50%
Required - Chapter 356 (MVA)	34.87%	33.31%	31.54%	29.60%	27.53%	25.21%	22.87%	21.06%	19.14%	17.09%
Sufficiency / (Deficiency)	11.56%	13.10%	14.84%	15.90%	17.97%	20.29%	15.63%	17.44%	19.36%	21.41%
Contributions										
Statutory - Chapter 352	$ 49,722	$ 51,244	$ 52,781	$ 53,550	$ 55,317	$ 57,000	$ 49,744	$ 51,329	$ 52,889	$ 54,440
Required - Chapter 356 (MVA)	37,343	36,780	35,897	34,842	33,470	31,582	29,543	28,075	26,287	24,165
Sufficiency / (Deficiency)	12,379	14,465	16,884	18,708	21,848	25,417	20,201	23,254	26,602	30,275
Funding Ratios										
Current Assets (MVA)	$ 883,581	$ 945,469	$1,012,510	$1,084,862	$1,162,151	$1,245,683	$1,335,732	$1,423,497	$1,517,914	$1,619,323
Actuarial Accrued Liability (AAL)	1,067,605	1,104,532	1,143,096	1,183,057	1,224,611	1,267,746	1,312,353	1,358,511	1,406,291	1,455,570
Unfunded AAL	184,024	159,063	130,586	98,195	62,460	22,063	(23,379)	(64,986)	(111,623)	(163,753)
Funding Ratio	82.8%	85.6%	88.6%	91.7%	94.9%	98.3%	101.8%	104.8%	107.9%	111.3%
Benefit Payments	$ 66,372	$ 68,286	$ 70,507	$ 72,775	$ 75,216	$ 77,850	$ 80,526	$ 83,295	$ 86,288	$ 89,596
Ratio of Assets to Benefit Payments	13.31	13.85	14.36	14.91	15.45	16.00	16.59	17.09	17.59	18.07

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 9.0% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Contributions (% of Payroll)										
Statutory - Chapter 352B	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%
Required - Chapter 356 (MVA)	14.93%	12.64%	10.21%	7.62%	4.87%	1.98%	0.00%	0.00%	0.00%	0.00%
Sufficiency / (Deficiency)	23.57%	25.86%	28.29%	30.88%	33.63%	36.52%	38.50%	38.50%	38.50%	38.50%
Contributions										
Statutory - Chapter 352	$ 56,136	$ 57,997	$ 59,845	$ 61,703	$ 63,627	$ 65,663	$ 67,574	$ 69,562	$ 71,579	$ 73,516
Required - Chapter 356 (MVA)	21,768	19,048	15,874	12,209	8,050	3,374	-	-	-	-
Sufficiency / (Deficiency)	34,368	38,949	43,971	49,494	55,577	62,289	67,574	69,562	71,579	73,516
Funding Ratios										
Current Assets (MVA)	$1,728,013	$1,844,904	$1,971,285	$2,108,096	$2,256,042	$2,416,068	$2,589,397	$2,776,982	$2,979,775	$3,198,826
Actuarial Accrued Liability (AAL)	1,506,127	1,558,236	1,612,471	1,669,112	1,728,091	1,789,485	1,853,527	1,920,269	1,989,554	2,061,247
Unfunded AAL	(221,886)	(286,667)	(358,815)	(438,983)	(527,951)	(626,583)	(735,870)	(856,713)	(990,221)	(1,137,578)
Funding Ratio	114.7%	118.4%	122.3%	126.3%	130.6%	135.0%	139.7%	144.6%	149.8%	155.2%
Benefit Payments	$ 92,797	$ 95,632	$ 98,376	$ 101,349	$ 104,446	$ 107,522	$ 110,709	$ 114,287	$ 118,202	$ 122,668
Ratio of Assets to Benefit Payments	18.62	19.29	20.04	20.80	21.60	22.47	23.39	24.30	25.21	26.08

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 31, 2023 letter to MSRS.

State Patrol Retirement Fund

Scenario: 9.0% Investment Return for All Years

Fiscal Year Beginning July 1

$ in Thousands	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**
Contributions (% of Payroll)										
Statutory - Chapter 352B	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%
Required - Chapter 356 (MVA)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sufficiency / (Deficiency)	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%	38.50%
Contributions										
Statutory - Chapter 352	$ 75,672	$ 77,918	$ 80,132	$ 82,443	$ 85,011	$ 87,466	$ 90,358	$ 93,101	$ 96,162	$ 99,095
Required - Chapter 356 (MVA)	-	-	-	-	-	-	-	-	-	-
Sufficiency / (Deficiency)	75,672	77,918	80,132	82,443	85,011	87,466	90,358	93,101	96,162	99,095
Funding Ratios										
Current Assets (MVA)	$3,434,937	$3,689,656	$3,964,854	$4,261,979	$4,582,483	$4,928,690	$5,302,495	$5,706,736	$6,143,887	$6,617,172
Actuarial Accrued Liability (AAL)	2,134,950	2,210,707	2,288,832	2,369,171	2,451,341	2,535,559	2,621,702	2,710,011	2,800,505	2,893,412
Unfunded AAL	(1,299,987)	(1,478,949)	(1,676,022)	(1,892,808)	(2,131,142)	(2,393,131)	(2,680,793)	(2,996,725)	(3,343,381)	(3,723,760)
Funding Ratio	160.9%	166.9%	173.2%	179.9%	186.9%	194.4%	202.3%	210.6%	219.4%	228.7%
Benefit Payments	$ 127,340	$ 131,915	$ 136,836	$ 142,352	$ 147,912	$ 153,762	$ 159,706	$ 165,757	$ 171,872	$ 178,005
Ratio of Assets to Benefit Payments	26.97	27.97	28.98	29.94	30.98	32.05	33.20	34.43	35.75	37.17

Numbers may not add due to rounding.

The interest rate used to discount liabilities was 7.5%.