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Minnesota Legislative Commission on Pensions and Retirement

Replication of July 1, 2023 PERA Public Employees Police and Fire Plan Actuarial Valuation Report

July 15, 2024

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Minnesota Legislative Commission on Pensions and Retirement
Centennial Office Building, 1st floor
658 Cedar St.
St. Paul, MN 55155

Attn: Susan Lenczewski, Executive Director

Re: Replication of July 1, 2023 PERA Public Employees Police and Fire Plan Actuarial Valuation Report

This report presents our replication of the July 1, 2023 actuarial valuation report for the Public Employees Retirement Association of Minnesota Public Employees Police and Fire Plan (PERA Police and Fire Plan). It provides various exhibits illustrating the degree to which we were able to replicate both (1) the retained actuary's liability calculations and (2) their use of those liabilities to determine contribution rates and sufficiency.

> **In our professional opinion, we were able to reasonably match the retained actuary's data inputs, liability calculations, and contribution determinations. We did not find any meaningful differences or deficiencies in their calculations, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.**

Purpose of the Study

This study was prepared at the request of the Legislative Commission on Pensions and Retirement (LCPR). Its sole purpose is to replicate the July 1, 2023 PERA Police and Fire Plan actuarial valuation calculations for reasonability, accuracy, and compliance with applicable Minnesota Statutes; LCPR standards for actuarial work; and relevant Actuarial Standards of Practice (ASOPs).

The report is intended to comply with Minnesota Statute 356.214 Subd. 4(b) which states that the auditing actuary shall:

> "audit the valuation reports submitted by the actuary retained by each governing or managing board or administrative official, and provide an assessment of the reasonableness, reliability, and areas of concern or potential improvement in the specific reports reviewed, the procedures utilized by any particular reporting actuary, or general modifications to standards, procedures, or assumptions that the commission may wish to consider."

This report may not be used for any other purpose, and VIA Actuarial Solutions is not responsible for the consequences of any unauthorized use. Its content may not be modified, incorporated into or used in other materials, or otherwise provided, in whole or in part, to any other person or entity, without our permission.

Data Used in the Analysis

The results in this report are based on the following data sources:

- July 1, 2023 actuarial valuation report prepared by the PERA Police and Fire Plan's retained actuary;

- July 1, 2023 census data files provided by PERA, and "scrubbed" census files provided by the retained actuary; and

- July 1, 2023 asset and financial data found in the system's audited financial statements.

Although we reviewed all data sources for reasonability, we have not audited the underlying data and are relying on its substantial accuracy. If any data supplied are not accurate and complete, then our conclusions in this actuarial valuation replication may differ significantly.

We wish to thank all the involved parties for providing information in a timely manner and for answering our questions. We are particularly grateful to the staff at GRS for their help answering questions about their valuation system's technical calculations.

Actuarial Certification

To the best of our knowledge, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices.

Upon receipt of the report, the LCPR should notify us if you disagree with any information contained in the report or if you are aware of any information that would affect the results that has not been communicated to us. The report will be deemed final and acceptable to the LCPR unless you immediately notify us otherwise.

The undersigned credentialed actuaries are members of the American Academy of Actuaries and meet the Academy's Qualification Standards to render the actuarial opinion contained herein. We are available to answer questions on the material contained in the report or to provide explanations or further detail, as may be appropriate. We are not aware of any financial interest or relationship that could create a conflict of interest or impair the objectivity of our work.

Mark W. Schulte, FSA, EA, MAAA
Consulting Actuary

Emily M. Knutson, FSA, EA, MAAA
Consulting Actuary

L/D/C/R:5/jmg/mjc/emk/mws

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Executive Summary

This report summarizes our replication of the July 1, 2023 PERA Public Employees Police and Fire Plan actuarial valuation report. **We conclude that the retained actuary reasonably determined the system's July 1, 2023 actuarial liabilities and contribution sufficiency/(deficiency).**

The next section of this report describes our process for replicating and evaluating the retained actuary's calculations. It is followed by separate sections addressing different components of the replication process (e.g., validating census data and liability calculations), along with appendices that summarize many of the technical calculations.

We did not find any meaningful differences or deficiencies in the retained actuary's data or calculations. Overall liabilities and contributions were matched with sufficient accuracy, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.

	PERA Police and Fire Plan Actuarial Valuation	VIA Replication	Difference[1]
Participant data[2]			
Active members	11,635	11,635	0.0%
Service retirements	8,492	8,810	3.7%
Survivors	1,998	1,994	-0.2%
Disability retirements	2,111	1,793	-15.1%
Deferred retirements	1,966	1,965	-0.1%
Other non-vested terminations	941	941	0.0%
Total	**27,143**	**27,138**	0.0%
System assets *($1,000's)*			
Market value of assets	$ 11,038,928	$ 11,038,928	0.0%
Actuarial Value of Assets	11,105,741	11,105,741	0.0%
System liabilities *($1,000's)*			
Present Value of Future Benefits (PFVB)	15,395,775	15,383,105	-0.1%
Present Value of Future Normal Costs (PVFNC)	2,629,977	2,641,040	0.4%
Actuarial Accrued Liability (AAL)	12,765,798	12,742,065	-0.2%
Normal Cost (NC)	280,316	275,014	-1.9%
System contributions *(% of payroll)*			
Normal cost rate	23.26%	22.79%	-0.47%
UAAL amortization payment	8.50%	8.37%	-0.13%
Expenses	0.11%	0.11%	0.00%
Total required contribution (Chapter 356)	31.87%	31.27%	-0.60%
Statutory contribution rate (Chapter 353)	33.23%	33.23%	0.00%
Contribution sufficiency/(deficiency)	1.36%	1.96%	0.60%

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[1] The system contribution comparisons are absolute differences presented as a percent of payroll. All other comparisons are the relative differences between our replication results and the retained actuary.

[2] Comparison of the retained actuary's final valuation data to the system's data. PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. The retained actuary adjusted the status for 318 service retirees to be retirees to be disabled retirees based on their historical classification as disabled retirees.

Process Overview

The purpose of this report is to replicate (1) the technical calculation of the Plan's actuarial liabilities and (2) the contribution rates and sufficiency results based on those liabilities.

Our report focuses on replicating the following items:
1. Census data summaries;
2. Market asset data and Actuarial Value of Assets calculations;
3. Calculation of Plan liabilities;
4. Calculation of contribution sufficiency/(deficiency);
5. Confirmation of actuarial assumptions, methods, and plan provisions; and
6. Review of additional compliance items.

The table below summarizes how our valuation replication report incorporates each of these items.

Census data	- Compare participant category counts and summary statistics for the retained actuary vs. system census data files - Compare detailed participant distributions for the retained actuary's census file vs. the valuation report summaries
Plan assets	- Compare market asset values in the valuation report to those in the system's audited financial statements - Replicate retained actuary's Actuarial Value of Assets calculations
Plan liabilities	- Replicate technical liability calculations, including Present Value of Future Benefits (PVFB), Present Value of Future Normal Costs (PVFNC), Actuarial Accrued Liability (AAL), and Normal Cost (NC) - Compare liability calculations for various member status groups
Contribution sufficiency/(deficiency)	- Replicate the required normal cost and supplemental contribution rate calculations - Replicate retained actuary's contribution sufficiency/(deficiency) determination
Assumptions, methods, and plan provisions	Verify that the actuarial assumptions, methods, and plan provisions used in the July 1, 2023 actuarial valuation are consistent with applicable Minnesota Statutes and the System's recent actuarial experience studies.
Additional compliance requirements	Confirm that other aspects of the valuation report comply with applicable Minnesota Statutes, the LCPR's Standards for Actuarial Work, and relevant actuarial standards of practice (ASOPs).

Census Data

Census data is a foundational input for actuarial calculations. While it is not practical for data to be perfect, it should be reviewed for overall accuracy and reasonability.

Guidance on actuarial data is provided by Actuarial Standard of Practice No. 23, Data Quality (ASOP 23). It provides, in summary, that "The actuary should use available data that, in the actuary's professional judgment, allow the actuary to perform the desired analysis. However, if material data limitations are known to the actuary, the actuary should disclose those limitations and their implications".

To validate the census data used in the July 1, 2023 actuarial valuation report, we used the following process:

- Request separate census files from the retained actuary and the system;

- Compare overall census counts and summary statistics for various member classes (e.g., active members, service retirements, etc.); and

- Prepare detailed participant statistical distribution tables and compare them to those found in the retained actuary's July 1, 2023 actuarial valuation report.

Overall, we found that the census data used by the retained actuary was consistent with the census data provided by the system. Our census data comparisons and tables can be found in **Appendix A**. These exhibits are described below, along with some brief commentary.

> **Summary of participant statistics:** This table summarizes and compares participant counts and high-level participant category statistics for the retained actuary and system census files. It shows that the two files were very closely aligned.

> **Distribution of active members:** This table summarizes the retained actuary's active member data by classifying them in various age/service categories, along with the average pay for each classification. We found that this data was consistent with a similar summary table on page 16 of the July 1, 2023 actuarial valuation report.

> **Distributions of service retirements, survivors, and disability retirements:** These tables summarize the retained actuary's inactive member data by classifying them by age and service since retirement/death/disability, along with the average annual benefit for each classification. We found that the data in each of these tables was consistent with similar tables found on pages 17, 18 and 19 of the July 1, 2023 actuarial valuation report.

Plan Assets

Asset data is another of the foundational inputs for actuarial calculations. In addition to the Market Value of Assets, many public sector pension plans also use a smoothed Actuarial Value of Assets (AVA). The purpose of AVA methods is to stabilize contribution rates by smoothing investment returns – generally over a five-year period.

Guidance on asset smoothing methods is provided by Actuarial Standard of Practice No. 44, Selection and Use of Asset Valuation Methods for Pension Plans (ASOP 44). It provides considerations for selecting an actuarial asset method, including:

- Purpose of the measurement;

- Objectives of the employer and/or retirement system;

- Use of different methods/assumptions and adjustment for timing differences; and

- Other considerations such as the plan's expected future cash flows and liquidity needs.

Actuarial Standard of Practice No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions (ASOP 4) also provides guidance, but generally defers to ASOP 44. The specific methodology for determining the AVA is prescribed in Minnesota Statutes, Section 356.215, Subd.1(f).

To validate the asset data and AVA calculations used in the July 1, 2023 actuarial valuation report, we used the following process:

- Review audited financial data and compare it to the information disclosed in the actuarial valuation report; and

- Replicate the AVA calculations shown in the July 1, 2023 actuarial valuation report.

We found that the asset data used by the retained actuary was consistent with the system's audited asset information. We were also able to replicate the AVA calculation prepared by the retained actuary and confirm it follows the methods prescribed in Minnesota Statutes. Our asset data comparison can be found in Appendix B, and the AVA replication can be found in Appendix C.

Plan Liabilities

Actuarial liabilities are calculated by programming actuarial software with a retirement system's data, assumptions, methods, and plan provisions. This is a complex process which involves substantial effort and actuarial programming experience.

For the replication, we independently programmed our valuation software based on our understanding of the data, assumptions, methods, and plan provisions used in the July 1, 2023 actuarial valuation report, Minnesota Statutes, and the LCPR's standards for actuarial work. The primary results we replicated are:

- **Present Value of Future Benefits (PVFB):** plan liability equal to the discounted value of all projected future benefit payments (based on current participant group with projected compensation and service accruals).

- **Normal Cost (NC):** the portion of the PVFB allocated to the valuation year based on current compensation levels.

- **Present Value of Future Normal Costs (PVFNC):** the portion of the PVFB allocated to future years based on the present value of projected participant compensation.

- **Actuarial Accrued Liability (AAL):** the portion of the PFVB allocated to prior years based on each participant's historical and projected compensation.

We expect some liability calculation differences even if we used the exact same inputs as the retained actuary. This is because each actuarial software program may have slightly different ways of applying actuarial formulas. As a general rule, we would like to match the overall PVFB and AAL within 2% and PVFNC and Normal Cost within 5% of the retained actuary's results.

Results for member subgroups or split by benefit source may differ by larger magnitudes depending on how each actuary interprets and programs their actuarial software. We believe these differences are acceptable as long as they are small relative to the overall plan.

The tables in **Appendix D** summarize and compare the liability measurements for different membership groups. **Our overall results are very close to those presented in the July 1, 2023 actuarial valuation, and we believe that the retained actuary is reasonably calculating plan liabilities.**

One technical item clarified during the replication process is how the system's retained actuary is valuing disabled retiree payment options. If a disabled retiree under Normal Retirement Age (NRA) is reported with a single life annuity benefit, then the actuary is instead valuing their pre-NRA benefit as a 100% joint and survivor annuity. The purpose of this adjustment is to reflect potential pre-NRA survivor benefits, along with the fact that disabled retirees can change their payment option when they reach NRA. We believe this approach is reasonable, and the retained actuary indicated they may add more description of the process to future valuation reports.

Contribution Sufficiency/(Deficiency)

The PERA Police and Fire Plan's statutory pension contribution rates are defined in Chapter 353 of Minnesota Statues, but the retained actuary is also required to calculate "required contributions" per Chapter 356 of Minnesota Statutes. The required contribution rates are those which are expected to fully fund the pension plan by the statutory full funding date.

We replicated the contribution sufficiency/(deficiency) calculations as follows:

- **Statutory contributions:** We calculated the estimated dollar value of the statutory contributions based on statutory contribution rates applied to our replication of projected payroll.

- **Required contributions:** We calculated the estimated "percent of payroll" and dollar value of the contributions required to fully fund the Plan based on the Chapter 356 required contribution rates. These consist of normal cost contributions plus the required supplemental contribution rate. The normal cost and supplemental components of the required contributions were based our replication of the Plan's normal cost, Unfunded Actuarial Accrued Liability, and projected payroll through the statutory June 30, 2049 full funding date.[3]

- **Contribution sufficiency/(deficiency):** We compare our contribution sufficiency calculation (i.e., difference between the statutory and required contributions) to those determined by the retained actuary in the July 1, 2023 actuarial valuation report.

The tables in **Appendix E** summarize and compare our calculations. **Our overall results are close to those calculated by the retained actuary, and we believe that the retained actuary is reasonably calculating the contribution sufficiency/(deficiency).**

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[3] MN Statute 356.215 Subd. 11(h) specifies a June 30, 2048 full funding date, but this is overridden by application of Subd. 11(c) in the 2023 actuarial valuation which adjusted the amortization date to June 30, 2049.

Assumptions, Methods, and Plan Provisions

The retained actuary's July 1, 2023 actuarial valuation report contains a detailed description of the actuarial assumptions, methods, and plan provisions used to prepare their results. These items are summarized in their report on pages 26 through 42. We do not reprint all the assumptions, methods, and plan provisions in this replication report, but we do provide a high-level commentary below.

Actuarial Methods

Actuarial Cost Method: Minnesota Statutes, Section 356.215 Subd.1(b) and (d) require that PERA use the Entry Age Normal level percent of pay actuarial cost method. In this method, the actuarial Present Value of Future Benefits (PVFB) for each individual is allocated as a level percent of pay from entry age (hire age, for most employees) to decrement age (e.g., expected age at termination or retirement).

The portion of the PVFB allocated to the valuation year is called the Normal Cost (NC). The portion of the PVFB allocated to past years is called the Actuarial Accrued Liability (AAL). The retained actuary documents using this cost method in their report, and the closeness of our replication liabilities (Appendix D) indicate that it was applied appropriately.

Asset valuation method: The asset valuation method is used to smooth market fluctuations over time to create contribution stability. Minnesota Statutes, Section 356.215 Subd.1(f) requires using an Actuarial Value of Assets that smooths investment gains and losses over a five-year period. We confirmed that the retained actuary described and used the statutory asset smoothing method, and our replication calculations can be found in Appendix C of this report.

Contribution method: The contribution method specifies a process for funding the current year liability accruals (the Normal Cost) plus paying down/amortizing a portion of unfunded past liabilities (the Unfunded Actuarial Accrued Liability, or UAAL amortization).

These contribution parameters are defined in Minnesota Statutes, Section 356.215 Subd.5 and Subd.11. They specify that (1) the Normal Cost must be expressed as a level percent of payroll and (2) the required supplemental contribution must be calculated by amortizing the UAAL as a level percent of projected payroll over a closed period ending June 30, 2048.

Minnesota Statutes, Section 356.215 Subd. 11, paragraph (c) also contains a provision for adjusting the target amortization date if there has been a change in actuarial assumptions, methods, or plan provisions. Our understanding is that the 2023 assumption and plan changes caused the amortization end date to change from 2048 to 2049.

We confirmed that pages 22-24 of the July 1, 2023 actuarial valuation report describes the correct contribution calculation process, and our replication calculations (Appendix E of this report) indicate that the retained actuary applied the methods and assumptions appropriately.

Actuarial Assumptions

Demographic assumptions: We verified that the demographic assumptions described in the July 1, 2023 actuarial valuation report were based on those developed in the 2015-2019 actuarial experience study dated July 14, 2020. The allowance for Combined Service Annuity assumptions are based on the LCPR prior actuary's report dated October 2016.

Economic assumptions: We verified that the economic assumptions described in the July 1, 2023 actuarial valuation report were based on those developed in the 2015-2019 experience study, and an investment return assumption and discount rate per Minnesota Statute, Section 356.215 Subd.8(a). They also include the COLA, salary scale, payroll growth, and other assumptions described in 356.215 Subd.8(b)-(d) and Subd.9

We also confirmed that demographic and economic assumptions used in the valuation are consistent with those described in Appendix A (effective July 1, 2021) to the LCPR's Standards for Actuarial Work. These assumptions include 2.25% price inflation, 3.00% payroll growth, service-based salary increase table, and PUB-2010 mortality tables.

Plan Provisions

Minnesota Statutes, Chapter 353 describe the retirement benefits provided to PERA Police and Fire Plan members, and the primary service annuity formulas. We reviewed the plan provisions summarized in the July 1, 2023 actuarial valuation report and believe they are consistent with our understanding of the benefits described in Minnesota Statutes.

Additional Compliance Requirements

In addition to correctly summarizing and applying the assumptions, methods, and plan provisions, the actuarial valuation report must comply with other statutory requirements and professional standards. We reviewed the PERA Police and Fire Plan July 1, 2023 actuarial valuation report for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant Actuarial Standards of Practice. We found that the report complied with all major guidance in these sources. The primary items we reviewed, along with any relevant observations, are summarized in the tables below.

Minnesota Statute Compliance	
The applicable Minnesota Statutes include Sections 356.214 (actuarial valuation preparation) and 356.215 (actuarial valuations and experience studies). We confirmed compliance with the following requirements as described below.	
Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2049 per 356.215 Subd.11 paragraphs (c) and (h)[4]. This is the adjusted target amortization date after reflecting 2023 assumption and plan changes.
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance	
In addition to specific actuarial assumptions (described earlier in this report), the LCPR's Standards for Actuarial Work and its Appendix A specify actuarial cost methods and detailed report contents. We confirmed compliance with these requirements as described below.	
Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

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[4] MN Statute 356.215 Subd. 11(h) specifies a June 30, 2048 full funding date, but this is overridden by application of Subd. 11(c) in the 2023 actuarial valuation which adjusted the amortization date to June 30, 2049.

Actuarial Standards of Practice Compliance

Actuarial Standards of Practice (ASOPs) provide broad standards that all actuaries must follow as part of our professional standards. The relevant ASOPs for pension actuarial reports include:

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

We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice, including ASOPs 4, 23, 27, 35, 41, 44, 51, and 56.

We specifically note GRS' compliance with revised ASOP 4 which is effective for actuarial reports with measurement dates on or after February 15, 2023. ASOP 4 requires presentation and discussion of additional pension risk information. This includes disclosure of a Low-Default-Risk Obligation Measure (LDROM) and commentary about any concerns with the Actuarially Determined Contribution (ADC) or funding policy. The actuarial valuation report includes an LDROM analysis on page 10, while the "Other Observations" page in the transmittal letter addresses implications of the contribution allocation procedures and funding policy.

Appendix A – Census Data Comparisons

The exhibits below compare the participant counts and certain data statistics between the "raw" system data and the "scrubbed" actuarial data. The notable differences are reasonable and the actuary's data updates appear appropriate.

Summary of Participant Statistics

	Retained Actuary	System Data	Difference
Active members	**11,635**	**11,635**	**0**
Average age	39.8	39.9	0.3%
Average service	11.7	11.7	0.0%
Average salary[5]	$ 98,958	$ 96,569	-2.4%
Service retirements[6]	**8,492**	**8,810**	**318**
Average age	68.6	68.5	-0.1%
Average annual annuity	$ 59,457	$ 59,197	-0.4%
Survivors	**1,998**	**1,994**	**(4)**
Average age	73.2	73.3	0.1%
Average annual annuity	$ 34,253	$ 34,258	0.0%
Disability retirements[6]	**2,111**	**1,793**	**(318)**
Average age	56.8	55.1	-3.0%
Average annual annuity	$ 51,720	$ 51,622	-0.2%
Deferred retirements	**1,966**	**1,965**	**(1)**
Average age	45.5	45.5	0.0%
Other non-vested terminations	**941**	**941**	**0**
Total	**27,143**	**27,138**	**(5)**

[5] The average salary for active members from the system data does not include the data adjustments described in the assumption section of the 2023 valuation report.

[6] PERA reclassifies disabled members as service retirees once they reach Normal Retirement Age. The retained actuary adjusted the status for 318 service retirees to be disabled retirees based on their historical classification as disabled retirees.

Distribution of Active Member Data

The table below summarizes our review of the retained actuary's active member data by age and years of service, and it also includes the average earnings for each grouping. It can be compared to the similar summary table on page 16 from the July 1, 2023 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years of Service as of June 30, 2023

Age	<3	3-4	5-9	10-14	15-19	20-24	25-29	30-34	35+	Total
<25	441	22								**463**
Avg pay	60,152	81,817								**61,181**
25-29	757	459	259							**1,475**
Avg pay	68,089	88,754	93,018							**78,897**
30-34	478	334	979	118						**1,907**
Avg pay	67,079	87,422	99,011	101,488						**89,232**
35-39	258	208	664	570	233					**1,933**
Avg pay	72,543	86,279	97,630	105,004	106,727					**96,331**
40-44	154	112	385	373	765	163				**1,952**
Avg pay	72,994	87,042	94,869	108,447	111,542	112,950				**103,333**
45-49	72	46	142	140	442	664	133			**1,639**
Avg pay	72,450	100,037	96,579	104,454	110,559	118,027	123,286			**110,915**
50-54	34	15	80	109	226	471	618	59		**1,612**
Avg pay	66,570	97,122	104,772	96,744	110,801	119,194	129,418	133,610		**118,916**
55-59	12	12	31	37	72	128	139	58	6	**495**
Avg pay	93,157	77,660	99,737	108,433	112,568	119,836	132,245	140,417	144,303	**121,191**
60-64	11	2	14	14	14	30	28	11	10	**134**
Avg pay	62,992	85,772	73,927	101,879	117,196	111,809	118,813	110,555	137,270	**106,241**
65-69	1	1	1	3	1	2	6	1	4	**20**
Avg pay	108,210	80,464	143,231	54,352	81,221	122,155	125,808	133,987	153,970	**116,260**
70+	1		1			1				**3**
Avg pay	81,403		19,425			124,330				**75,052**
Total	**2,219**	**1,211**	**2,556**	**1,364**	**1,753**	**1,459**	**924**	**129**	**20**	**11,635**
Avg pay	**67,405**	**88,088**	**97,324**	**104,875**	**110,629**	**117,877**	**128,616**	**134,707**	**142,720**	**99,101**

Distribution of Service Retirements

The table below summarizes our review of the retained actuary's service retirement data by age and years since retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 17 from the July 1, 2023 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Retired as of June 30, 2023

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<50								
Avg benefit								
50-54	103	176						**279**
Avg benefit	57,057	38,393						**45,284**
55-59	258	786	328					**1,372**
Avg benefit	73,550	71,752	47,408					**66,270**
60-64	50	396	835	381				**1,662**
Avg benefit	65,441	67,140	62,258	53,018				**61,399**
65-69	9	111	371	575	376			**1,442**
Avg benefit	82,270	55,608	62,424	63,383	51,774			**59,629**
70-74	2	22	129	265	552	421	4	**1,395**
Avg benefit	45,585	56,597	50,224	57,841	57,370	53,137	63,335	**55,509**
75-79	1	3	17	99	172	691	180	**1,163**
Avg benefit	13,068	4,692	40,095	50,715	52,163	58,678	52,270	**55,595**
80-84			1	14	30	233	370	**648**
Avg benefit			886	28,025	33,993	59,923	64,926	**60,799**
85-89				3	3	87	260	**353**
Avg benefit				40,634	44,819	53,406	61,986	**59,544**
90+				3		20	155	**178**
Avg benefit				26,812		67,631	60,510	**60,742**
Total	**423**	**1,494**	**1,681**	**1,340**	**1,133**	**1,452**	**969**	**8,492**
Avg benefit	**68,486**	**65,042**	**58,213**	**57,902**	**54,070**	**57,079**	**61,073**	**59,457**

Distribution of Survivors

The table below summarizes our review of the retained actuary's survivor data by age and years since death, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 18 of the July 1, 2023 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Since Death as of June 30, 2023

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<45	11	52	34	42	17	1		**157**
Avg benefit	$21,346	$18,526	$15,088	$15,321	$12,139	$32,020		**$16,516**
45-49	2	5	6	8	1	2		**24**
Avg benefit	$18,314	$40,421	$35,642	$32,260	$43,737	$24,892		**$33,508**
50-54	3	9	8	6	8		2	**36**
Avg benefit	$34,822	$29,888	$42,104	$27,497	$39,633		$33,434	**$34,978**
55-59	7	25	9	7	6	4	3	**61**
Avg benefit	$54,521	$40,535	$43,286	$35,608	$41,318	$43,693	$34,473	**$41,967**
60-64	11	29	16	18	14	2	9	**99**
Avg benefit	$25,560	$43,381	$37,352	$45,022	$35,611	$21,700	$42,975	**$39,151**
65-69	10	50	32	24	24	12	15	**167**
Avg benefit	$42,823	$43,076	$34,781	$32,740	$34,293	$35,441	$45,082	**$38,355**
70-74	14	74	66	33	24	19	27	**257**
Avg benefit	$32,579	$32,186	$33,289	$36,557	$33,683	$33,182	$42,554	**$34,355**
75-79	22	78	68	48	41	45	49	**351**
Avg benefit	$37,930	$33,717	$34,678	$38,715	$32,497	$36,266	$38,161	**$35,655**
80-84	26	85	66	38	30	39	44	**328**
Avg benefit	$33,805	$34,945	$35,412	$32,181	$33,817	$37,525	$38,448	**$35,302**
85-89	13	45	57	47	26	29	41	**258**
Avg benefit	$41,769	$37,607	$36,286	$34,199	$37,294	$33,382	$34,485	**$35,902**
90+	5	38	37	32	31	45	72	**260**
Avg benefit	$40,451	$39,827	$35,518	$31,142	$34,566	$31,922	$30,831	**$33,670**
Total	**124**	**490**	**399**	**303**	**222**	**198**	**262**	**1,998**
Avg benefit	**$35,336**	**$34,791**	**$33,681**	**$32,355**	**$33,032**	**$34,625**	**$36,555**	**$34,253**

Distribution of Disability Retirements

The table below summarizes our review of the retained actuary's disability retirement data by age and years since disability retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 19 of the July 1, 2023 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Disabled as of June 30, 2023

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<45	69	293	55	12	3			**432**
Avg benefit	$49,860	$49,080	$41,564	$32,853	$35,264			**$47,701**
45-49	36	152	44	13	6	1		**252**
Avg benefit	$63,107	$52,396	$41,464	$38,671	$32,143	$29,647		**$50,737**
50-54	36	202	77	20	19	2	1	**357**
Avg benefit	$73,155	$59,891	$47,289	$43,089	$35,768	$18,201	$36,524	**$55,986**
55-59	48	114	17	16	26	13	7	**241**
Avg benefit	$60,826	$60,454	$56,639	$46,809	$41,169	$36,060	$35,350	**$55,228**
60-64	9	41	38	3	35	37	11	**174**
Avg benefit	$58,665	$48,914	$46,847	$46,849	$43,431	$39,777	$41,054	**$45,389**
65-69	2	13	24	13	64	50	11	**177**
Avg benefit	$32,263	$44,454	$58,282	$50,665	$48,662	$42,267	$45,985	**$47,646**
70-74		4	11	5	68	94	26	**208**
Avg benefit		$46,162	$40,729	$44,969	$51,076	$55,069	$49,885	**$51,943**
75+			5	5	21	120	119	**270**
Avg benefit			$60,935	$62,180	$57,351	$53,454	$56,280	**$55,303**
Total	**200**	**819**	**271**	**87**	**242**	**317**	**175**	**2,111**
Avg benefit	**$59,289**	**$53,849**	**$46,665**	**$44,168**	**$46,945**	**$49,734**	**$54,883**	**$51,720**

Appendix B – Market Value of Assets Comparison

The exhibit below compares the market value of assets from the system's annual financial report to the amounts used by the retained actuary (see page 12 in the July 1, 2023 valuation report). We find that the entries compare well, which indicates that the market asset data used in the valuation report was correct. All amounts shown are in $1,000's.

	Retained Actuary	System Financials
Assets in Trust		
Cash, equivalents, short term securities	328,611	328,611
Fixed income	2,337,364	2,337,364
Equity and private equity	8,359,524	8,359,524
Other	-	-
Total Assets in Trust	**11,025,499**	**11,025,499**
Assets Receivable	19,787	19,787
Amounts Payable	(6,358)	(6,358)
Net Assets Held in Trust for Pension Benefits	**11,038,928**	**11,038,928**

Appendix C – Actuarial Value of Assets Replication

The exhibit below compares the retained actuary's July 1, 2023 AVA calculation (see page 14 in the July 1, 2023 valuation report) to our replication. The calculations match and are consistent with relevant Minnesota Statutes, Section 356.215, Subd.1(f) so we believe they were prepared correctly. All amounts shown are in $1,000's.

				Retained Actuary	VIA Match
1.	**Market value of assets available for benefits**			11,038,928	11,038,928
2.	Determination of average asset balance				
	a.	Total assets at beginning of year		10,415,493	10,415,493
	b.	Total assets at end of year		11,038,928	11,038,928
	c.	Net investment income for fiscal year		912,519	912,519
	d.	Average balance (a. + b. - c.)/2		10,270,951	10,270,951
3.	Expected return (7.50% x 2.d.)			770,321	770,321
4.	Actual return			912,519	912,519
5.	Current year asset gain/(loss) (4. - 3.)			142,198	142,198
6.	Unrecognized asset returns	Original amounts	Unrecognized percent	Unrecognized amounts	Unrecognized amounts
	a. FYE 2023	142,198	80%	113,758	113,758
	b. FYE 2022	(1,545,237)	60%	(927,142)	(927,142)
	c. FYE 2021	2,009,123	40%	803,649	803,649
	d. FYE 2020	(285,391)	20%	(57,078)	(57,078)
	e. FYE 2019	(17,561)	0%	N/A	N/A
	f. Total unrecognized amount			(66,813)	(66,813)
7.	**AVA at end of year (1. - 6.f.)**			**11,105,741**	**11,105,741**

Appendix D – Plan Liability Replications

The exhibits below compare our replication of the plan liabilities to those calculated by the retained actuary. We believe that the overall closeness of the results indicates the July 1, 2023 actuarial valuation report liabilities are reasonable. There are a couple of small benefit subclasses with larger differences (e.g., deferred retirements and refunds for active members) but these are very small relative to the overall plan. All amounts shown are in $1,000's.

Present Value of Benefits (PVB) Liability	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 5,997,857	$ 6,015,425	$ 17,568	0.3%
Disability benefits	688,035	693,207	5,172	0.8%
Survivor benefits	97,273	98,864	1,591	1.6%
Deferred retirements	242,280	254,507	12,227	5.0%
Refunds	7,818	8,049	231	2.9%
Subtotal	$ 7,033,263	$ 7,070,052	$ 36,789	0.5%
Deferred retirements	463,204	466,155	2,951	0.6%
Former members without vested rights	1,798	1,783	(15)	-0.8%
Benefit recipients	7,897,510	7,845,115	(52,395)	-0.7%
Total	**$ 15,395,775**	**$ 15,383,105**	**$ (12,670)**	**-0.1%**

Present Value of Future Normal Costs (PVFNC)	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 1,850,674	$ 1,857,364	$ 6,690	0.4%
Disability benefits	492,468	495,210	2,742	0.6%
Survivor benefits	67,470	69,119	1,649	2.4%
Deferred retirements	199,739	202,342	2,603	1.3%
Refunds	19,626	17,005	(2,621)	-13.4%
Total	**$ 2,629,977**	**$ 2,641,040**	**$ 11,063**	**0.4%**

Actuarial Accrued Liability (AAL)	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 4,147,183	$ 4,158,061	$ 10,878	0.3%
Disability benefits	195,567	197,997	2,430	1.2%
Survivor benefits	29,803	29,745	(58)	-0.2%
Deferred retirements	42,541	52,165	9,624	22.6%
Refunds	(11,808)	(8,956)	2,852	-24.2%
Subtotal	$ 4,403,286	$ 4,429,012	$ 25,726	0.6%
Deferred retirements	463,204	466,155	2,951	0.6%
Former members without vested rights	1,798	1,783	(15)	-0.8%
Benefit recipients	7,897,510	7,845,115	(52,395)	-0.7%
Total	**$ 12,765,798**	**$ 12,742,065**	**$ (23,733)**	**-0.2%**

Normal Cost	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 197,644	$ 193,988	$ (3,656)	-1.8%
Disability benefits	53,147	52,173	(974)	-1.8%
Survivor benefits	7,110	7,151	41	0.6%
Deferred retirements	20,487	20,171	(316)	-1.5%
Refunds	1,928	1,531	(397)	-20.6%
Total	**$ 280,316**	**$ 275,014**	**$ (5,302)**	**-1.9%**

Appendix E – Contribution Sufficiency/(Deficiency) Replication

The exhibit below compares our replication of the contribution calculations to the retained actuary's results. We begin by replicating the Supplemental Contribution Rate and then determine the Contribution Sufficiency/(Deficiency). We believe that the overall closeness of the results indicates the July 1, 2023 actuarial valuation report calculations are reasonable. All amounts shown are in $1,000's.

Supplemental Contribution Rate	Retained Actuary	VIA Replication	$ Difference	% Difference
1. Determination of Unfunded Actuarial Accrued Liability (UAAL)				
a. Actuarial accrued liability	$ 12,765,798	$ 12,742,065	$ (23,733)	-0.2%
b. Current assets (AVA)	11,105,741	11,105,741	-	0.0%
c. Unfunded actuarial accrued liability	$ 1,660,057	$ 1,636,324	$ (23,733)	-1.4%
2. Determination of Supplemental Contribution Rate				
a. Present value of future payrolls through the amortization date of June 30, 2049	$ 19,536,470	$ 19,560,657	$24,187	0.1%
b. Supplemental contribution rate: (1.c. / 2.a.)	8.50%	8.37%		

	Retained Actuary		VIA Replication		$ Amount Difference
Projected annual payroll for FY2023-2024		$1,205,147		$1,206,639	0.12%

		% of Payroll	$ Amount	% of Payroll	$ Amount	$ Amount Difference
1.	Statutory Contributions - Chapter 353					
	a. Employee contributions	11.80%	$ 142,207	11.80%	$ 142,383	0.12%
	b. Employer contributions	17.70%	213,311	17.70%	213,575	0.12%
	c. Minneapolis Police contributions	0.37%	4,490	0.37%	4,490	
	d. Minneapolis Fire contributions	0.26%	3,189	0.26%	3,189	0.00%
	e. State contributions	1.49%	18,000	1.49%	18,000	0.00%
	f. One-time direct State aid	1.61%	19,397	1.61%	19,397	0.00%
	g. Total	33.23%	$ 400,594	33.23%	$ 401,034	0.11%
2.	Required Contributions - Chapter 356					**% of Payroll Difference**
	a. Normal cost					
	i. Retirement benefits	16.40%	$ 197,644	16.08%	$ 193,988	-0.32%
	ii. Disability benefits	4.41%	53,147	4.32%	52,173	-0.09%
	iii. Survivors	0.59%	7,110	0.59%	7,151	0.00%
	iv. Deferred retirement benefits	1.70%	20,487	1.67%	20,171	-0.03%
	v. Refunds	0.16%	1,928	0.13%	1,531	-0.03%
	vi. Total	23.26%	$ 280,316	22.79%	$ 275,014	-0.47%
	b. Supplemental Contribution Amortization of Unfunded Actuarial Accrued Liability by June 30, 2049	8.50%	$ 102,437	8.37%	$ 100,996	-0.13%
	c. Allowance for Expenses	0.11%	1,326	0.11%	1,327	0.00%
	d. Total	31.87%	$ 384,079	31.27%	$ 377,337	-0.60%
	e. Contribution Sufficiency/(Deficiency)	1.36%	$ 16,515	1.96%	$ 23,697	0.60%