MINUTES of SERS Board Meeting – Wednesday, December 4, 2019

CALLED TO ORDER: 11:50 a.m. by Chairman David R. Fillman

ATTENDEES:
Members and Designees
David R. Fillman – Chairman
Glenn E. Becker
John M. DiSanto
Gregory K. Jordan
Mary A. Soderberg
Gregory C. Thall
Michael G. Tobash
James Bloom – Designee for Secretary Robin L. Wiessmann
Susan Boyle – Designee for Representative Michael G. Tobash
Thomas Clancy – Designee for Treasurer Joseph M. Torsella
Christopher Craig – Designee for Treasurer Joseph M. Torsella
Charles Duncan – Designee for Senator Vincent J. Hughes
Lloyd Ebright – Designee for Treasurer Joseph M. Torsella
Charles Erdman – Designee for Senator John M. DiSanto
Alan Flannigan – Designee for Secretary Robin L. Wiessmann
Toni Marchowsky – Designee for Senator Vincent J. Hughes
Dan Ocko – Designee for Representative Dan B. Frankel
Leo Pandeladis – Designee for Secretary Robin L. Wiessmann
Jill Vecchio – Designee for Representative Michael G. Tobash

Executive Staff
Alicia James
N. Joseph Marcucci
James Nolan
Terrill Sanchez

Consultants
Britt Murdoch, Callan Associates
Tom Shingler, Callan Associates
Chris Waddell, Olson Hagel & Fishburn LLP

Staff
Rose Agnew
Randy Albright
Steve Balucha
Don Bell
Jason Burger
Thomas Derr
Marianna Fazylova

David Felix
Jonathan Ferrar
Brian Gilroy
Phil Greenburg
Suzi Hansel
Pam Hile
Christopher Houston
Kevin Kiehl
Kalfani King
Dan Krautheim
Alan Lin
Jeffrey McCormick
Ryan McCoy
Matthew Meads
Jeffrey Meyer
Ryan Morse
Melissa Seiders
Sarah Souder
Bruce Thomas
Joseph Torta
William Truong
Carly Wismer

pennsylvania
STATE EMPLOYEES' RETIREMENT SYSTEM

MINUTES of the SERS Board Meeting
Wednesday, December 4, 2019

1. CALL TO ORDER

Chair Fillman called the meeting to order at 11:50 a.m.

2. WELCOME AND INTRODUCTIONS

Chair Fillman remembered the passing of former board member Representative Robert Godshall and followed with a moment of silence. He noted that Representative Godshall had served on the board longer than he and how he was very dedicated to serving his constituents to the very end.

Executive Director Sanchez introduced new board member, Mr. Gregory Jordan. Mr. Jordan was the Former Executive Director of the Senate Appropriations Committee, and was appointed to the board by Governor Wolf on October 3, 2019.

3. ADOPTION OF THE AGENDA

Chair Fillman noted that there was a revision to the December 4, 2019, board agenda.

MOTION: 2019-78

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board (i) amends the board meeting agenda to include as an item under New Business the following: 5b. Cost of Living Increase for the Executive Director, and (ii) adopts the agenda for the December 4, 2019, board meeting, as amended.

4. APPROVAL OF CONSENT CALENDAR

A. Approving Board Meeting Minutes – September 25, 2019 and October 16, 2019

B. Approving Statement of Changes in Fiduciary Net Position for the Periods Ending – July 31, 2019 and August 31, 2019

MOTION: 2019-79

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board approves the Consent Calendar items, as listed, for the December 4, 2019, board meeting.

5. NEW BUSINESS

A. Informational Item Only – 2019 Annual Divestment Report

B. Cost of Living Increase for the Executive Director

Chair Fillman provided an update on a cost of living increase for the SERS Executive Director as approved by Governor Wolf.

MOTION: 2019-80

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board grants the Executive Director a cost of living increase of 1.9%, as approved by the Governor pursuant to Act of October 19, 1995, P.L. 324, No. 51, effective January 2020.

6. OLD BUSINESS - NONE

7. COMMITTEE REPORTS/ACTION ITEMS

A. Board Governance and Personnel Committee

Chair Fillman provided a report of the Board Governance & Personnel Committee to the board (SERS Board Handout). The report was accepted by the board along with the following motions:

COMPENSATION POLICY FOR INVESTMENT PROFESSIONAL STAFF/PAY BAND ADJUSTMENTS

MOTION: 2019-81

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board accepts the recommendation of the Board Governance and Personnel Committee to: (i) approve a 2% upward adjustment, actual values may vary slightly in accordance with standard calculations for commonwealth pay, to the salary bands for investment professionals, to be effective January 1, 2020; and (ii) that the values in the Compensation Policy for Investment Professional Staff – State Employees' Retirement System be updated accordingly.

ANNUAL PAY INCREASE BUDGET

MOTION: 2019-82

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board accepts the recommendation of the Board Governance and Personnel Committee to approve the annual aggregate pay increase budget for 2020 to be set at 6% of salary for investment professional staff for positions below that of the Chief Financial Officer and the Chief Investment Officer, whose pay increases will be determined in accordance with the Compensation Policy for Investment Professional Staff – State Employees' Retirement System.

COMPENSATION POLICY FOR INVESTMENT PROFESSIONAL STAFF/PAY BAND ADJUSTMENTS

MOTION: 2019-83

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board accepts the recommendation of the Board Governance and Personnel Committee to approve amendments to the promotion/reclassification section of the Compensation Policy for Investment Professional Staff – State Employees' Retirement System, as set forth in the attachment, to be effective December 7, 2019 (ATTACHMENT A).

CIO SEARCH FIRM RFP

MOTION: 2019-84

By motion that was moved, seconded, and approved by board members, it was

RESOLVED: That the board accepts the recommendation of the Board Governance and Personnel Committee to: (i) accept the determination of the SERS Contracting Officer that the proposal submitted by CBIZ Benefits & Insurance Services, DBA EFL Associates, for Chief Investment Officer recruitment services, in response to SERS RFP 19-038, is most advantageous to the Commonwealth; and (ii) authorize staff to proceed with contract negotiations with CBIZ Benefits & Insurance Services, DBA EFL Associates.

B. Finance and Member Services Committee

Chair Soderberg provided a report of the Finance and Member Services Committee to the board (SERS Board Handout). The report was accepted by the board along with the following motions:

STRESS TESTING AND RISK ASSESSMENT REPORT
MOTION: 2019-85
By motion that was moved, seconded, and approved by board members, it was
RESOLVED: That the board accepts the recommendation of the Finance and Member Services Committee to approve the Stress Testing and Risk Assessment Report, which was prepared in accordance with and for the purpose of achieving the broad overall objectives outlined in the Public Pension Management and Asset Investment Review Commission (PPMAIRC) recommendations (ATTACHMENT B).

C. Investment Committee
Chair Becker provided a report of the Investment Committee to the board (SERS Board Handout). The report was accepted by the board along with the following motions:

SPECIALTY CONSULTANTS' PERFORMANCE REPORTS–PPMAIRC RECOMMENDATION #24
MOTION: 2019-86
By motion that was moved, seconded, and approved by board members, it was
RESOLVED: That the board accepts the recommendation of the Investment Committee to approve the sample private market specialty consultants' semi-annual performance reports for public dissemination, as set forth in the attachments (ATTACHMENTS C and D).

INVESTMENT POLICY STATEMENT
MOTION: 2019-87
By motion that was moved, seconded, and approved by board members, except Ms. Marchowsky, designee for Senator Hughes, who voted No, it was
RESOLVED: That the board accepts the recommendation of the Investment Committee to adopt SERS' Defined Benefit Plan's Investment Policy Statement sections 1 through 20, section 21 (except for the Policy Target Asset Allocation %), and sections 22, 24 and 25 (ATTACHMENT E).

MOTION: 2019-88
By motion that was moved, seconded, and approved by board members, except Ms. Marchowsky, designee for Senator Hughes, who voted No, it was
RESOLVED: That the board accepts the recommendation of the Investment Committee to adopt SERS' Policy Target Asset Allocations set forth in the SERS' Defined Benefit Plan's Investment Policy Statement section 21 and section 23.

PRIVATE EQUITY – CLEARLAKE CAPITAL PARTNERS VI, L.P.
MOTION: 2019-89
By motion that was moved, seconded, and approved by board members, except Mr. Ebright, designee for Treasurer Torsella, who abstained, and Mr. Ocko, designee for Representative Frankel, who voted No, it was
RESOLVED: That the board accepts the recommendation of the Investment Committee to commit up to $75 million to Clearlake Capital Partners VI, L.P., plus investment expenses and pro rata share of partnership operating expenses, consistent with executed partnership documents, as a follow-on investment within the Private Equity asset class, subject to successful completion of contract negotiations and execution and delivery of closing documents by all parties, including required Commonwealth legal approvals, within 12 months.

PRIVATE EQUITY – INSIGHT PARTNERS XI, L.P.

MOTION: 2019-90

By motion that was moved, seconded, and approved by board members, except Mr. Ebright, designee for Treasurer Torsella, who voted No, it was

RESOLVED: That the board accepts the recommendation of the Investment Committee to commit up to $75 million to Insight Partners XI, L.P., plus investment expenses and pro rata share of partnership operating expenses, consistent with executed partnership documents, as an investment within the Private Equity asset class, subject to successful completion of contract negotiations and execution and delivery of closing documents by all parties, including required Commonwealth legal approvals, within 12 months.

D. Audit, Risk and Compliance Committee

Tom Clancy, designee for Assistant Chair Torsella, provided a report of the Audit, Risk and Compliance Committee to the board (SERS Board Handout). The report was accepted by the board and there were no motions brought to the board by the AR&C Committee.

8. EXECUTIVE SESSION

TOPIC 1 – Pending Benefits and Administration Litigation Update
TOPIC 2 – Outside Fiduciary Counsel RFP
TOPIC 3 – Legislation Status

At 12:20 p.m., the board recessed and entered executive session to receive legal advice on the above executive session agenda items. The public meeting resumed at 1:53 p.m.

9. REPORTS OF EXECUTIVE DIRECTOR AND AGENCY STAFF

A. Executive Director Sanchez noted that (ii) 2020 board meeting dates will be February 25-26, March 12-13 (retreat), April 21-22, June 9-10, July 28-29, September 29-30 and December 1-2. (iii) Following are the results of the notational ballots from the September board meeting regarding the following accounts:

Account of Donald Grimaldi
Docket No. 2019-04
Claim of Donald Grimaldi

By Order dated October 18, 2019, the State Employees' Retirement Board **DENIED** the Motion for Summary Judgment filed by the Pennsylvania Liquor Control Board, Intervenor. Donald Grimaldi's appeal will proceed to an administrative hearing after which an independent hearing officer will issue a recommendation to the Board.

Account of Bryan K. Kerekish
Docket No. 2017-03
Claim of Bryan K. Kerekish

By Order dated October 18, 2019, the State Employees' Retirement Board **DENIED** Bryan K. Kerekish's appeal of SERS' denial of his request to reverse its determination that he forfeited his pension under Act 140 and to retroactively reinstate his benefit.

(iv) Executive Director Sanchez presented the report regarding uncontested matters in which an Order was issued dismissing the following administrative appeals, as provided to the board.

Account of Barbara C. Allerton
Docket No. 2016-12
Claim of Barbara C. Allerton

Account of David L. Divita
Docket No. 2016-18
Claim of David L. Divita

Account of Colleen A. McQueeney
Docket No. 2016-15
Claim of Colleen A. McQueeney

10. BOARD COMMENTS/ANNOUNCEMENTS/DATES TO REMEMBER
Next regular meeting of the SERS board is scheduled for February 25-26, 2020.

11. MOTION TO ADJOURN
MOTION: 2019-91
By motion of Chair Fillman, the board unanimously agreed to adjourn the meeting at 2:00 p.m.

Respectfully submitted,

Terrill J. Sanchez
Executive Director

ATTACHMENT A

pennsylvania
STATE EMPLOYEES' RETIREMENT SYSTEM

COMPENSATION POLICY FOR INVESTMENT PROFESSIONAL STAFF

STATE EMPLOYEES' RETIREMENT SYSTEM

Effective January 1, 2017
Amended Effective December 7, 2019

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Compensation Policy for Investment Professional Staff

State Employees' Retirement System

INTRODUCTION

SERS was established by the General Assembly of the Commonwealth of Pennsylvania in 1923. SERS' enabling legislation, the State Employees' Retirement Code, was recodified in 1959 and again in 1974.

The Retirement Code establishes the Board as an independent administrative board, which has the authority to make all decisions with respect to the implementation of the Retirement Code and the management of the State Employees' Retirement Fund.

Section 5902(a) of Title 71, amended April 2, 1998:

(1) Effective 30 days after the effective date of this paragraph, the positions of secretary, assistant secretary and investment professional shall be placed under the unclassified service provisions of the act of August 5, 1941 (P.L.752, No.286), known as the Civil Service Act, as those positions are vacated. All other positions of the board shall be placed in either the classified or unclassified service according to the definition of the terms under the Civil Service Act.

(2) Notwithstanding any other provisions of law, the compensation of investment professionals shall be established by the board. The compensation of all other officers and employees of the board who are not covered by a collective bargaining agreement shall be established by the board consistent with the standards of compensation established by the Executive Board of the Commonwealth.

SERS' *Compensation Policy for Investment Professional Staff* is established to:

- Maintain transparency for the compensation of investment professional staff
- Attract, motivate, and retain highly qualified, experienced investment professionals needed to satisfy the standard-of-care requirements of fiduciary obligations consistent with SERS Board policy
- Provide a reasonable and competitive pay program for investment professional staff

SERS continually strives to have a compensation plan for its investment professional staff that attracts and retains highly qualified individuals, establishes internal equity of positions, and maintains external competitiveness. The Board shall establish and maintain a pay schedule and structure that reflects market competitive salary ranges for each job classification based on median salary levels in the Public Pension Funds Comparator Group. This comparator group may be re-established as appropriate with changes in the public pension systems.

DELEGATION OF AUTHORITY

The Board has authority to set compensation for SERS' investment professional staff. With approval of this policy the Board delegates the following, effective January 1, 2017 and as amended:

- Authority to SERS' Chief Investment Officer and SERS' Executive Director, in consultation with SERS' Human Resources Director, to recommend salaries and annual salary adjustments for investment professional positions in the Investment Office to the Board Governance and Personnel Committee for approval as discussed in the PROGRAM ADMINISTRATION section; and
- Authority to SERS' Executive Director and SERS' Chief Financial Officer, in consultation with SERS' Human Resources Director, to recommend salaries and annual salary adjustments for the investment professional positions in the Office of Finance and Administration to the Board Governance and Personnel Committee for approval as discussed in the PROGRAM ADMINISTRATION section; and
- Authority to SERS' Executive Director in consultation with SERS' Human Resources Director to recommend the salary of the Chief Financial Officer position and annual salary adjustments to the Board Governance and Personnel Committee for approval as discussed in the PROGRAM ADMINISTRATION section.

If the parties named above cannot reach consensus concerning the actions that have been delegated by SERS Board, the issue(s) will be elevated to the Board Governance and Personnel Committee of SERS Board for a final determination.

The Board will maintain authority to approve the annual pay increase budget based on current market pay data and the availability of funds.

PEER COMPARATOR GROUP

The below peer comparator group, used to determine the appropriate compensation for SERS' investment professional staff, was originally established in June 2013 in conjunction with McLagan, a professional organization with well-established expertise in the area of pension system compensation. This group of 15 public pension systems, at the time the list was developed, was similar to SERS in size and investment approach, and none of the comparable pension systems utilized a bonus program. The salary structures of these comparative systems were used to determine the initial market pay for SERS' investment professional staff.

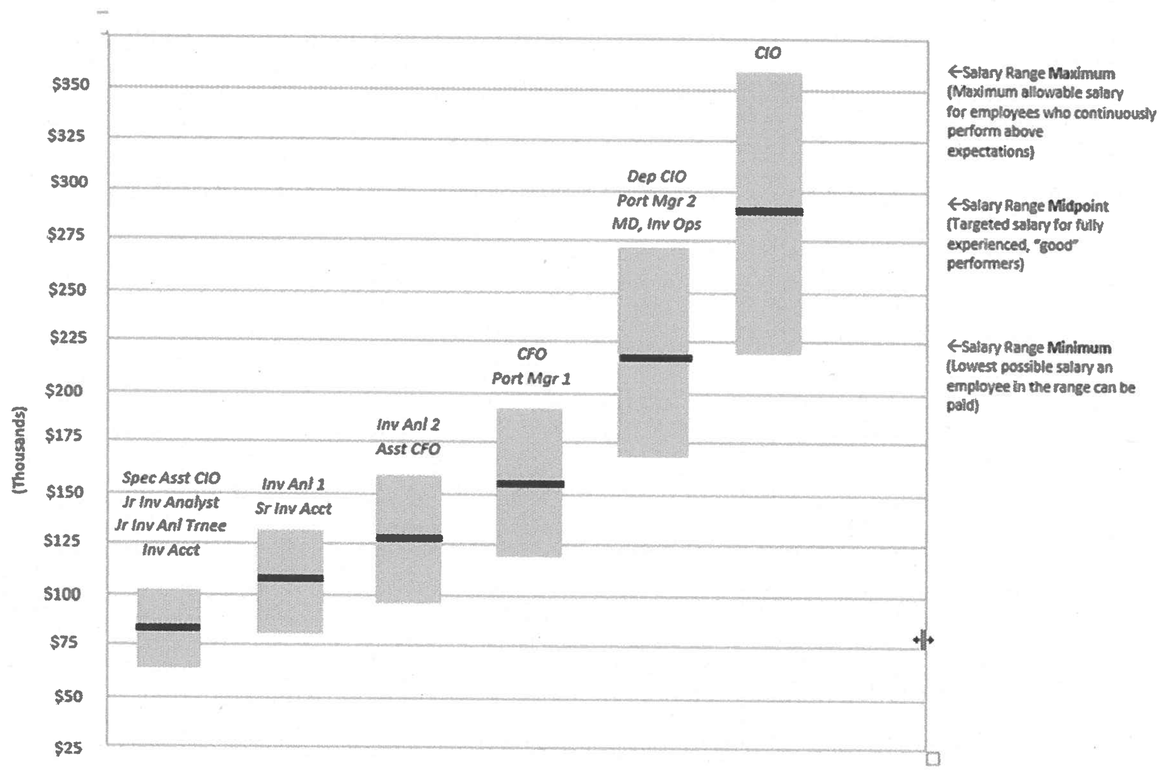
Illinois Municipal Retirement Fund
Indiana Public Retirement System
Iowa Public Employees Retirement System
LA County Employees Retirement Association
Maryland State Retirement Agency
Massachusetts Pension Reserves Investment Management Board
Minnesota State Board of Investment
Mississippi Public Employees Retirement System
Missouri Public Schools Retirement System
Nevada PERS
Pennsylvania Public School Employees' Retirement System (included in the comparator group due to geographical location)
South Carolina Retirement System
Texas County and District Retirement System
Texas Municipal Retirement System
Utah State Retirement System

PAY SCHEDULE

SERS moved investment professional positions from a pay schedule of 12 pay ranges with 20 steps within each range, to a banded pay structure effective January 1, 2017. Each investment professional position was appropriately placed within the respective band based on the comparative parity with peer pension systems, experience and credentials, contributions to SERS, and internal pay equity. The banded pay structure has six bands, with minimum and maximum annual salaries for each band, but no steps. This type of structure allows for increased flexibility to differentiate salaries based on an employee's performance, workload, contributions to SERS, etc. The below chart shows annual salaries down the left side and the bands across the bottom.

The current salary band structure is depicted below (*Figure 1*).

Figure 1
As of 01/01/2019



	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8
Minimum	$64,967	$82,673	$99,571	$120,804	$172,873	$224,541
Midpoint	$84,353	$107,264	$129,134	$157,251	$224,942	$292,633
Maximum	$103,739	$131,855	$158,696	$193,697	$277,012	$360,725

CLASSIFICATION

The below job titles (*Figure 2*) are currently covered by this compensation policy. SERS-Human Resources Division is responsible for maintaining the job specifications (definition of work, examples of work, knowledge, skills, abilities, minimum experience and training) for each job title. SERS-Human Resources Division is authorized to make content changes to the job specifications with the concurrence of the Executive Director and the Chief Investment Officer or Chief Financial Officer, as applicable.

Adding new jobs, abolishing jobs, or changing the designated pay level for a job requires authorization from the Board Governance and Personnel Committee.

Figure 2

Job	SAP Code	Pay Band
Junior Investment Analyst Trainee SERS	R9403	Band 3 (ISB3)
Junior Investment Analyst SERS	R9404	Band 3 (ISB3)
Investment Accountant	R9300	Band 3 (ISB3)
Special Assistant to the Chief Investment Officer SERS	R9402	Band 3 (ISB3)
Investment Analyst 1 SERS	R9405	Band 4 (ISB4)
Senior Investment Accountant	R9305	Band 4 (ISB4)
Investment Analyst 2 SERS	R9406	Band 5 (ISB5)
Assistant Chief Financial Officer SERS	R9310	Band 5 (ISB5)
Portfolio Manager 1 SERS (Director)	R9513	Band 6 (ISB6)
Chief Financial Officer SERS	R9315	Band 6 (ISB6)
Portfolio Manager 2 SERS (Managing Director)	R9511	Band 7 (ISB7)
Managing Director of Investment Operations SERS	R9515	Band 7 (ISB7)
Director of Public Markets SERS	R9512	Band 7 (ISB7)
Deputy Chief Investment Officer SERS	R9514	Band 7 (ISB7)
Chief Investment Officer SERS	R9510	Band 8 (ISB8)

PROGRAM ADMINISTRATION

A high-level annual study will be conducted to determine current market pay for the industry. The Board Governance and Personnel Committee will use the data to determine whether adjustments should be made to the salary pay bands. The data will also be considered when establishing the annual aggregate pay increase budget subject to approval by SERS Board.

Pay increases shall give consideration to individual employee performance, changes to job duties, retention, internal pay equity relationships, periodic market comparison of peer pension systems, or other relevant issues. Annual salary reviews will be conducted to make adjustments to pay based upon merit and competitive levels as necessary. Reflecting good-governance practices, each employee's salary level will be reviewed annually to ensure pay levels remain competitive, high performers are recognized, and staff development and growth are reinforced. Adjustments to current employees' salaries outside of the annual scheduled adjustments may be made under the delegation of authority of this policy for retention purposes to meet a critical need of the agency. These adjustments will be recommended to the Board Governance and Personnel Committee for approval.

A comprehensive study, if approved by the SERS Board, will be conducted every three to five years by an external and qualified consultant, and appropriate adjustments will be made to this compensation policy to maintain comparative parity with peer pension systems.

Investment Office professional staff are currently, and will remain, on a January 1 through December 31 performance review cycle with performance reviews due to the Human Resources Division by January 31 each year. They will receive pay increases, if appropriate, effective the first full pay in March each year. Effective January 1, 2017, investment professional staff in the Investment Office will no longer be eligible to receive the general pay increases, service increments, or any other one-time pay adjustments approved by the SERS Board for management employees.

Office of Finance and Administration investment professional staff are currently on an October 1 through September 30 performance review cycle. Effective January 1, 2017, they will be transferred to the January 1 through December 31 performance review cycle. Their performance reviews will be due to the Human Resources Division by January 31 each year and they will receive pay increases, if appropriate, effective the first full pay in March each year. Effective January 1, 2017, investment professional staff in the Office of Finance and Administration will no longer be eligible to receive the general pay increases, service increments, or any other one-time pay adjustments approved by the SERS Board for management employees.

When a new investment professional is hired, initial placement in the appropriate band will take into account the person's relevant work experience, relevant education, relevant professional credentials, and pay equity.

The salary range in each band can be broken down into thirds that fit the following general or illustrative profiles:

<u>Lower Third</u>

- Employees who are not meeting the established performance criteria for the position, or
- Employees who have minimum qualifications to fulfill the job responsibilities, or
- Employees with minimum amount of relevant work experience

Middle Third

- Employees who fully meet the established performance criteria, or
- Employees who are fully qualified for the position, or
- Employees with critical skills, yet no shortage of talent for the role in the market

Upper Third

- Employees who exceed established performance criteria, or
- Employees with a higher degree of qualifications of the position requirements, or
- Employees who occupy key jobs with hard to recruit talent

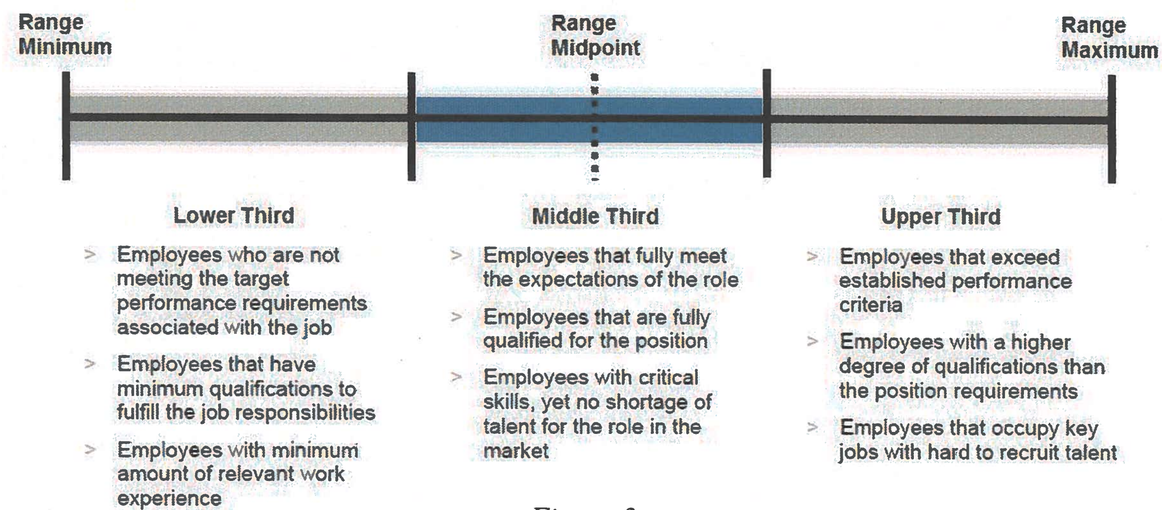


Figure 3

As shown in *Figure 3* above, employees who fully meet the expectations of their positions should fall within the middle third of the pay range, taking into account length of service with SERS and job relevant experience. Annually each investment professional shall be evaluated on a calendar year basis and receive a performance review by January 31 of each year.

The following process applies to all investment professional staff in SERS:

- Supervisors meet with each employee at the beginning of the review cycle to set goals and objectives for the year, set clear expectations, and provide performance standards
- Supervisors conduct a mid-year review with each employee to discuss/confirm progress toward goals and adjust, as appropriate, objectives of the program plan. If progress is less than expected the supervisor will contact the Human Resources Division for assistance in improving performance
- At the end of each rating cycle supervisors complete the *Employee Performance Review* form (Form 363L) for each employee and discuss performance and recommended pay

increase with the Executive Director and Human Resources Director. Pay increases are recommended to the Board Governance and Personnel Committee for approval

- Supervisors conduct an annual performance review with each employee, communicate the salary increase, and link the salary increase to overall performance. Pay increases for investment professional staff will be effective the first full pay in March each year
- Supervisors will conduct a formal six month performance review, using the *Employee Performance Review* form (Form 363L), for each newly appointed investment professional employee.

GUIDELINES FOR PAY ADJUSTMENTS

Annually, taking into account the pay increase budget approved by the Board, the Chief Investment Officer, with the concurrence of the Executive Director and in consultation with the Human Resources Director, will submit pay adjustment recommendations to the Board Governance and Personnel Committee. The pay adjustment for each investment professional staff member in the Investment Office will be within the assigned pay band and will be based on the individual's overall annual performance evaluation and the individual's position in the band at the time of the annual review. When the annual employee review results in an overall less than satisfactory rating, no pay increase is awarded. A less than satisfactory rating may result in employee discipline, up to and including termination.

For investment professional positions in the Office of Finance and Administration, the Chief Financial Officer, with the concurrence of the Executive Director and in consultation with the Human Resources Director, will follow the same process.

The performance review of the Chief Investment Officer will be conducted by the Executive Director and Investment Committee Chair with input from the Board. Pay adjustments will be recommended to the Board Governance and Personnel Committee and approved by the SERS Board.

The performance review of the Chief Financial Officer will be conducted by the Executive Director who will recommend to the Board Governance and Personnel Committee, in consultation with the Human Resources Director, movement within the salary range based on the overall annual performance evaluation and the individual's placement in the range at the time of the annual review.

The Executive Director, in conjunction with the Chief Investment Officer or Chief Financial Officer, as appropriate, and in consultation with the Human Resources Director, may recommend to the Board Governance and Personnel Committee salary adjustments for new investment professional staff in conjunction with a six-month performance evaluation. No action related to salary adjustments will be considered for new employees until the completion of a six-month performance evaluation.

PROMOTION/RECLASSIFICATION

Individuals promoting from Junior Investment Analyst Trainee to Junior Investment Analyst may receive up to a 9% pay increase.

For all other promotion actions (excluding trainee to working level), a 9% pay increase is recommended per pay band or placement at the minimum of the pay band, whichever is greater, however, the actual percentage may be less or more depending on the circumstances. Placement should be in the appropriate band, not to exceed the band maximum, taking into account the person's relevant work experience, relevant education, relevant professional credentials, and pay equity. Sufficient justification must be provided in support of pay increases less than or exceeding the recommended 9% per pay band.

A promotion is defined as moving from one job title to a higher job title either as a result of moving to a different position or the reclassification of a current position. Changes to job title within the same pay band are generally not considered promotions, although exceptions may apply. For example, changes to pay may be appropriate when moving between investment professional titles with accounting functions and investing functions or appointment from Portfolio Manager 2 to Deputy Chief Investment Officer. Any changes to pay resulting from changes to job title within the same pay band must be sufficiently justified.

Placement within the pay bands under this section is at the discretion of the Chief Investment Officer or Chief Financial Officer subject to the concurrence of the Executive Director and in discussion with the Human Resource Director. Issues which cannot be resolved will be escalated to the Board Governance and Personnel Committee to make the final determination.

DEMOTION

When an employee demotion results from employee poor performance, or the employee voluntarily agrees to be demoted to a position in a lower pay band, the employee's current salary may be reduced by 9% and then compared to the maximum pay of the lower pay band. If the employee's adjusted salary is greater than the new salary grade maximum, the new salary will be reduced to the maximum pay of the lower pay band.

When an organizational change results in an employee's job title being changed to a job title in a lower pay band, the employee will be demoted to the new job title and will maintain the current pay level.

COMPLETION OF CHARTERED FINANCIAL ANALYST (CFA) EXAM

When completion of the above exam is relevant to the employee's current role at SERS, the Chief Investment Officer, with the concurrence of the Executive Director and Human Resources

Director, shall have the discretion to award an individual an increase of up to 2.5% of annual salary each time one of the three levels that make up the Chartered Financial Analyst (CFA) certification examination is successfully completed. The Executive Director, with the concurrence of the Human Resources Director, shall have discretion to award the same increase to the Chief Investment Officer for successfully completing each level of the exam. Said increases shall be effective prospectively from the date the successful exam completion notification has been provided to the employee's supervisor.

COMPLETION OF CERTIFIED PUBLIC ACCOUNTANT (CPA) EXAM
When completion of the above exam is relevant to the employee's current role at SERS, the Chief Financial Officer, with the concurrence of the Executive Director and Human Resources Director, shall have the discretion to award an individual an increase of up to 2% of annual salary each time one of the four sections of the CPA certification exam is successfully completed. The Executive Director, with the concurrence of the Human Resources Director, shall have discretion to award the same increase to the Chief Financial Officer for successfully completing each level of the exam. Said increases shall be effective prospectively from the date the successful exam completion notification has been provided to the employee's supervisor.

COMPLETION OF CHARTERED ALTERNATIVE INVESTMENT ANALYST (CAIA) EXAM
When completion of the above exam is relevant to the employee's current role at SERS, the Chief Investment Officer, with the concurrence of the Executive Director and Human Resources Director, shall have the discretion to award an individual an increase of up to 2% of annual salary each time one of the two levels of the CAIA certification exam is successfully completed. The Executive Director, with the concurrence of the Human Resources Director, shall have discretion to award the same increase to the Chief Investment Officer for successfully completing the exam. Said increases shall be effective prospectively from the date the successful exam completion notification has been provided to the employee's supervisor.

PERFORMANCE MANAGEMENT
SERS is committed to attracting, developing, managing, and retaining a high performing, diverse, and productive workforce. This requires effective performance management. Performance management entails constructive direction, training, assessment, feedback, and recognition of employees by managers and supervisors to assure a competent, high-performing, and motivated workforce. Establishing clear expectations and evaluating performance are very important parts of that process. The SERS General Performance Standards, provided by the supervisor to each new employee and also annually in conjunction with the performance review, provide supervisors with the opportunity to establish clear expectations. The annual performance review provides supervisors the opportunity to formally discuss performance outcomes with staff.

As part of the performance management process, performance evaluations for investment professional staff shall be issued consistent with the Management Directive 540.7, Performance Management Program, and as discussed in PROGRAM ADMINISTRATION section.

New employees will receive an interim evaluation after six months to review performance and evaluate continued employment.

The annual performance evaluation rating will be used to determine annual salary increases as outlined in PROGRAM ADMINISTRATION section.

RECRUITMENT AND PLACEMENT

SERS Board has the authority to hire the Chief Investment Officer. Recruitment for this position will be conducted internally or through the services of an executive search firm, as determined by the Board.

The filling of all investment professional vacancies will comply with the Commonwealth policies for filling senior level non-civil service positions and may involve internal promotions or active recruitment.

With the exception of the Chief Investment Officer position, investment professional positions in the Investment Office will be filled at the discretion of the Chief Investment Officer, with the concurrence of the Executive Director and in consultation with the Human Resources Director.

The Chief Financial Officer position will be filled at the discretion of the Executive Director in consultation with the Human Resources Director. All other investment professional positions in the Office of Finance and Administration will be filled at the discretion of the Chief Financial Officer and Executive Director, in consultation with the Human Resources Director.

Background investigations will be conducted on all new SERS employees. Although employees may begin employment, their continued employment is contingent upon a satisfactory background investigation report. Background investigations are conducted by the Office of Inspector General.

Consistent with Commonwealth policies and directives, recruitment shall not be influenced by race, color, religious creed, ancestry, union membership, age, gender, sexual orientation, gender identity or expression, national origin, AIDS or HIV status, or disability.

AT-WILL EMPLOYMENT

The State Employees' Retirement System reserves the right to terminate the employment of an investment professional at any time for any reason or no reason, except as prohibited by law.

SUCCESSION PLANNING

The Chief Investment Officer, Chief Financial Officer, and their direct subordinate staff are responsible for workforce and succession planning in their respective areas to ensure effective business continuity. Areas to include for this purpose include knowledge management, staff development, career progression, and staffing projections.

EXCEPTIONS

SERS Board reserves the right to revise or make exceptions to this policy at any time.

HISTORY OF POLICY CHANGES

10/2/2013	Final draft created
03/30/2015	Revisions to draft
08/09/2016	Updates to include CAIA, current dates
09/30/2016	Incorporated final edits from 08/2016
10/19/2016	Incorporated edits from PC to give Personnel Committee approval for pay increases
01/03/2017	Incorporated recommendations from SERS Board and CBIZ
05/24/2017	Updated pay band chart on page 5 with approved minimum and maximum salaries
03/16/2018	Updated pay band chart on page 5 with 01/2018 board approved min and max amts
01/01/2019	Updated pay band chart. Added classification section and removed appendix containing job specifications. Updated committee name to Board Governance and Personnel Committee. Added Investment Committee Chair to performance review of CIO. Changes approved at 12/05/2018 SERS Board meeting to be effective 01/01/2019.
12/07/2019	Removed reference to background, most recent salary, and comparison to other staff and added reference to education and professional credentials under PROGRAM ADMINISTRATION section regarding determination of pay for new investment professionals. Revised entire PROMOTION/RECLASSIFICATION section to provide increased flexibility in employee placement in pay bands instead of restricting to just 9%. Changes approved at 12/04/2019 SERS Board meeting to be effective 12/07/2019.

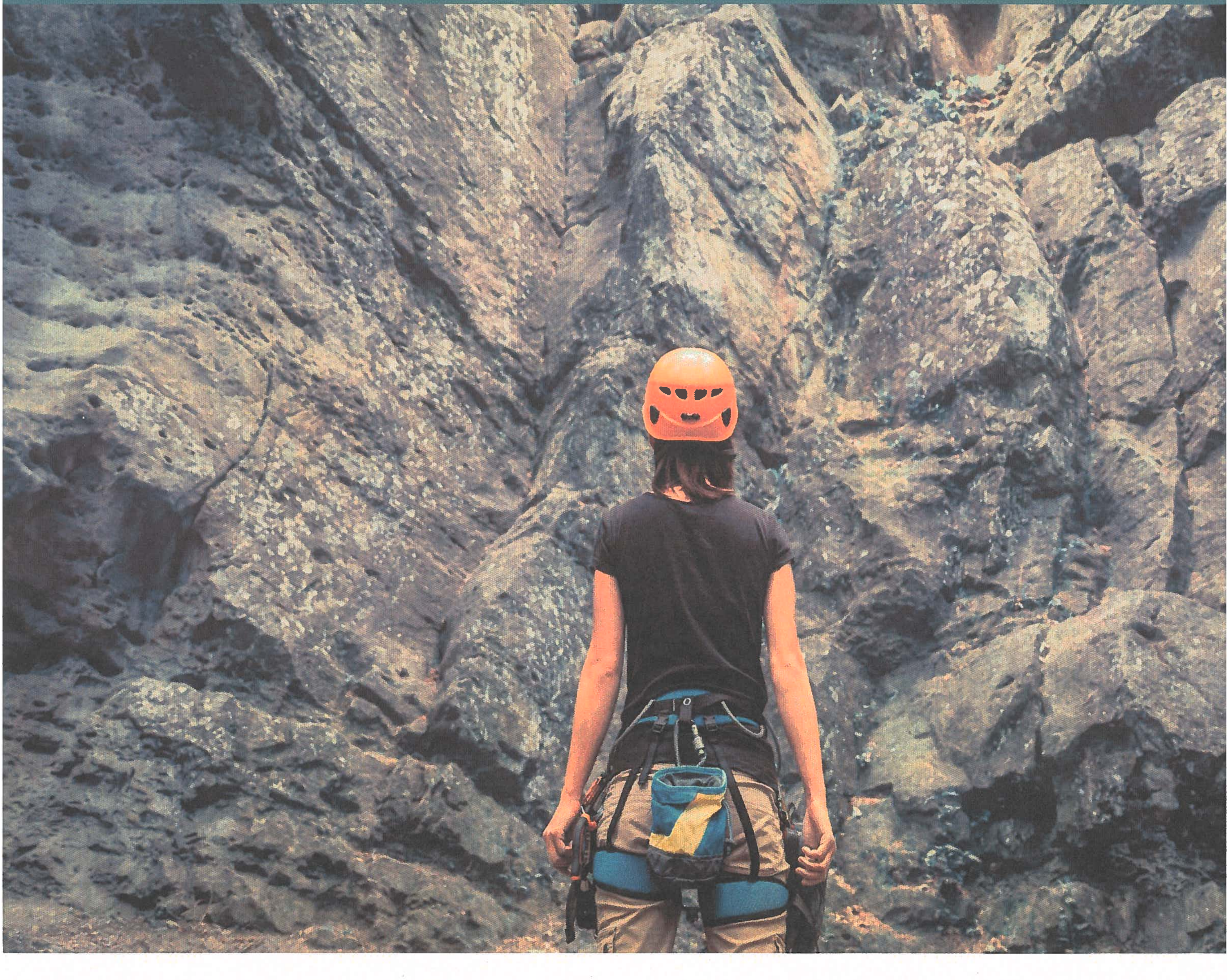
KORN FERRY

ATTACHMENT B

Commonwealth of Pennsylvania State Employees' Retirement System

Stress Testing and Risk Assessment

December 5, 2019



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1 Introduction

The Commonwealth of Pennsylvania State Employees' Retirement System (SERS) provides retirement benefits through a Defined Benefit (DB) plan and a Defined Contribution (DC) plan. The future DB plan benefits are based on contingent events such as members remaining employed until retirement eligibility and the future rates of retiree mortality. The value of the benefits, and the cost for employers to provide the benefits, is unknown and can only be estimated. Determinations of the value of benefits and the allocation of employer costs are conducted annually through an actuarial valuation. The allocation calculates an Actuarially Determined Contribution (ADC) to set the employer contribution rates applicable to the SERS employers.

The annual actuarial valuation and calculation of the ADC represent only a single measurement based on a single set of expectations of future experience. The purpose of this report is to identify and assess major factors that contribute to the risk that the actual future value of benefits will differ from the estimated value provided by the actuarial valuation and the ADC.

This is provided through analysis of "What if?" scenarios to determine the effect on future employer contributions and the availability of assets to pay benefits when due to members. These "What if?" scenarios are referred to as Stress Tests or Scenario Tests. In each scenario, the effect on the Actuarially Determined Contribution (ADC) and funded ratio are projected over a period of 20 years and compared to the Baseline expectations.

Actuarially Determined Contribution: The employer contribution determined based on the SERS funding policy to ensure assets are accumulated and available to provide benefits when due to members.

Funded Ratio: The ratio of the Actuarial Value of Assets to the Actuarial Accrued Liability at a specified date. The Actuarial Value of Assets is based on the market value of SERS assets but reflects an adjustment to dampen the effect of market volatility. Investment markets are volatile, and this "smoothing" is used to spread investment returns that are above or below expectations over a period of 5 years. This method is set in the SERS funding policy and is a generally accepted and recommended practice for retirement systems in the Public Sector. The Actuarial Accrued Liability is the expected value of member benefits that is allocated to past years of service. The value of benefits allocated to future years of service is funded through future contributions from members and employers.

Baseline: The baseline results are the current expectations based on the completed December 31, 2018 actuarial valuation and reflect the action taken by the SERS Board at its June 2019 meeting to reduce the assumed investment return rate to 7.125% effective with the December 31, 2019 actuarial valuation.

The stress testing scenarios are organized into three distinct sections based on the major categories of risks: Investment Risks, Demographic Risks, and Contribution Risks.

Investment Risks

SERS assets are accumulated and invested to create investment earnings that help offset the cost for employers to provide retirement benefits. The SERS funding policy is based on an assumed future investment return rate that is set as a long-term expectation of investment performance. However, it is important to understand that there is significant volatility in investment markets and that the actual investment return experienced during any given year may vary greatly from the long-term expected investment return rate.

The scenarios included in this section assess the sensitivity of the ADC and the funded ratio to:

2.1 – Differences in future investment performance
2.2 – A large investment loss
2.3 – The effect of investment liquidity
2.4 – Simulated future investment performance and volatility (Stochastic Analysis)
2.5 – Changes in the investment return assumption

Demographic Risks

The value of retirement benefits paid by SERS is affected by the future experience of members. The actuarial valuation and ADC are based on a single set of demographic assumptions related to future member experience. There is a risk that future member experience will differ from the assumptions used and will cause changes in the value of plan benefits.

The scenarios included in this section assess the sensitivity of the ADC and the funded ratio to:

3.1 – Changes in rates of member mortality
3.2 – Changes in rates of member salary growth

Contribution Risks

The SERS funding policy sets employer contribution rates based on an Actuarially Determined Contribution (ADC). The ADC is designed to provide a relatively predictable and stable pattern of contributions that will ensure assets are accumulated to pay all benefits when due to members.

The scenarios included in this section assess the effect on future contribution needs and the funded ratio of employers making contributions that differ from the ADC. These scenarios do not assess the ability or willingness of the SERS employers to make future contributions. Any future contribution amounts shown are for illustrative purposes only. Contributing less than the ADC is neither recommended nor expected. The scenarios include the effect of:

4.1 – Reduced funding of the Actuarially Determined Contribution
4.2 – Limited employer contributions due to sustained unfavorable investment performance
4.3 – Limited employer contributions due to a large investment loss
4.4 – Funding in excess of the Actuarially Determined Contribution

Actuarial Certification

To the best of our knowledge, this report is complete and accurate, and all costs and liabilities have been determined in accordance with the applicable actuarial standards of practice and on the basis of actuarial assumptions and methods which are reasonable for the purpose of this analysis.

The actuaries certifying this analysis are members of the Society of Actuaries or other professional actuarial organizations, and meet the Qualification Standards of the American Academy of Actuaries for purposes of issuing Statements of Actuarial Opinion.

Respectfully submitted,
Korn Ferry

By ______________________
Brent M. Mowery, F.S.A.
Member American Academy of Actuaries
Enrolled Actuary No. 17-3885

By ______________________
Kristopher E. Seets, F.S.A.
Member American Academy of Actuaries
Enrolled Actuary No. 17-8055

By ______________________
Craig R. Graby
Member American Academy of Actuaries
Enrolled Actuary No. 17-7319

2 Investment Risks

2.1 Effect of Future Investment Performance

SERS assets are accumulated and invested to create investment earnings that help offset the cost for employers to provide retirement benefits. The SERS funding policy is based on an assumed future investment return rate that is set as a long-term expectation of investment performance. However, it is important to understand that there is significant volatility in investment markets and that the actual investment return experienced during any given year may vary greatly from the long-term expected investment return rate.

The SERS funding policy utilizes an asset smoothing method to help dampen the effect of market volatility on the Actuarially Determined Contribution (ADC) and the funded ratio. This smoothing method recognizes investment returns that are above or below the expected rate over a period of 5 years. This allows employers to plan and adjust future budgets for changes in contribution needs.

Investment returns below the expected investment return rate will dampen the growth of SERS assets and therefore increase the contributions needed to fund the benefits. The following scenarios provide the projected effects of various investment return rates over a 20-year period:

<u>Baseline</u> – Investment returns are equal to the assumed investment return throughout the 20-year period.

<u>2% Above Assumption</u> – Investment returns are equal to the assumed investment return rate plus 2% (200 basis points) for each of the first 10 years, then equal to the assumed investment return rate for the remainder of the period.

<u>2% Below Assumption</u> – Investment returns are equal to the assumed investment return rate minus 2% (200 basis points) for each of the first 10 years, then equal to the assumed investment return rate for the remainder of the period.

The investment return rates used by calendar year are provided in the following schedule:

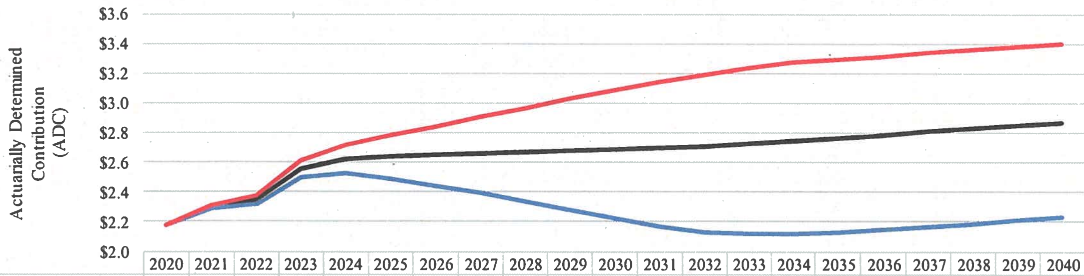
Calendar Year	Baseline	2% Above Assumption	2% Below Assumption
2019*	7.250%	9.250%	5.250%
2020-2028	7.125%	9.125%	5.125%
2029-2038	7.125%	7.125%	7.125%

*The scenarios are based on the assumed investment return rate for Calendar Year 2019 of 7.25% and do not reflect any actual 2019 investment performance. Pursuant to action taken by the SERS Board at its June 2019 meeting, the assumed investment return rate was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to future investment performance. Investment returns above the actuarial assumption reduce the ADC relative to the baseline. Investment returns below the actuarial assumption increase the ADC relative to the baseline.

Chart 1
Sensitivity to Future Investment Performance
Effect on Actuarially Determined Contribution
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
2% Above Assumption	2.18	2.29	2.32	2.50	2.53	2.49	2.45	2.40	2.34	2.28	2.22	2.17	2.13	2.12	2.12	2.13	2.15	2.17	2.19	2.21	2.23
2% Below Assumption	2.18	2.31	2.37	2.61	2.72	2.78	2.84	2.90	2.96	3.02	3.09	3.14	3.19	3.23	3.27	3.29	3.32	3.34	3.36	3.38	3.40

The favorable investment returns in the "2% Above Assumption" scenario gradually reduce the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $2.22 billion, about $470 million lower than the baseline ADC. Since investment returns that are above the assumed rates are smoothed over a period of 5 years, the investment gains that occurred through Calendar Year 2028 continue to reduce the ADC through Fiscal Year 2033/2034. After the initial 10-year period, the investment performance is set equal to the assumed investment return rate of 7.125%. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rates) as a percentage of payroll.

The unfavorable investment returns in the "2% Below Assumption" scenario gradually increase the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $3.09 billion, about $400 million higher than the baseline ADC. Since investment returns that are below the assumed rates are smoothed over a period of 5 years, the investment losses that occurred through Calendar Year 2028 continue to increase the ADC through Fiscal Year 2033/2034. After the initial 10-year period, the investment performance is set equal to the assumed investment return rate of 7.125%. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rates) as a percentage of payroll.

Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)

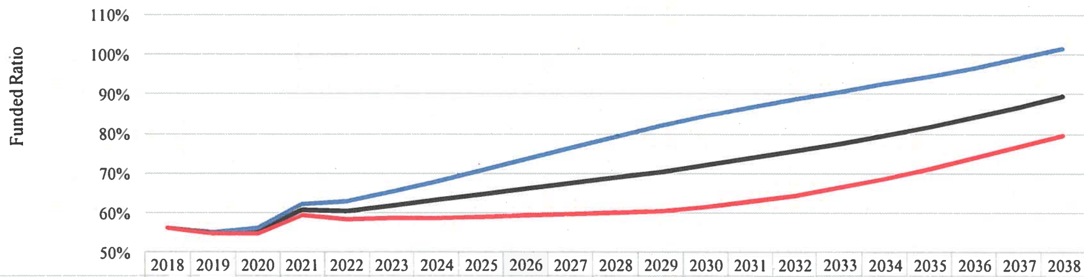
(Dollars in Billions)

	Baseline			2% Above Assumption			2% Below Assumption		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)	ADC (8)	Payroll (9)	ADC Rate (10)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.29	$6.66	34.4%	$2.31	$6.66	34.7%
2022	$2.35	$6.85	34.3%	$2.32	$6.85	33.9%	$2.37	$6.85	34.6%
2023	$2.56	$7.05	36.3%	$2.50	$7.05	35.5%	$2.61	$7.05	37.0%
2024	$2.62	$7.25	36.1%	$2.53	$7.25	34.9%	$2.72	$7.25	37.5%
2025	$2.64	$7.46	35.4%	$2.49	$7.46	33.4%	$2.78	$7.46	37.3%
2026	$2.65	$7.68	34.5%	$2.45	$7.68	31.9%	$2.84	$7.68	37.0%
2027	$2.66	$7.90	33.7%	$2.40	$7.90	30.4%	$2.90	$7.90	36.7%
2028	$2.67	$8.13	32.8%	$2.34	$8.13	28.8%	$2.96	$8.13	36.4%
2029	$2.68	$8.37	32.0%	$2.28	$8.37	27.2%	$3.02	$8.37	36.1%
2030	$2.69	$8.61	31.2%	$2.22	$8.61	25.8%	$3.09	$8.61	35.9%
2031	$2.69	$8.86	30.4%	$2.17	$8.86	24.5%	$3.14	$8.86	35.4%
2032	$2.70	$9.12	29.6%	$2.13	$9.12	23.4%	$3.19	$9.12	35.0%
2033	$2.72	$9.38	29.0%	$2.12	$9.38	22.6%	$3.23	$9.38	34.4%
2034	$2.75	$9.65	28.5%	$2.12	$9.65	22.0%	$3.27	$9.65	33.9%
2035	$2.77	$9.93	27.9%	$2.13	$9.93	21.5%	$3.29	$9.93	33.1%
2036	$2.79	$10.22	27.3%	$2.15	$10.22	21.0%	$3.32	$10.22	32.5%
2037	$2.81	$10.52	26.7%	$2.17	$10.52	20.6%	$3.34	$10.52	31.7%
2038	$2.83	$10.82	26.2%	$2.19	$10.82	20.2%	$3.36	$10.82	31.1%
2039	$2.85	$11.14	25.6%	$2.21	$11.14	19.8%	$3.38	$11.14	30.3%
2040	$2.87	$11.46	25.0%	$2.23	$11.46	19.5%	$3.40	$11.46	29.7%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the funded ratio to investment performance under the three scenarios. Investment returns above the actuarial assumption increase the funded ratio relative to the baseline. Investment returns below the actuarial assumption decrease the funded ratio relative to the baseline.

Chart 2
Sensitivity to Future Investment Performance
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
2% Above Assumption	56%	55%	56%	62%	63%	65%	68%	71%	73%	76%	79%	82%	84%	87%	89%	91%	92%	94%	97%	99%	101%
2% Below Assumption	56%	55%	55%	59%	58%	58%	59%	59%	59%	59%	60%	60%	61%	63%	64%	66%	69%	71%	74%	77%	80%

The effect of investment performance on the funded ratio is delayed by the asset smoothing method, which is designed to dampen the effect of market volatility. In the long-term, the unfavorable investment performance of the "2% Below Assumption" scenario does result in a lower funded ratio compared to the baseline but does not prevent the growth of the funded ratio from 56% in 2018 to 60% in 2028 and 80% in 2038. The favorable investment performance of the "2% Above Assumption" scenario accelerates the growth of the funded ratio from 56% in 2018 to 79% in 2028 and 101% in 2038.

Conclusions

The future investment performance of the SERS assets is unknown and will have a substantial impact on the contributions needed to fund benefits. These scenarios have shown the sensitivity of the ADC and funded ratio to sustained periods of favorable or unfavorable investment performance, including:

1. Investment market volatility will produce investment returns that, during any given year, may be either above or below the expected investment returns. The asset smoothing method is utilized to dampen the effect of market volatility on the ADC and funded ratio to provide a more stable and predictable contribution pattern. The effect of market underperformance is recognized over multiple years, allowing employers to plan for the contribution increases and set future budget expectations.

2. The ADC will increase over time if the actual investment returns are below the assumed investment return rate. The unfavorable investment performance in the "2% Below Assumption" scenario steadily increased the ADC relative to the baseline, causing the contribution rate (ADC Rate) to be as much as 5.4% of payroll higher than the baseline (35.0% in Fiscal Year 2031/2032 compared to the baseline ADC Rate of 29.6% of payroll).

3. Although unfavorable investment performance can cause the funded ratio to decrease temporarily, the funded ratio is still expected to increase in the long-term. Even during the 10 years of unfavorable performance in the "2% Below Assumption" scenario, in most years, the funded ratio is gradually increasing as the ADC is contributed.

2.2 Effect of a Large Investment Loss

SERS assets are accumulated and invested to create investment earnings that help offset the cost for employers to provide retirement benefits. The SERS funding policy is based on an assumed future investment return rate that is set as a long-term expectation of investment performance. However, it is important to understand that there is significant volatility in investment markets and that the actual investment return experienced during any given year may vary greatly from the long-term expected investment return rate.

The SERS funding policy utilizes an asset smoothing method to help dampen the effect of market volatility on the Actuarially Determined Contribution (ADC) and the funded ratio. This smoothing method recognizes investment returns that are above or below the expected rate over a period of 5 years. This allows employers to plan and adjust future budgets for changes in contribution needs.

Investment returns below the expected investment return rate will dampen the growth of SERS assets and therefore increase the contributions needed to fund the benefits. The following scenario provides the projected effects of a large investment loss:

Baseline – Investment returns are equal to the assumed investment return throughout the 20-year period.

Scenario – The investment return for Calendar Year 2019 is -20%. For the remainder of the 20-year period, the investment returns are equal to the assumed investment return rate.

The investment return rates used by calendar year are provided in the following schedule:

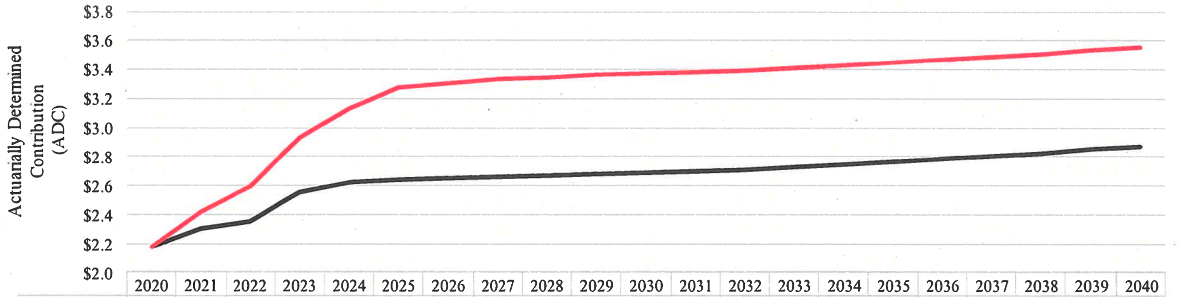
Calendar Year	Baseline	Scenario
2019*	7.250%	-20.000%
2020-2038	7.125%	7.125%

*The scenarios are based on the assumed investment return rate for Calendar Year 2019 of 7.25% and do not reflect any actual 2019 investment performance. Pursuant to action taken by the SERS Board at its June 2019 meeting, the assumed investment return rate was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to a large investment loss. The loss is assumed to occur during Calendar Year 2019, would first be recognized in the December 31, 2019 actuarial valuation and would first be reflected as an increase to the ADC in Fiscal Year 2020/2021.

Chart 1
Sensitivity to a Large Investment Loss
Effect on Actuarially Determined Contribution
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Scenario	2.18	2.42	2.59	2.93	3.13	3.28	3.31	3.33	3.35	3.36	3.37	3.38	3.39	3.41	3.43	3.45	3.47	3.49	3.51	3.53	3.55

The asset smoothing method causes the hypothetical -20% return experienced during Calendar Year 2019 to be recognized over a 5-year period. One-fifth (1/5) of the 2019 loss is recognized each year, with the first amount recognized in the Fiscal Year 2020/2021 ADC and the final amount recognized in the Fiscal Year 2024/2025 ADC.

The hypothetical -20% return in Calendar Year 2019 causes the December 31, 2019 market value of assets to be $7.19 billion less in the Scenario as compared to the baseline. This shortfall will need to be funded through additional employer contributions and is reflected in Scenario ADC's that are significantly higher than the baseline ADC's. When the Calendar Year 2019 loss is fully recognized in Fiscal Year 2024/2025, the Scenario ADC is about $640 million higher than the baseline ADC. This $640 million increase represents about 8.6% of member payroll and would be a substantial additional burden on employers. Table 1 provides the effect of the hypothetical Calendar Year 2019 investment loss on the future contribution rates (ADC Rate) as a percentage of payroll.

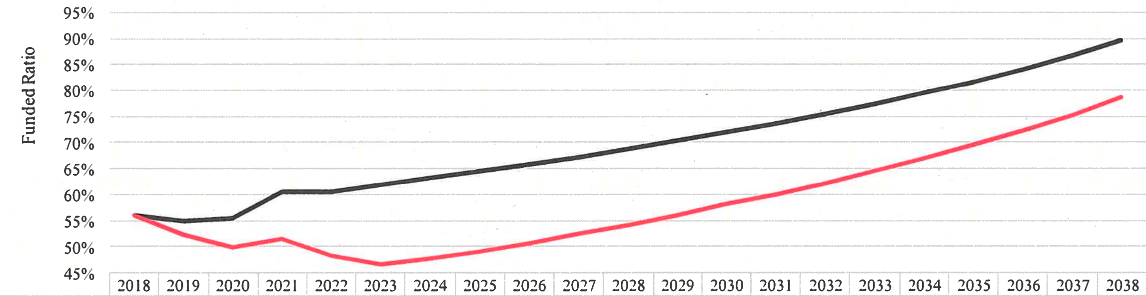
Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)
(Dollars in Billions)

	Baseline			Scenario		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.42	$6.66	36.3%
2022	$2.35	$6.85	34.3%	$2.59	$6.85	37.8%
2023	$2.56	$7.05	36.3%	$2.93	$7.05	41.6%
2024	$2.62	$7.25	36.1%	$3.13	$7.25	43.2%
2025	$2.64	$7.46	35.4%	$3.28	$7.46	44.0%
2026	$2.65	$7.68	34.5%	$3.31	$7.68	43.1%
2027	$2.66	$7.90	33.7%	$3.33	$7.90	42.2%
2028	$2.67	$8.13	32.8%	$3.35	$8.13	41.2%
2029	$2.68	$8.37	32.0%	$3.36	$8.37	40.1%
2030	$2.69	$8.61	31.2%	$3.37	$8.61	39.1%
2031	$2.69	$8.86	30.4%	$3.38	$8.86	38.1%
2032	$2.70	$9.12	29.6%	$3.39	$9.12	37.2%
2033	$2.72	$9.38	29.0%	$3.41	$9.38	36.4%
2034	$2.75	$9.65	28.5%	$3.43	$9.65	35.5%
2035	$2.77	$9.93	27.9%	$3.45	$9.93	34.7%
2036	$2.79	$10.22	27.3%	$3.47	$10.22	34.0%
2037	$2.81	$10.52	26.7%	$3.49	$10.52	33.2%
2038	$2.83	$10.82	26.2%	$3.51	$10.82	32.4%
2039	$2.85	$11.14	25.6%	$3.53	$11.14	31.7%
2040	$2.87	$11.46	25.0%	$3.55	$11.46	31.0%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the funded ratio to a large investment loss. The loss is assumed to occur during Calendar Year 2019 and would first be recognized as a reduction to the funded ratio in the December 31, 2019 actuarial valuation.

Chart 2
Sensitivity to a Large Investment Loss
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Scenario	56%	52%	50%	52%	48%	47%	48%	49%	51%	52%	54%	56%	58%	60%	62%	64%	67%	69%	72%	75%	79%

The asset smoothing method causes the hypothetical -20% return experienced during Calendar Year 2019 to be recognized over a 5-year period. One-fifth (1/5) of the 2019 loss is recognized each year, with the first amount recognized in the December 31, 2019 funded ratio and the final amount recognized in the December 31, 2023 funded ratio.

The hypothetical large investment loss during Calendar Year 2019 in this stress test causes the December 31, 2023 funded ratio to decrease to 47%, substantially lower than the baseline December 31, 2023 funded ratio of 62% and the December 31, 2018 funded ratio of 56% before the investment loss occurred.

The effect on the funded ratio continues until the shortfall is fully funded through increased contributions. The December 31, 2038 funded ratio reflecting the large investment loss is only 79%, still substantially lower than the baseline December 31, 2038 funded ratio of 90%. The Scenario Funded Ratio would not return to the baseline value until December 31, 2054, when the large investment loss is fully amortized.

Conclusions

The future investment performance of the SERS assets is unknown and will have a substantial impact on the contributions needed to fund benefits. This scenario has shown the sensitivity of the ADC and funded ratio to a large investment loss, including:

1. The effect of a large investment loss is delayed by the asset smoothing method. The asset smoothing method recognizes the loss over a period of 5 years, causing the ADC to increase gradually over a 5-year period rather than one large increase in a single year. In this scenario, the ADC increased by about $120 million per year compared to the baseline for Fiscal Year 2020/2021 through Fiscal Year 2024/2025. Spreading the loss over the 5-year period allows employers to plan for the contribution increases and adjust future budgets.

2. This scenario assumes a large investment loss in a single year of -20% return on assets without considering the investment results in years preceding or following the year of the large loss. It is possible that the effect of a large investment loss in a given year could be partially offset by periods of favorable investment market performance. For example, note below the periods of favorable investment performance experienced by the SERS fund in the years preceding or following the large losses experienced in 2001-2002 and 2008:

Calendar Year	Investment Return
2001	-7.9%
2002	-10.9%
2003	24.3%
2004	15.1%
2005	14.5%
2006	16.4%
2007	17.2%
2008	-28.7%
2009	9.1%
2010	11.9%

3. A large investment loss could substantially reduce the funded ratio. In this scenario, the hypothetical -20% return in Calendar Year 2019 would cause the funded ratio to be as low as 47% in 2023. The calculation of the ADC reflects investment performance and would increase substantially to fund the investment shortfall. If the ADC is contributed each year, the funded ratio would be expected to return to 56%, the December 31, 2018 funded ratio just prior to the large investment loss, by December 31, 2029.

2.3 Effect on Investment Liquidity

Section 2.2 provides the effect of unfavorable investment performance on the Actuarially Determined Contribution (ADC) and the funded ratio. Although the ADC is designed to ensure assets are available to pay all benefits when due to members, there is a potential that SERS investments would need to be liquidated (sold) at unfavorable values in order to meet the cash flow needs of the plan.

The SERS investment policy includes an allocation to Capital Preservation investments that can be easily liquidated in public markets with values that have a low correlation to U.S. equity values. These Capital Preservation investments include Cash, Treasury Inflation-Protected Securities (TIPS), and U.S. public market fixed income investments based on the following target allocations:

Asset Class	Target Allocation
Cash	2%
TIPS	4%
U.S. Fixed Income	22%
Capital Preservation Total	28%

These Capital Preservation investments can be expected to maintain value during periods of unfavorable equity performance. If Capital Preservation investments were insufficient to pay member benefit payments net of contributions, there is a risk that other investments would need to be liquidated at unfavorable values.

The target allocation of 28% to Capital Preservation investments is expected to be sufficient to cover 92 months of member benefit payments net of contributions, thus providing a substantial period for equity investments to recover value or for other adjustments to be made to avoid liquidation at unfavorable values.

Future unfavorable investment performance could reduce the total fund values and therefore the Capital Preservation assets. Maintaining an allocation of 28% to Capital Preservation investments would provide sufficient assets to cover at least 36 months of expected member benefit payments net of contributions as long as the total fund value exceeded $11.6 billion, which is substantially lower than the July 31, 2019 fund value of $29.6 billion.

Future investment performance in a single year is not reasonably expected to cause the total fund value to decline from $29.6 billion to below $11.6 billion. Investment returns would need to be less than -20% per year for a 3-year period in order for the projected fund value to be approximately $11.6 billion and to include Capital Preservation investments sufficient to cover 36 months[4] of member benefit payments net of contributions. This investment performance was set to cause an adverse investment liquidity scenario that is not reasonably expected to occur.

[4] The Capital Preservation investments would be sufficient to cover the 36 months beginning at the end of the 3-year period. That is, the Capital Preservation investments would be available both during the 3-year period of -20% annual investment returns and still be sufficient to cover 36 months of expected member benefit payments net of contributions.

The following scenario provides the effect of severe investment losses over a 3-year period that would potentially cause the Capital Preservation assets to be sufficient to cover only 36 months of expected member benefits net of contributions:

Baseline – Investment returns are equal to the assumed investment return throughout the 20-year period.

Scenario – The investment return for Calendar Year 2019 through Calendar Year 2021 is -20% per year. For the remainder of the 20-year period, the investment returns are equal to the assumed investment return rate. These returns are expected to result in Capital Preservation investments as of December 31, 2021 that would be sufficient to cover approximately 36 months of expected member benefit payments net of contributions.

The investment return rates used by calendar year are provided in the following schedule:

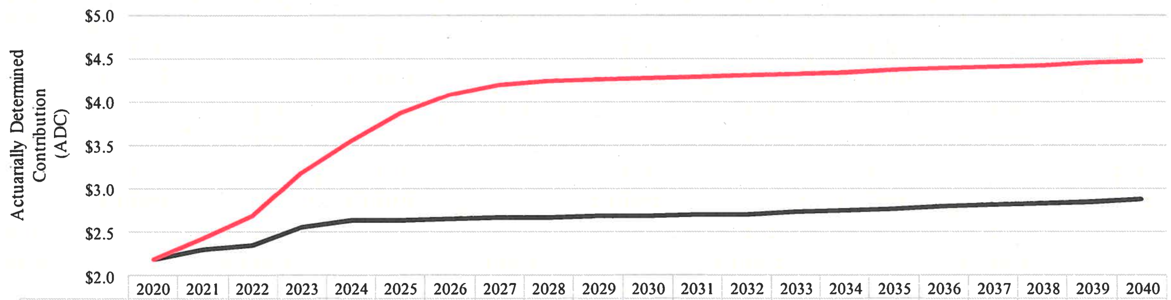
Calendar Year	Baseline	Scenario
2019*	7.250%	-20.000%
2020-2021	7.125%	-20.000%
2022-2038	7.125%	7.125%

*The scenarios are based on the assumed investment return rate for Calendar Year 2019 of 7.25% and do not reflect any actual 2019 investment performance. Pursuant to action taken by the SERS Board at its June 2019 meeting, the assumed investment return rate was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the effect of the adverse investment liquidity scenario on the Actuarially Determined Contribution (ADC). The investment losses under the adverse investment liquidity scenario are severe and would cause substantial increases in the ADC.

Chart 1
Adverse Investment Liquidity Scenario
Effect on Actuarially Determined Contribution
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Scenario	2.18	2.42	2.68	3.18	3.55	3.87	4.08	4.20	4.23	4.26	4.27	4.29	4.30	4.32	4.34	4.36	4.38	4.40	4.42	4.44	4.46

The hypothetical large investment losses in Calendar Year 2019 through Calendar Year 2021 cause the December 31, 2021 market value of assets to be $17.9 billion less in the Scenario as compared to the baseline. These investment losses represent a severely adverse scenario that may not be reasonably expected to occur. Table 1 provides the effect of the hypothetical investment losses in Calendar Year 2019 through Calendar Year 2021 on the future contribution rates (ADC Rate) as a percentage of payroll.

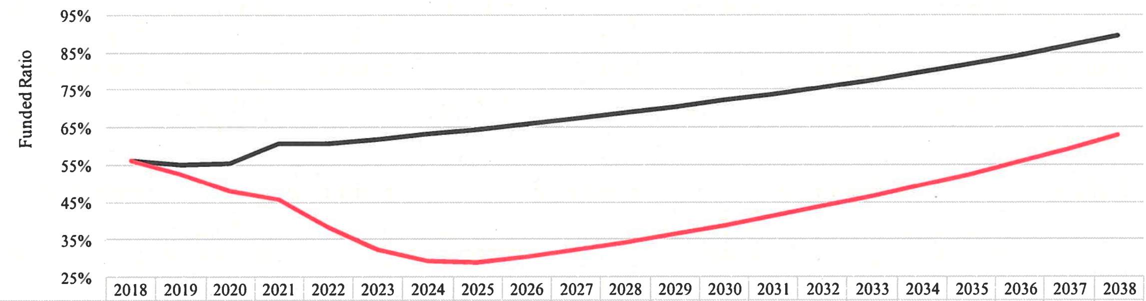
Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)
(Dollars in Billions)

	Baseline			Scenario		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.42	$6.66	36.3%
2022	$2.35	$6.85	34.3%	$2.68	$6.85	39.1%
2023	$2.56	$7.05	36.3%	$3.18	$7.05	45.1%
2024	$2.62	$7.25	36.1%	$3.55	$7.25	49.0%
2025	$2.64	$7.46	35.4%	$3.87	$7.46	51.9%
2026	$2.65	$7.68	34.5%	$4.08	$7.68	53.1%
2027	$2.66	$7.90	33.7%	$4.20	$7.90	53.2%
2028	$2.67	$8.13	32.8%	$4.23	$8.13	52.0%
2029	$2.68	$8.37	32.0%	$4.26	$8.37	50.9%
2030	$2.69	$8.61	31.2%	$4.27	$8.61	49.6%
2031	$2.69	$8.86	30.4%	$4.29	$8.86	48.4%
2032	$2.70	$9.12	29.6%	$4.30	$9.12	47.1%
2033	$2.72	$9.38	29.0%	$4.32	$9.38	46.1%
2034	$2.75	$9.65	28.5%	$4.34	$9.65	45.0%
2035	$2.77	$9.93	27.9%	$4.36	$9.93	43.9%
2036	$2.79	$10.22	27.3%	$4.38	$10.22	42.9%
2037	$2.81	$10.52	26.7%	$4.40	$10.52	41.8%
2038	$2.83	$10.82	26.2%	$4.42	$10.82	40.9%
2039	$2.85	$11.14	25.6%	$4.44	$11.14	39.9%
2040	$2.87	$11.46	25.0%	$4.46	$11.46	38.9%

Effect on Funded Ratio

Chart 2 provides the effect of the adverse investment liquidity scenario on the funded ratio. The investment losses under the adverse investment liquidity scenario are severe and would cause substantial reductions in the funded ratio.

Chart 2
Adverse Investment Liquidity Scenario
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Scenario	56%	52%	48%	45%	38%	32%	29%	29%	30%	32%	34%	36%	39%	41%	44%	46%	49%	52%	56%	59%	63%

The hypothetical large investment losses during Calendar Year 2019 through Calendar Year 2021 in this stress test causes the December 31, 2025 funded ratio to decrease to 29%, substantially lower than the baseline December 31, 2025 funded ratio of 64% and the December 31, 2018 funded ratio of 56% before the investment losses occurred. These investment losses represent a severely adverse scenario that may not be reasonably expected to occur.

Conclusions

The SERS investment policy includes Capital Preservation investments that are expected to be highly liquid and have a low correlation to changes in the U.S. equity markets. These investments provide a stable source for meeting the cash flow needs of the plan and to protect against the risk that equity investments would need to be liquidated at unfavorable values in order to pay member benefits. Analysis of the projected availability of Capital Preservation assets in this scenario has shown:

1. The Capital Preservation target allocation of 28% of total fund assets is expected to be sufficient to cover 92 months of projected member benefits net of contributions. The total fund would need to experience investment returns below -20% per year over a period of 3 years to cause the Capital Preservation investments to be insufficient to cover 36 months of the projected member benefits net of contributions. The Capital Preservation investments appear to be achieving the goal of providing security in both the ability to pay benefits when due and the ability to avoid liquidating equity investments at unfavorable values.

2. This scenario assumes significant investment losses over a period of 3 years. Although this is possible, the magnitude of the losses appears unlikely when compared to past performance and the expected range of future performance. Section 2.4 provides an analysis of simulated future investment performance to determine the likelihood of potential future outcomes. The unfavorable investment returns required for this adverse liquidity scenario are not reasonably expected to occur.

3. This analysis is based on the SERS investment policy, including a target allocation of 28% to Capital Preservation assets. Changes in the investment policy could significantly affect the results of this analysis. The projected availability of assets to pay member benefits when due should continue to be monitored.

2.4 Simulation of Future Investment Performance (Stochastic Analysis)

SERS assets are accumulated and invested to create investment earnings that help offset the cost for employers to provide retirement benefits. The SERS funding policy is based on an assumed future investment return rate that is set as a long-term expectation of investment performance. However, it is important to understand that there is significant volatility in investment markets and that the actual investment return experienced during any given year may vary greatly from the long-term expected investment return rate.

Simulations of future investment performance can be aggregated and analyzed to measure the expected likelihood of certain events. For this analysis, the SERS investment advisor, Callan LLC, provided 5,000 sets of simulated investment returns over a 20-year period based on the SERS investment policy and asset allocations. Korn Ferry has reviewed the simulated investment returns prepared by Callan LLC and found them to be reasonable to provide an estimated range of potential future investment performance. It is important to understand that this is only one set of simulations based on a single set of assumptions. Other simulations could be produced using other methods or assumptions that would provide different results.

The simulated returns were used to develop sets of future Actuarially Determined Contribution (ADC) amounts and funded ratios over a 20-year period. These results were aggregated and ranked by percentile. The following scenarios provide the projected effects of various investment return rates over a 20-year period:

Baseline – Investment returns are equal to the assumed investment return throughout the 20-year period.

95th Percentile – Results generated from the 95th percentile of simulated returns. This represents an **unlikely** scenario that would be **very unfavorable**. Only 5% of the simulated returns were less favorable than this scenario.

75th Percentile – Results generated from the 75th percentile of simulated returns. This represents a **reasonably likely unfavorable scenario**. 25% of the simulated returns were less favorable than this scenario.

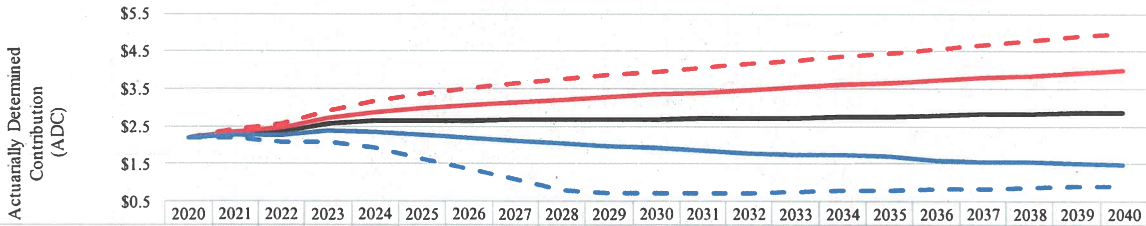
25th Percentile – Results generated from the 25th percentile of simulated returns. This represents a **reasonably likely favorable scenario**. 75% of the simulated returns were less favorable than this scenario.

5th Percentile – Results generated from the 5th percentile of simulated returns. This represents an **unlikely** scenario that would be **very favorable**. 95% of the simulated returns were less favorable than this scenario.

Simulated Future Actuarially Determined Contribution (ADC) Amounts

Chart 1 provides the simulated future Actuarially Determined Contribution (ADC) amounts. Unfavorable investment returns cause larger increases in the ADC relative to the baseline. Favorable investment returns cause larger reductions in the ADC relative to the baseline.

Chart 1
Effect of Future Investment Performance
Simulated Future Actuarially Determined Contribution Amounts
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
95th Percentile	2.18	2.40	2.56	2.91	3.15	3.36	3.52	3.66	3.76	3.86	3.95	4.05	4.15	4.24	4.34	4.44	4.56	4.66	4.76	4.87	4.97
75th Percentile	2.18	2.34	2.44	2.71	2.86	2.96	3.04	3.12	3.19	3.27	3.34	3.40	3.44	3.52	3.59	3.66	3.73	3.78	3.85	3.92	3.98
25th Percentile	2.18	2.26	2.25	2.38	2.35	2.26	2.17	2.11	2.05	1.97	1.91	1.83	1.78	1.74	1.72	1.69	1.61	1.56	1.54	1.53	1.48
5th Percentile	2.18	2.19	2.09	2.09	1.92	1.63	1.36	1.09	0.81	0.71	0.72	0.73	0.74	0.76	0.78	0.81	0.83	0.85	0.88	0.90	0.93

In general, favorable future investment performance results in future ADC amounts that are less than the baseline ADC. Unfavorable future investment performance results in future ADC amounts that exceed the baseline ADC. Comparing the "25th Percentile" scenario to the "75th Percentile" scenario provides a likely range of future ADC amounts. For example, the simulations predict that there is a 50% chance that the Fiscal Year 2029/2030 ADC will be in the range of $1.91 billion to $3.34 billion. It is important to understand that this also means there is a 50% chance that the Fiscal Year 2029/2030 ADC will be outside of that range.

Comparing the "5th Percentile" scenario to the "95th Percentile" scenario provides a highly likely range of future ADC amounts. For example, the simulations predict that there is a 90% chance that the Fiscal Year 2029/2030 ADC will be in the range of $0.72 billion to $3.95 billion. This is a very wide range that may not be reasonable for budgeting purposes but does provide a reasonable range for the "best case" ("5th Percentile") and "worst case" ("95th Percentile"). However, this is not a guarantee that future results will be within this range.

The simulations predict a relatively narrow range of likely ADC amounts during the initial years, but the volatility of investment returns causes the range of potential outcomes to widen over the projection period. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rates) as a percentage of payroll.

Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)

(Dollars in Billions)

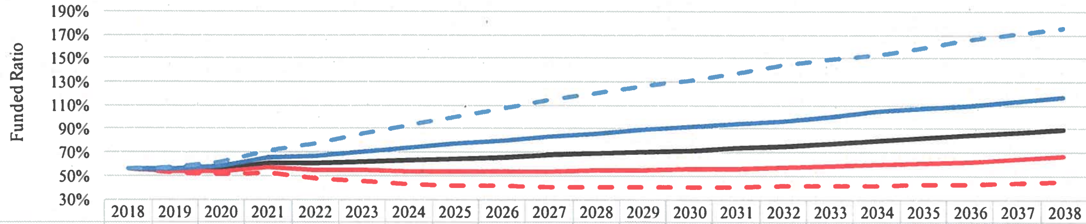
	Baseline			95th Percentile		75th Percentile		25th Percentile		5th Percentile	
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate* (4)	ADC (5)	ADC Rate* (6)	ADC (7)	ADC Rate* (8)	ADC (9)	ADC Rate* (10)	ADC (11)	ADC Rate* (12)
2020	$2.18	$6.47	33.7%	$2.18	33.7%	$2.18	33.7%	$2.18	33.7%	$2.18	33.7%
2021	$2.30	$6.66	34.5%	$2.40	36.0%	$2.34	35.1%	$2.26	33.9%	$2.19	32.9%
2022	$2.35	$6.85	34.3%	$2.56	37.4%	$2.44	35.6%	$2.25	32.8%	$2.09	30.5%
2023	$2.56	$7.05	36.3%	$2.91	41.3%	$2.71	38.4%	$2.38	33.8%	$2.09	29.6%
2024	$2.62	$7.25	36.1%	$3.15	43.4%	$2.86	39.4%	$2.35	32.4%	$1.92	26.5%
2025	$2.64	$7.46	35.4%	$3.36	45.0%	$2.96	39.7%	$2.26	30.3%	$1.63	21.8%
2026	$2.65	$7.68	34.5%	$3.52	45.8%	$3.04	39.6%	$2.17	28.3%	$1.36	17.7%
2027	$2.66	$7.90	33.7%	$3.66	46.3%	$3.12	39.5%	$2.11	26.7%	$1.09	13.8%
2028	$2.67	$8.13	32.8%	$3.76	46.2%	$3.19	39.2%	$2.05	25.2%	$0.81	10.0%
2029	$2.68	$8.37	32.0%	$3.86	46.1%	$3.27	39.1%	$1.97	23.5%	$0.71	8.5%
2030	$2.69	$8.61	31.2%	$3.95	45.9%	$3.34	38.8%	$1.91	22.2%	$0.72	8.4%
2031	$2.69	$8.86	30.4%	$4.05	45.7%	$3.40	38.4%	$1.83	20.7%	$0.73	8.2%
2032	$2.70	$9.12	29.6%	$4.15	45.5%	$3.44	37.7%	$1.78	19.5%	$0.74	8.1%
2033	$2.72	$9.38	29.0%	$4.24	45.2%	$3.52	37.5%	$1.74	18.6%	$0.76	8.1%
2034	$2.75	$9.65	28.5%	$4.34	45.0%	$3.59	37.2%	$1.72	17.8%	$0.78	8.1%
2035	$2.77	$9.93	27.9%	$4.44	44.7%	$3.66	36.9%	$1.69	17.0%	$0.81	8.2%
2036	$2.79	$10.22	27.3%	$4.56	44.6%	$3.73	36.5%	$1.61	15.8%	$0.83	8.1%
2037	$2.81	$10.52	26.7%	$4.66	44.3%	$3.78	35.9%	$1.56	14.8%	$0.85	8.1%
2038	$2.83	$10.82	26.2%	$4.76	44.0%	$3.85	35.6%	$1.54	14.2%	$0.88	8.1%
2039	$2.85	$11.14	25.6%	$4.87	43.7%	$3.92	35.2%	$1.53	13.7%	$0.90	8.1%
2040	$2.87	$11.46	25.0%	$4.97	43.4%	$3.98	34.7%	$1.48	12.9%	$0.93	8.1%

*All simulations and ADC Rates are based on the same projection of member payroll shown in the “Baseline” results.

Simulated Future Funded Ratios

Chart 2 provides the simulated future funded ratios. Unfavorable investment returns cause reductions in the funded ratio relative to the baseline. Favorable investment returns cause increases in the funded ratio relative to the baseline.

Chart 2
Effect of Future Investment Performance
Simulated Future Funded Ratios
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
95th Percentile	56%	53%	51%	52%	48%	45%	43%	41%	41%	41%	40%	40%	40%	41%	41%	41%	42%	42%	43%	44%	45%
75th Percentile	56%	54%	53%	57%	55%	54%	54%	54%	54%	54%	54%	55%	56%	56%	57%	58%	59%	61%	62%	64%	66%
25th Percentile	56%	56%	58%	65%	67%	71%	74%	77%	80%	83%	86%	89%	92%	95%	97%	100%	104%	107%	110%	113%	117%
5th Percentile	56%	57%	61%	72%	77%	85%	93%	100%	108%	114%	120%	126%	131%	138%	144%	149%	153%	159%	166%	171%	176%

In general, favorable future investment performance results in future funded ratios that are greater than the baseline results. Unfavorable future investment performance results in future funded ratios that are less than the baseline results. Comparing the "25th Percentile" scenario to the "75th Percentile" scenario provides a likely range of future funded ratios. For example, the simulations predict that there is a 50% chance that the December 31, 2028 funded ratio will be in the range of 54% to 86%.

Comparing the "5th Percentile" scenario to the "95th Percentile" scenario provides a highly likely range of future funded ratios. For example, the simulations predict that there is a 90% chance that the December 31, 2028 funded ratio will be in the range of 40% to 120%. This is a very wide range that may not be reasonable for understanding funding expectations but does provide a reasonable range for the "best case" ("5th Percentile") and "worst case" ("95th Percentile"). However, this is not a guarantee that future results will be within this range.

Conclusions

The future investment performance of the SERS assets is unknown and will have a substantial impact on the contributions needed to fund benefits. These scenarios have shown the sensitivity of the ADC and funded ratio to future volatility of investment performance, including:

1. It is likely that investment market volatility will cause future ADC amounts to be significantly different from the expected long-term amounts shown in the "Baseline" projections. Based on the simulated investment returns, there is a 50% chance that the expected ("Baseline") Fiscal Year 2029/2030 ADC of $2.69 billion could instead be either above $3.34 billion or below $1.91 billion.

2. Assets are expected to be available to pay benefits when due to members. In the reasonably likely unfavorable outcome represented by the "75th Percentile" scenario, the funded ratio is expected to remain relatively stable compared to the December 31, 2018 funded ratio of 56%. Even in the unlikely very unfavorable outcome represented by the "95th Percentile" scenario, the funded ratio is not expected to fall below 40% as long as the SERS employers continue to contribute the full ADC.

This analysis only recognizes the effect of future investment performance based on a single expectation of future investment returns. The effect of changes in future expectations, reflected through changes in the investment return assumption, are included in the "Sensitivity to Changes in the Investment Return Assumption" section of this report. Many other factors affect the contribution needs of the plan and can cause the ADC to vary widely in the future. Analysis of the effects of other major risks are included within the "Demographic Risks" and "Contribution Risks" sections of this.

2.5 Sensitivity to Changes in the Investment Return Assumption

The SERS funding policy is based on an assumed future investment return rate that is set as a long-term expectation of investment performance. Changes in the expected future investment performance and the assumed future investment return rate can have significant effects on the results of future actuarial valuations. As of the December 31, 2018 actuarial valuation date, this assumption was 7.25% compounded annually. Pursuant to action taken by the SERS Board at its June 2019 meeting, this assumption was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

This section provides the sensitivity of the key actuarial cost and liability components and the funded ratio as of December 31, 2018 under alternative investment return assumptions. The cost and liability components include the Total Normal Cost (i.e., the total allocated cost of benefits), the Employer Normal Cost (i.e., the allocated costs to employers calculated as the Total Normal Cost offset by the contributions from employees), the Actuarial Accrued Liability and the Unfunded Actuarial Accrued Liability.

Although the investment return assumption used in the December 31, 2018 (most recent) actuarial valuation was 7.25%, the "Baseline" results provided in Table 1 reflect the new 7.125% assumption to be implemented in the December 31, 2019 valuation.

Table 1 provides the hypothetical valuation results as of December 31, 2018 based on adjusting the investment return assumption (i) upward by 1% (to 8.125%), (ii) downward by 1% (to 6.125%) and (iii) downward by 2% (to 5.125%) compared to the Baseline assumption of 7.125%.

Table 1 – Hypothetical Valuation Results as of December 31, 2018 Under Various Investment Return Assumptions

Annual Investment Return Assumption	Baseline 7.125%	(i) 8.125%	(ii) 6.125%	(iii) 5.125%
Total Normal Cost Rate (As % of Payroll)	6.36%	5.30%	7.73%	9.50%
Employer Normal Cost Rate (As % of Payroll)	1.41%	0.35%	2.78%	4.55%
Actuarial Accrued Liability ($ Billions)	$52.55	$47.09	$59.24	$68.23
Unfunded Actuarial Accrued Liability ($ Billions)	$23.57	$18.10	$30.25	$39.24
Funded Ratio	55.2%	61.6%	48.9%	42.5%

Note: The results shown above are based upon the same census and asset data and the same actuarial assumptions and methods as used in the SERS December 31, 2018 actuarial valuation with the exception that alternative annual investment return assumptions have been utilized.

Conclusions

This analysis has shown the sensitivity of valuation results to changes in the investment return assumption, including:

1. Reducing the investment return assumption would result in higher actuarial costs and liabilities, since a smaller share of the funding of SERS would be expected to be covered by annual net investment returns. Increases in the investment return assumption would reduce the actuarial costs and liabilities.

2. Reducing the investment return assumption would increase the Actuarial Accrued Liability and reduce the funded ratio. Increasing the investment return assumption would reduce the Actuarial Accrued Liability and increase the funded ratio.

3. The SERS Board, with input and assistance from both the actuary and the investment advisor, reviews the investment return assumption annually to determine the appropriate assumption to be used for each actuarial valuation. The SERS Board makes this determination based upon a review of the SERS asset allocation and Investment Policy Statement as well as recent economic experience, future capital market expectations, and the projected effect on future contribution requirements.

3 Demographic Risks

3.1 Effect of Changes in Rates of Member Mortality

The value of retirement benefits paid by SERS is affected by the future experience of members. Because most SERS retirement benefits are paid in the form of a lifetime annuity, the valuation of such benefits requires that mortality assumptions be used to estimate the future lifetimes of SERS annuitants, both those currently receiving benefits and those projected to receive annuity benefits in the future.

The mortality assumptions used for SERS annual actuarial valuation purposes, when applied to any individual member, will not likely accurately predict that individual's remaining lifetime; however, when these assumptions are applied to the entire SERS covered population of 240,000+ members, they generally will result in fairly accurate predictions of the remaining lifetimes of the population on average.

The actuarial valuation and Actuarially Determined Contribution (ADC) are based on a single set of demographic assumptions related to future member experience. Included in this set of assumptions are the mortality assumptions. There is a risk that future member mortality experience will differ from the mortality assumptions currently used in the SERS valuations and that this difference will cause changes in the value of plan benefits. Increased future annuitant longevity compared to the current SERS mortality assumptions will increase the value of benefits and therefore increase the contributions needed to fund the benefits. The following scenarios provide the projected effects of actual rates of member mortality deviating from the current mortality assumptions over a 20-year period:

<u>Baseline</u> – Members (specifically, healthy annuitants) will experience deaths consistent with the mortality assumptions used in the December 31, 2018 valuation throughout the 20-year period.

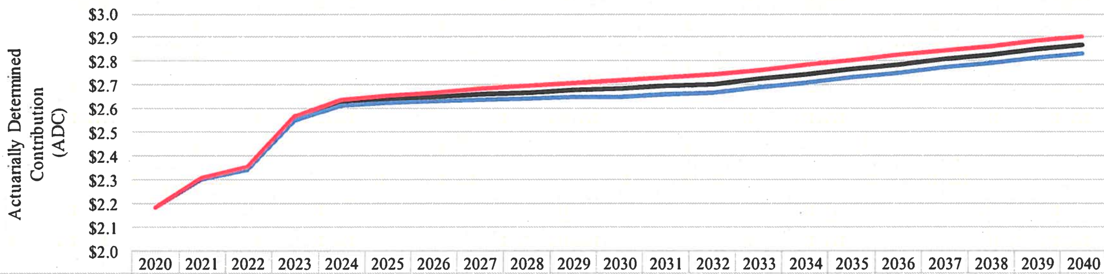
<u>10% More Deaths</u> – Members (specifically, healthy annuitants) will experience 10% more deaths than those currently assumed for the SERS actuarial valuation during the first 10 years of the projection, then will experience deaths consistent with the mortality assumptions for the remainder of the 20-year projection.

<u>10% Less Deaths</u> – Members (specifically, healthy annuitants) will experience 10% less deaths than those currently assumed for the SERS actuarial valuation during the first 10 years of the projection, then will experience deaths consistent with the mortality assumptions for the remainder of the 20-year projection.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to changes in healthy annuitant mortality rates under the three scenarios. Member mortality rates that are higher than the actuarial assumptions decrease annuitant lifetimes, increase the number of deaths and thus decrease the value of plan benefits and the ADC relative to the baseline. Member mortality rates that are lower than the actuarial assumptions increase annuitant lifetimes, decrease the number of deaths and thus increase the value of plan benefits and the ADC relative to the baseline.

Chart 1
Sensitivity to Changes in Participant Mortality
Effect on Actuarially Determined Contribution
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
10% More Deaths	2.18	2.30	2.34	2.55	2.61	2.62	2.63	2.64	2.64	2.65	2.65	2.66	2.67	2.69	2.71	2.73	2.75	2.77	2.79	2.81	2.83
10% Less Deaths	2.18	2.31	2.35	2.57	2.64	2.65	2.67	2.68	2.70	2.71	2.72	2.73	2.74	2.76	2.78	2.80	2.82	2.84	2.86	2.88	2.91

The higher mortality rates in the "10% More Deaths" scenario gradually decrease the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $2.65 billion, about $40 million lower than the baseline ADC. After the initial 10-year period, the mortality rates return to the actuarial assumption, but the ADC remains lower than the baseline to reflect the lower than expected number of living healthy annuitants. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rate) as a percentage of payroll.

The lower mortality rates in the "10% Less Deaths" scenario gradually increase the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $2.72 billion, about $30 million higher than the baseline ADC. After the initial 10-year period, the mortality rates return to the actuarial assumption, but the ADC remains higher than the baseline to reflect the higher than expected number of living healthy annuitants. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rate) as a percentage of payroll.

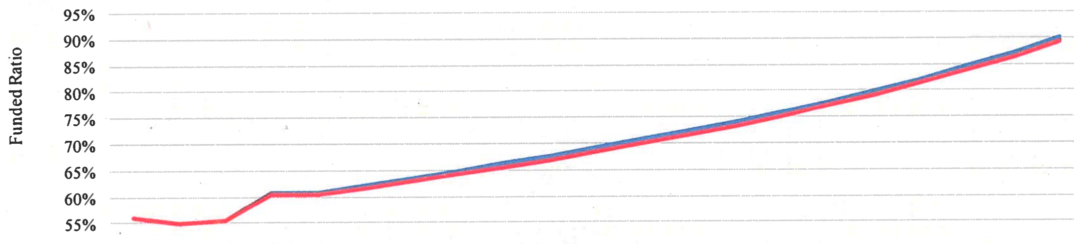
Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)
(Dollars in Billions)

	Baseline			10% More Deaths			10% Less Deaths		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)	ADC (8)	Payroll (9)	ADC Rate (10)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.30	$6.66	34.5%	$2.31	$6.66	34.7%
2022	$2.35	$6.85	34.3%	$2.34	$6.85	34.2%	$2.35	$6.85	34.3%
2023	$2.56	$7.05	36.3%	$2.55	$7.05	36.2%	$2.57	$7.05	36.5%
2024	$2.62	$7.25	36.1%	$2.61	$7.25	36.0%	$2.64	$7.25	36.4%
2025	$2.64	$7.46	35.4%	$2.62	$7.46	35.1%	$2.65	$7.46	35.5%
2026	$2.65	$7.68	34.5%	$2.63	$7.68	34.2%	$2.67	$7.68	34.8%
2027	$2.66	$7.90	33.7%	$2.64	$7.90	33.4%	$2.68	$7.90	33.9%
2028	$2.67	$8.13	32.8%	$2.64	$8.13	32.5%	$2.70	$8.13	33.2%
2029	$2.68	$8.37	32.0%	$2.65	$8.37	31.7%	$2.71	$8.37	32.4%
2030	$2.69	$8.61	31.2%	$2.65	$8.61	30.8%	$2.72	$8.61	31.6%
2031	$2.69	$8.86	30.4%	$2.66	$8.86	30.0%	$2.73	$8.86	30.8%
2032	$2.70	$9.12	29.6%	$2.67	$9.12	29.3%	$2.74	$9.12	30.0%
2033	$2.72	$9.38	29.0%	$2.69	$9.38	28.7%	$2.76	$9.38	29.4%
2034	$2.75	$9.65	28.5%	$2.71	$9.65	28.1%	$2.78	$9.65	28.8%
2035	$2.77	$9.93	27.9%	$2.73	$9.93	27.5%	$2.80	$9.93	28.2%
2036	$2.79	$10.22	27.3%	$2.75	$10.22	26.9%	$2.82	$10.22	27.6%
2037	$2.81	$10.52	26.7%	$2.77	$10.52	26.3%	$2.84	$10.52	27.0%
2038	$2.83	$10.82	26.2%	$2.79	$10.82	25.8%	$2.86	$10.82	26.4%
2039	$2.85	$11.14	25.6%	$2.81	$11.14	25.2%	$2.88	$11.14	25.9%
2040	$2.87	$11.46	25.0%	$2.83	$11.46	24.7%	$2.91	$11.46	25.4%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the funded ratio to changes in healthy annuitant mortality under the three scenarios. Member mortality rates that are higher than the actuarial assumptions decrease annuitant lifetimes, increase the number of deaths and thus decrease the liability for plan benefits, thereby increasing the funded ratio relative to the baseline. Member mortality rates that are lower than the actuarial assumptions increase annuitant lifetimes, decrease the number of deaths and thus increase the liability for plan benefits, thereby decreasing the funded ratio relative to the baseline.

Chart 2
Sensitivity to Changes in Participant Mortality
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
10% More Deaths	56%	55%	55%	61%	61%	62%	63%	65%	66%	68%	69%	71%	72%	74%	76%	78%	80%	82%	85%	87%	90%
10% Less Deaths	56%	55%	55%	60%	60%	62%	63%	64%	66%	67%	68%	70%	72%	73%	75%	77%	79%	81%	84%	86%	89%

Although the sustained period of higher mortality rates in the "10% More Deaths" scenario does increase the funded ratio, and the sustained period of lower mortality rates in the "10% Less Deaths" scenario does decrease the funded ratio, the funded ratio effect in both scenarios is not significant. Throughout the 20-year period, the funded ratios under the three scenarios were always within 1% of each other.

Conclusions

Although sustained lower mortality rates will increase the ADC, it is unlikely to be a significant risk since:

1. During the 20-year period, the "10% Less Deaths" ADC never exceeded the baseline ADC by more than about $40 million, or about 0.4% of covered payroll.

2. As shown in Chart 2, sustained periods of lower mortality rates are not expected to significantly affect the funded ratio or the availability of assets to pay benefits when due to members. There was no significant difference (never greater than 1%) in the funded ratio under the "10% Less Deaths" scenario compared to the baseline funded ratio.

3. Every 5 years, the SERS actuary performs an actuarial experience study, which includes a review of the actual SERS member mortality experience of the recent past compared to the then current mortality assumptions. As appropriate, new mortality assumptions will be recommended. The adoption of new, lower mortality assumptions (absent any other assumption changes) will result in higher ADC amounts and lower funded ratios.

3.2 Effect of Changes in Rates of Member Salary Growth

The retirement benefits paid by SERS are based on each member's salary (compensation) at the time of their retirement. SERS funding is based on each member's current salary projected to retirement, using a salary scale to reflect increases for general inflation, real wage growth, and career (merit) growth. This salary increase scale is used as a budgeting tool to reflect expected overall salary growth in funding the future benefits. It is not a guarantee of future salary increases nor a reflection of the expected career progression of any single individual.

It is common for actual member salary increases to be significantly higher or lower than expected during any individual year or over a period of multiple years as the economy moves through cycles. For example, many retirement systems experienced dampened salary growth following the economic recession of 2007-2009.

Member salary increases above the expected growth rate will increase the value of benefits and therefore increase the contributions needed to fund the benefits. The following scenarios provide the projected effects of salaries increasing by various rates over a 20-year period:

Baseline – Member salaries increase based on the salary scale used in the current valuation (as of 12/31/2018) throughout the 20-year period.

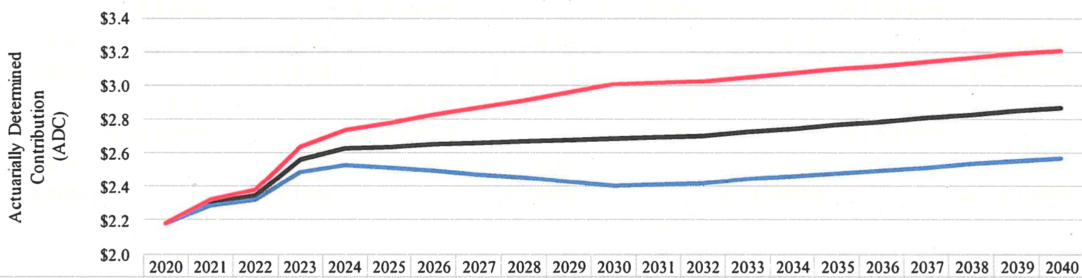
2% Above Assumption – Member salaries increase by the assumed salary scale plus 2% (200 basis points) for each of the first 10 years, then increase by the assumed salary scale for the remainder of the period.

2% Below Assumption – Member salaries increase by the assumed salary scale minus 2% (200 basis points) for each of the first 10 years, then increase by the assumed salary scale for the remainder of the period.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to changes in salary growth rates under the three scenarios. Salary growth rates above the actuarial assumption increase the ADC relative to the baseline. Salary growth rates below the actuarial assumption decrease the ADC relative to the baseline.

Chart 1
Sensitivity to Changes in Participant Salary Growth
Effect on Actuarially Determined Contribution
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
2% Below Assumption	2.18	2.29	2.32	2.48	2.52	2.51	2.49	2.47	2.45	2.43	2.40	2.41	2.42	2.44	2.46	2.48	2.50	2.51	2.53	2.55	2.57
2% Above Assumption	2.18	2.32	2.38	2.64	2.73	2.78	2.82	2.87	2.91	2.96	3.00	3.01	3.02	3.05	3.07	3.09	3.12	3.14	3.16	3.19	3.21

The larger salary growth rate in the "2% Above Assumption" scenario gradually increases the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $3.00 billion, about $310 million higher than the baseline ADC. After the initial 10-year period, the salary growth rates return to the actuarial assumption, but the ADC remains larger than the baseline to reflect the larger payroll. The larger projected payroll in the "2% Above Assumption" scenario also results in a decrease in the contribution rate as a percentage of payroll compared to the baseline projection. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rate) as a percentage of payroll.

The reduced salary growth rate in the "2% Below Assumption" scenario gradually reduces the ADC compared to the baseline projection. The accumulated effect over the 10-year period results in an expected Fiscal Year 2029/2030 ADC of $2.40 billion, about $290 million lower than the baseline ADC. After the initial 10-year period, the salary growth rates return to the actuarial assumption, but the ADC remains lower than the baseline to reflect the reduced payroll. The reduced projected payroll in the "2% Above Assumption" scenario also results in an increase in the contribution rate as a percentage of payroll compared to the baseline projection. Table 1 provides the projected ADC, payroll, and contribution rates (ADC rate) as a percentage of payroll.

Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)

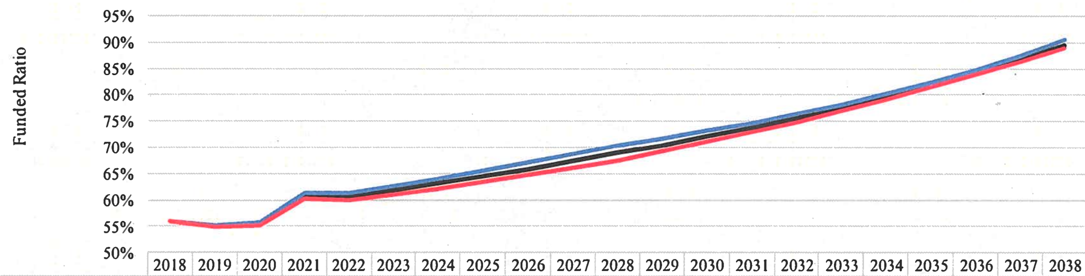
(Dollars in Billions)

	Baseline			2% Below Assumption			2% Above Assumption		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)	ADC (8)	Payroll (9)	ADC Rate (10)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.29	$6.52	35.1%	$2.32	$6.79	34.2%
2022	$2.35	$6.85	34.3%	$2.32	$6.58	35.3%	$2.38	$7.13	33.4%
2023	$2.56	$7.05	36.3%	$2.48	$6.63	37.4%	$2.64	$7.48	35.3%
2024	$2.62	$7.25	36.1%	$2.52	$6.69	37.7%	$2.73	$7.85	34.8%
2025	$2.64	$7.46	35.4%	$2.51	$6.75	37.2%	$2.78	$8.24	33.7%
2026	$2.65	$7.68	34.5%	$2.49	$6.80	36.6%	$2.82	$8.65	32.6%
2027	$2.66	$7.90	33.7%	$2.47	$6.86	36.0%	$2.87	$9.08	31.6%
2028	$2.67	$8.13	32.8%	$2.45	$6.92	35.4%	$2.91	$9.53	30.5%
2029	$2.68	$8.37	32.0%	$2.43	$6.98	34.8%	$2.96	$10.00	29.6%
2030	$2.69	$8.61	31.2%	$2.40	$7.04	34.1%	$3.00	$10.50	28.6%
2031	$2.69	$8.86	30.4%	$2.41	$7.24	33.3%	$3.01	$10.80	27.9%
2032	$2.70	$9.12	29.6%	$2.42	$7.45	32.5%	$3.02	$11.11	27.2%
2033	$2.72	$9.38	29.0%	$2.44	$7.67	31.8%	$3.05	$11.44	26.7%
2034	$2.75	$9.65	28.5%	$2.46	$7.89	31.2%	$3.07	$11.77	26.1%
2035	$2.77	$9.93	27.9%	$2.48	$8.12	30.5%	$3.09	$12.11	25.5%
2036	$2.79	$10.22	27.3%	$2.50	$8.35	29.9%	$3.12	$12.46	25.0%
2037	$2.81	$10.52	26.7%	$2.51	$8.59	29.2%	$3.14	$12.82	24.5%
2038	$2.83	$10.82	26.2%	$2.53	$8.84	28.6%	$3.16	$13.19	24.0%
2039	$2.85	$11.14	25.6%	$2.55	$9.10	28.0%	$3.19	$13.58	23.5%
2040	$2.87	$11.46	25.0%	$2.57	$9.36	27.5%	$3.21	$13.97	23.0%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the funded ratio to changes in salary growth rates under the three scenarios. Salary growth rates above the actuarial assumption slightly reduce the funded ratio relative to the baseline. Salary growth rates below the actuarial assumption slightly increase the funded ratio relative to the baseline.

Chart 2
Sensitivity to Changes in Participant Salary Growth
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
2% Below Assumption	56%	55%	56%	61%	61%	62%	64%	65%	67%	69%	70%	72%	73%	75%	76%	78%	80%	82%	85%	87%	90%
2% Above Assumption	56%	55%	55%	60%	60%	61%	62%	63%	65%	66%	67%	69%	71%	73%	75%	77%	79%	81%	84%	86%	89%

Although the sustained period of larger salary growth rates does reduce the funded ratio, the effect is not significant compared to the total SERS benefits. The larger salary growth rates increase the future benefits for current active members but do not affect the value of benefits for current retirees, which account for a large portion of the total SERS benefits. Also, the increased ADC increases SERS assets as the additional contributions are received and invested to pay future benefits, which somewhat offsets the reduction to the funded ratio.

Conclusions

Although sustained salary growth that exceeds the expected growth rates will increase the ADC, it is unlikely to be a significant risk since:

1. Sustained periods of high salary growth rates are likely to coincide with strong economic growth periods that could also provide favorable investment returns and revenue growth.

2. High salary growth rates would reduce the ADC rate as a percentage of payroll. A reduced ADC rate may be viewed as a reduced burden on employers to provide the benefits since the contributions would represent a smaller portion of the total compensation costs.

3. Sustained periods of high salary growth rates are not expected to significantly affect the funded ratio or the availability of assets to pay benefits when due to members. There was no significant difference in the funded ratio under the “2% Above Assumption” scenario compared to the baseline.

4 Contribution Risks

4.1 Effect of Reduced Funding of Actuarially Determined Contribution

It is the SERS funding policy to fully fund the Actuarially Determined Contribution (ADC), the annual employer contribution calculated by the actuary based on a defined actuarial cost method, asset valuation method and amortization method. Developing an ADC each year serves two primary purposes:

1. Ensures assets are accumulated to pay all benefits when due to members

2. Provides a relatively predictable and stable pattern of contributions to assist with budgeting

Substantial underfunding can result in an insufficient accumulation of assets to pay benefits when due to members. However, even temporary periods of underfunding can create a significant burden on future budgets.

When contributions are not appropriately budgeted and paid, many governments have struggled to restore the appropriation in subsequent years. Therefore, it is important to recognize both the effect of underfunding and the difficulty to return to full funding. Although we neither recommend nor expect future underfunding, the following scenarios provide the projected effects of temporarily reducing SERS funding:

Baseline – Employers contribute 100% of the ADC in all years.

Scenario Contribution – Employers contribute all required contributions to the Defined Contribution Plan but provide reduced funding to the Defined Benefit Plan based on the following schedule:

Fiscal Year	Percentage of ADC Contributed to Defined Benefit Plan
2019/2020	0%
2020/2021	20%
2021/2022	40%
2022/2023	60%
2023/2024	80%
2024/2025 through 2039/2040	100%

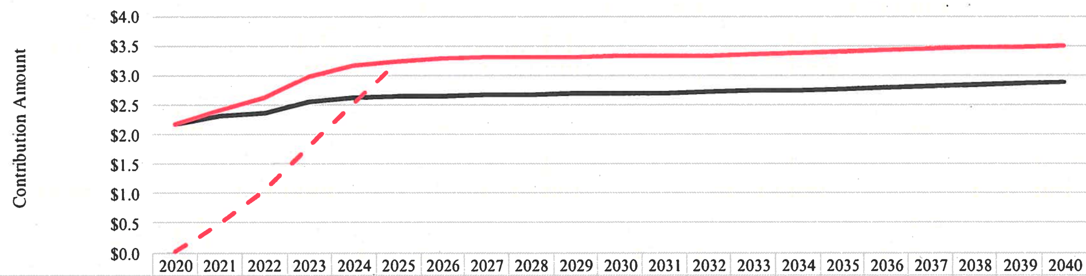
This scenario reflects a missed contribution during Fiscal Year 2019/2020 followed by a four-year period of partial funding during Fiscal Year 2020/2021 through Fiscal Year 2023/2024, as the annual budget gradually ramps up before recovering to full funding in Fiscal Year 2024/2025 and thereafter.

Scenario ADC – The Actuarially Determined Contribution (ADC) reflecting the reduced funding provided in the Scenario Contribution.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to reduced funding of the ADC. The reduced funding for Fiscal Year 2019/2020 through Fiscal Year 2023/2024 in this stress test increases the unfunded actuarial liabilities relative to the baseline. These additional unfunded liabilities cause the Scenario ADC to increase relative to the baseline.

Chart 1
Reduced Funding of the Actuarially Determined Contribution (ADC)
Effect on ADC
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Scenario Contribution	0.01	0.49	1.06	1.79	2.53	3.24	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.36	3.38	3.40	3.42	3.44	3.46	3.48	3.50
Scenario ADC	2.18	2.39	2.61	2.97	3.15	3.24	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.36	3.38	3.40	3.42	3.44	3.46	3.48	3.50

The accumulated effect of the reduced funding for Fiscal Year 2019/2020 through Fiscal Year 2023/2024 results in an expected Fiscal Year 2024/2025 ADC of $3.24 billion, about $600 million higher than the baseline ADC. The increased ADC continues throughout the projection period until the System's 30-year amortization of the underfunded liabilities is complete.

In this scenario, there is about $6.13 billion of underfunding during Fiscal Year 2019/2020 through Fiscal Year 2023/2024 relative to the baseline. This $6.13 billion of underfunding causes future contributions (through Fiscal Year 2053/2054) to increase by $18.97 billion.

The underfunding also creates a larger burden for future employers since the Scenario ADC represents a larger percentage of member funding payroll. Table 1 provides the effect of the underfunding on the future contribution rates (ADC Rate) as a percentage of payroll.

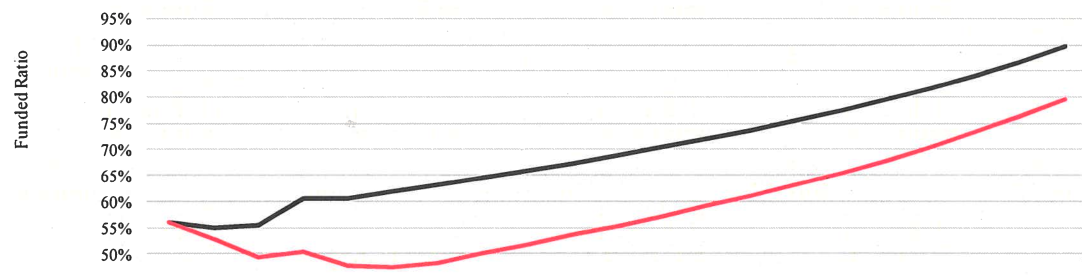
Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)
(Dollars in Billions)

	Baseline			Scenario ADC		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.39	$6.66	35.9%
2022	$2.35	$6.85	34.3%	$2.61	$6.85	38.1%
2023	$2.56	$7.05	36.3%	$2.97	$7.05	42.1%
2024	$2.62	$7.25	36.1%	$3.15	$7.25	43.4%
2025	$2.64	$7.46	35.4%	$3.24	$7.46	43.4%
2026	$2.65	$7.68	34.5%	$3.28	$7.68	42.7%
2027	$2.66	$7.90	33.7%	$3.29	$7.90	41.6%
2028	$2.67	$8.13	32.8%	$3.30	$8.13	40.6%
2029	$2.68	$8.37	32.0%	$3.31	$8.37	39.5%
2030	$2.69	$8.61	31.2%	$3.32	$8.61	38.6%
2031	$2.69	$8.86	30.4%	$3.33	$8.86	37.6%
2032	$2.70	$9.12	29.6%	$3.34	$9.12	36.6%
2033	$2.72	$9.38	29.0%	$3.36	$9.38	35.8%
2034	$2.75	$9.65	28.5%	$3.38	$9.65	35.0%
2035	$2.77	$9.93	27.9%	$3.40	$9.93	34.2%
2036	$2.79	$10.22	27.3%	$3.42	$10.22	33.5%
2037	$2.81	$10.52	26.7%	$3.44	$10.52	32.7%
2038	$2.83	$10.82	26.2%	$3.46	$10.82	32.0%
2039	$2.85	$11.14	25.6%	$3.48	$11.14	31.2%
2040	$2.87	$11.46	25.0%	$3.50	$11.46	30.5%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the Funded Ratio to reduced funding of the ADC. The reduced funding for Fiscal Year 2019/2020 through Fiscal Year 2023/2024 in this stress test substantially reduces the SERS assets relative to the baseline. These reduced asset values cause the Scenario Funded Ratio to decrease relative to the baseline funded ratio.

Chart 2
Reduced Funding of the Actuarially Determined Contribution (ADC)
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Scenario Funded Ratio	56%	53%	49%	50%	48%	47%	48%	50%	52%	53%	55%	57%	59%	61%	63%	65%	68%	70%	73%	76%	79%

The reduced funding for Fiscal Year 2019/2020 through Fiscal Year 2023/2024 in this stress test causes the December 31, 2024 funded ratio to decrease to 48%, substantially lower than the baseline December 31, 2024 funded ratio of 63% and the December 31, 2018 funded ratio of 56% before the reduced funding begins.

The effect on the funded ratio continues until the underfunding is fully amortized over the 30-year period. The December 31, 2038 funded ratio reflecting the reduced funding is only 79%, still substantially lower than the baseline December 31, 2038 funded ratio of 90%. The Scenario Funded Ratio would not return to the baseline value until December 31, 2055, when the additional contributions for the underfunding are fully amortized.

Conclusions

Even temporary reductions in funding can have significant effects on both the future contribution burden and the funded ratio. This hypothetical scenario of missed contributions has shown:

1. The $6.13 billion of missed contributions increased future contributions by a total of $18.97 billion and increased the future employer contribution rate by as much as 8.2% of payroll.

2. Each dollar of shortfall between the amount contributed and the baseline ADC immediately increases the unfunded liability and reduces the funded ratio. The funded ratio is expected to steadily increase in the baseline scenario from 56% in 2018 to 90% in 2038. The reduced funding scenario would reduce the funded ratio from 56% in 2018 to as low as 47% in 2023 before recovering to only 79% by 2038.

3. The ADC is designed to provide relatively predictable and stable contribution patterns. When ADC-level contributions are not appropriately budgeted and paid, it may be very difficult to budget for the large contribution increases needed to return to fully funding the ADC.

4.2 Effect of Limited Employer Contributions Due to Sustained Unfavorable Investment Performance

The Investment Risks Section includes a stress test to assess the effect of future investment performance assuming SERS employers continue to contribute the full Actuarially Determined Contribution (ADC). However, if there is sustained unfavorable investment performance, there is an additional risk that SERS employers would be unable to adjust their budgets to meet the increases in the ADC without adversely impacting their ability to meet the critical needs of the Commonwealth.

The following scenarios provide the projected effects of sustained unfavorable investment performance assuming various employer contribution patterns:

Baseline – Investment returns are equal to the assumed investment return throughout the 20-year period. All employers contribute the ADC in each year of the 20-year period.

Full Funding Scenario – Investment returns are equal to the assumed investment return rate minus 2% (200 basis points) for each year of the 20-year period. All employers contribute the ADC in each year of the 20-year period.

Limited Funding Scenario – Investment returns are equal to the assumed investment return rate minus 2% (200 basis points) for each year of the 20-year period. Employers contribute all required contributions to the Defined Contribution Plan in each year of the 20-year period; however, after Fiscal Year 2019/2020, the annual rate of growth of employer contributions to the Defined Benefit Plan is limited to the 3.1% per year average projected rate of State revenue growth.

The investment return rates used by calendar year are provided in the following schedule:

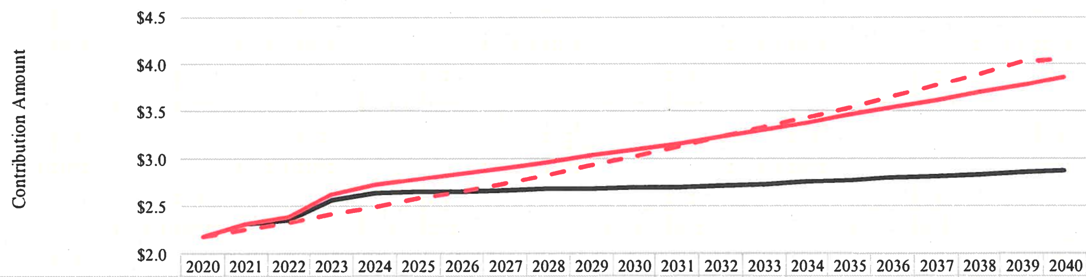
Calendar Year	Baseline	Full Funding Scenario	Limited Funding Scenario
2019*	7.250%	5.250%	5.250%
2020-2038	7.125%	5.125%	5.125%

*The scenarios are based on the assumed investment return rate for Calendar Year 2019 of 7.25% and do not reflect any actual 2019 investment performance. Pursuant to action taken by the SERS Board at its June 2019 meeting, the assumed investment return rate was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

Effect on the Actuarially Determined Contribution (ADC)

Chart 1 provides the projected contribution amounts by Fiscal Year for each scenario.

Chart 1
Effect of Sustained Unfavorable Investment Performance
Projected Contributions
($ Billions; Contributions for Fiscal Year Ending)



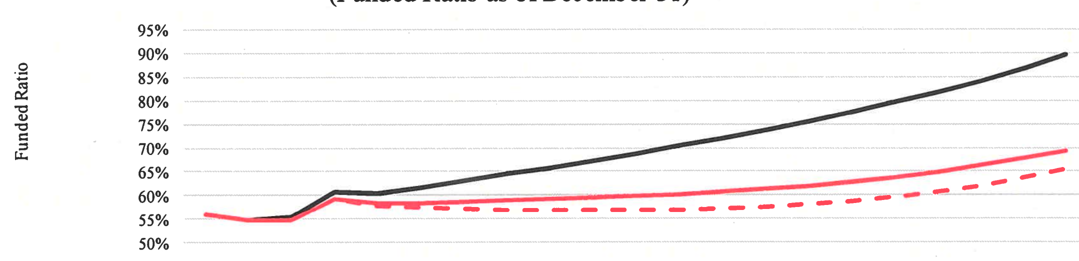
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Full Funding Scenario	2.18	2.31	2.37	2.61	2.72	2.78	2.84	2.90	2.96	3.02	3.09	3.15	3.22	3.29	3.37	3.45	3.53	3.61	3.69	3.77	3.85
Limited Funding Scenario	2.18	2.25	2.33	2.40	2.48	2.57	2.65	2.74	2.83	2.92	3.02	3.11	3.22	3.32	3.43	3.54	3.65	3.77	3.89	4.02	4.06

The sustained unfavorable investment performance gradually increases the ADC compared to the baseline projection. The "Limited Funding Scenario" would not generate sufficient increases in employer contributions to fund the ADC. Although contributions under the "Limited Funding Scenario" exceed the "Full Funding Scenario" beginning in Fiscal Year 2032/2033, the lower contributions in the earlier years create a funding deficiency. The funding deficiency is shown by analyzing the effect on the funded ratio. Analysis of the effect on the funded ratio is provided in the following section. Detailed projections of the results are provided in Table 1 (Baseline), Table 2 (Full Funding Scenario), and Table 3 (Limited Funding Scenario), which follow the "Conclusions" section.

Effect on Funded Ratio

Chart 2 provides the projected funded ratios by Calendar Year for each scenario.

Chart 2
Effect of Sustained Unfavorable Investment Performance
Projected Funded Ratios
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Full Funding Scenario	56%	55%	55%	59%	58%	58%	59%	59%	59%	59%	60%	60%	61%	61%	62%	63%	64%	65%	66%	68%	69%
Limited Funding Scenario	56%	55%	55%	59%	58%	57%	57%	57%	57%	57%	57%	57%	57%	57%	58%	59%	59%	61%	62%	64%	65%

The sustained unfavorable investment performance gradually reduces the funded ratio compared to the baseline. The Actuarially Determined Contribution (ADC) is adjusted to reflect the unfavorable investment performance and is contributed in the "Full Funding Scenario". These increased contributions cause the funded ratio to rise gradually compared to the "Limited Funding Scenario" funded ratio. Although the December 31, 2038 funded ratio of 69% under the "Full Funding Scenario" is well below the baseline funded ratio of 90% it is higher than the "Limited Funding Scenario" funded ratio of 65%. The funding deficiency under the "Limited Funding Scenario" causes the projected unfunded liability as of December 31, 2038 to be $2.1 billion higher than the unfunded liability under the "Full Funding Scenario". The ADC is designed to reflect investment performance and fully fund member benefits. Limited funding can substantially increase the future contributions needed to fund member benefits. Detailed projections of the results are provided in Table 1 (Baseline), Table 2 (Full Funding Scenario), and Table 3 (Limited Funding Scenario), which follow the "Conclusions" section.

Conclusions

Sustained periods of unfavorable investment performance can increase the future contributions needed to fund member benefits. Analysis of the "Limited Funding Scenario" has shown:

1. Although the Actuarially Determined Contribution (ADC) is designed to provide relatively predictable and stable contribution patterns, adjustments are required to reflect actual investment performance and to ensure member benefits are fully funded. When the ADC is not fully contributed, even though contribution levels are stable, as they are under the "Limited Funding Scenario", there is a funding deficiency that can substantially increase the future employer contributions needed to fund member benefits.

2. Each dollar of shortfall between the amount contributed and the ADC immediately increases the unfunded liability and reduces the funded ratio. By December 31, 2038, reduced contributions under the "Limited Funding Scenario" would increase the total unfunded liability by $2.1 billion compared to the "Full Funding Scenario".

3. The sustained unfavorable performance reflected in these scenarios would likely result in changes to plan funding. If SERS' annual investment performance repeatedly fell short of the actuarial expectations, it is important to note that the SERS Board, with assistance from both the plan's actuary and investment consultant, would re-examine and potentially adjust the plan's investment return assumption and other actuarial assumptions. Analysis of the effect of changes in the investment return assumption is included in the Investment Risks section of this report.

Table 1 – Baseline Projection of Results
(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.30	$6.66	34.5%	$53.22	$29.22	$24.00	$1.21	54.9%	$0.09	$3.59	3.3%
2020	2021/2022	$2.35	$6.85	34.3%	$53.83	$29.81	$24.02	$0.02	55.4%	$0.10	$3.70	3.3%
2021	2022/2023	$2.56	$7.05	36.3%	$50.30	$30.47	$19.83	($4.19)	60.6%	$0.65	$3.82	3.2%
2022	2023/2024	$2.62	$7.25	36.1%	$50.85	$30.74	$20.11	$0.28	60.4%	$0.65	$3.94	3.1%
2023	2024/2025	$2.64	$7.46	35.4%	$51.40	$31.72	$19.68	($0.43)	61.7%	$0.65	$4.06	3.2%
2024	2025/2026	$2.65	$7.68	34.5%	$51.91	$32.72	$19.19	($0.49)	63.0%	$0.65	$4.17	3.4%
2025	2026/2027	$2.66	$7.90	33.7%	$52.36	$33.73	$18.63	($0.56)	64.4%	$0.65	$4.27	3.6%
2026	2027/2028	$2.67	$8.13	32.8%	$52.75	$34.73	$18.02	($0.61)	65.8%	$0.65	$4.37	3.7%
2027	2028/2029	$2.68	$8.37	32.0%	$53.06	$35.72	$17.34	($0.68)	67.3%	$0.65	$4.48	3.9%
2028	2029/2030	$2.69	$8.61	31.2%	$53.30	$36.68	$16.62	($0.72)	68.8%	$0.65	$4.58	4.0%
2029	2030/2031	$2.69	$8.86	30.4%	$53.47	$37.63	$15.84	($0.78)	70.4%	$0.65	$4.69	4.2%
2030	2031/2032	$2.70	$9.12	29.6%	$53.60	$38.59	$15.01	($0.83)	72.0%	$0.66	$4.74	4.2%
2031	2032/2033	$2.72	$9.38	29.0%	$53.68	$39.56	$14.12	($0.89)	73.7%	$0.66	$4.82	4.2%
2032	2033/2034	$2.75	$9.65	28.5%	$53.70	$40.54	$13.16	($0.96)	75.5%	$0.66	$4.89	4.2%
2033	2034/2035	$2.77	$9.93	27.9%	$53.68	$41.56	$12.12	($1.04)	77.4%	$0.66	$4.95	4.2%
2034	2035/2036	$2.79	$10.22	27.3%	$53.63	$42.63	$11.00	($1.12)	79.5%	$0.67	$5.01	4.2%
2035	2036/2037	$2.81	$10.52	26.7%	$53.53	$43.75	$9.78	($1.22)	81.7%	$0.67	$5.07	4.2%
2036	2037/2038	$2.83	$10.82	26.2%	$53.43	$44.95	$8.48	($1.30)	84.1%	$0.68	$5.11	4.1%
2037	2038/2039	$2.85	$11.14	25.6%	$53.26	$46.19	$7.07	($1.41)	86.7%	$0.68	$5.19	4.1%
2038	2039/2040	$2.87	$11.46	25.0%	$53.06	$47.51	$5.55	($1.52)	89.5%	$0.69	$5.23	4.0%

Table 2 – Full Funding Scenario Projection of Results

(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.31	$6.66	34.7%	$53.22	$29.11	$24.11	$1.32	54.7%	$0.09	$3.59	3.3%
2020	2021/2022	$2.37	$6.85	34.6%	$53.83	$29.49	$24.34	$0.23	54.8%	$0.10	$3.70	3.2%
2021	2022/2023	$2.61	$7.05	37.0%	$50.30	$29.81	$20.49	($3.85)	59.3%	$0.65	$3.82	3.1%
2022	2023/2024	$2.72	$7.25	37.5%	$50.85	$29.61	$21.24	$0.75	58.2%	$0.65	$3.94	2.9%
2023	2024/2025	$2.78	$7.46	37.3%	$51.40	$30.01	$21.39	$0.15	58.4%	$0.65	$4.06	3.0%
2024	2025/2026	$2.84	$7.68	37.0%	$51.91	$30.41	$21.50	$0.11	58.6%	$0.65	$4.17	3.1%
2025	2026/2027	$2.90	$7.90	36.7%	$52.36	$30.80	$21.56	$0.06	58.8%	$0.65	$4.27	3.2%
2026	2027/2028	$2.96	$8.13	36.4%	$52.75	$31.18	$21.57	$0.01	59.1%	$0.65	$4.37	3.3%
2027	2028/2029	$3.02	$8.37	36.1%	$53.06	$31.54	$21.52	($0.05)	59.4%	$0.65	$4.48	3.4%
2028	2029/2030	$3.09	$8.61	35.9%	$53.30	$31.88	$21.42	($0.10)	59.8%	$0.65	$4.58	3.4%
2029	2030/2031	$3.15	$8.86	35.6%	$53.47	$32.21	$21.26	($0.16)	60.2%	$0.65	$4.69	3.5%
2030	2031/2032	$3.22	$9.12	35.3%	$53.60	$32.55	$21.05	($0.21)	60.7%	$0.66	$4.74	3.4%
2031	2032/2033	$3.29	$9.38	35.1%	$53.68	$32.91	$20.77	($0.28)	61.3%	$0.66	$4.82	3.4%
2032	2033/2034	$3.37	$9.65	34.9%	$53.70	$33.29	$20.41	($0.36)	62.0%	$0.66	$4.89	3.4%
2033	2034/2035	$3.45	$9.93	34.7%	$53.68	$33.71	$19.97	($0.44)	62.8%	$0.66	$4.95	3.2%
2034	2035/2036	$3.53	$10.22	34.5%	$53.63	$34.20	$19.43	($0.54)	63.8%	$0.67	$5.01	3.1%
2035	2036/2037	$3.61	$10.52	34.3%	$53.53	$34.73	$18.80	($0.63)	64.9%	$0.67	$5.07	3.0%
2036	2037/2038	$3.69	$10.82	34.1%	$53.43	$35.37	$18.06	($0.74)	66.2%	$0.68	$5.11	2.8%
2037	2038/2039	$3.77	$11.14	33.8%	$53.26	$36.05	$17.21	($0.85)	67.7%	$0.68	$5.19	2.8%
2038	2039/2040	$3.85	$11.46	33.6%	$53.06	$36.82	$16.24	($0.97)	69.4%	$0.69	$5.23	2.6%

Table 3 – Limited Funding Scenario Projection of Results

(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.25	$6.66	33.8%	$53.22	$29.11	$24.11	$1.32	54.7%	$0.09	$3.59	3.4%
2020	2021/2022	$2.33	$6.85	34.0%	$53.83	$29.46	$24.37	$0.26	54.7%	$0.10	$3.70	3.4%
2021	2022/2023	$2.40	$7.05	34.0%	$50.30	$29.72	$20.58	($3.79)	59.1%	$0.65	$3.82	3.5%
2022	2023/2024	$2.48	$7.25	34.2%	$50.85	$29.39	$21.46	$0.88	57.8%	$0.65	$3.94	3.7%
2023	2024/2025	$2.57	$7.46	34.5%	$51.40	$29.55	$21.85	$0.39	57.5%	$0.65	$4.06	3.8%
2024	2025/2026	$2.65	$7.68	34.5%	$51.91	$29.70	$22.21	$0.36	57.2%	$0.65	$4.17	3.9%
2025	2026/2027	$2.74	$7.90	34.7%	$52.36	$29.84	$22.52	$0.31	57.0%	$0.65	$4.27	3.9%
2026	2027/2028	$2.83	$8.13	34.8%	$52.75	$29.98	$22.77	$0.25	56.8%	$0.65	$4.37	3.9%
2027	2028/2029	$2.92	$8.37	34.9%	$53.06	$30.12	$22.94	$0.17	56.8%	$0.65	$4.48	3.9%
2028	2029/2030	$3.02	$8.61	35.1%	$53.30	$30.26	$23.04	$0.10	56.8%	$0.65	$4.58	3.9%
2029	2030/2031	$3.11	$8.86	35.1%	$53.47	$30.40	$23.07	$0.03	56.9%	$0.65	$4.69	3.9%
2030	2031/2032	$3.22	$9.12	35.3%	$53.60	$30.60	$23.00	($0.07)	57.1%	$0.66	$4.74	3.7%
2031	2032/2033	$3.32	$9.38	35.4%	$53.68	$30.83	$22.85	($0.15)	57.4%	$0.66	$4.82	3.6%
2032	2033/2034	$3.43	$9.65	35.5%	$53.70	$31.11	$22.59	($0.26)	57.9%	$0.66	$4.89	3.5%
2033	2034/2035	$3.54	$9.93	35.6%	$53.68	$31.46	$22.22	($0.37)	58.6%	$0.66	$4.95	3.3%
2034	2035/2036	$3.65	$10.22	35.7%	$53.63	$31.90	$21.73	($0.49)	59.5%	$0.67	$5.01	3.0%
2035	2036/2037	$3.77	$10.52	35.8%	$53.53	$32.42	$21.11	($0.62)	60.6%	$0.67	$5.07	2.8%
2036	2037/2038	$3.89	$10.82	36.0%	$53.43	$33.09	$20.34	($0.77)	61.9%	$0.68	$5.11	2.5%
2037	2038/2039	$4.02	$11.14	36.1%	$53.26	$33.84	$19.42	($0.92)	63.5%	$0.68	$5.19	2.3%
2038	2039/2040	$4.06	$11.46	35.4%	$53.06	$34.73	$18.33	($1.09)	65.4%	$0.69	$5.23	2.1%

4.3 Effect of Limited Employer Contributions Due to a Large Investment Loss

The Investment Risks Section includes a stress test to assess the effect of future investment performance assuming SERS employers continue to contribute the full Actuarially Determined Contribution (ADC). However, if there is a large investment loss during a single calendar year, there is an additional risk that SERS employers would be unable to adjust their budgets to meet the increases in the ADC without adversely impacting their ability to meet the critical needs of the Commonwealth.

The following scenarios provide the projected effects of a large investment loss assuming various employer contribution patterns:

Baseline – Investment returns are equal to the assumed investment return throughout the 20-year period. All employers contribute the ADC in each year of the 20-year period.

Full Funding Scenario – The investment return for Calendar Year 2019 is -20%. For the remainder of the 20-year period, the investment returns are equal to the assumed investment return rate. All employers contribute the ADC in each year of the 20-year period.

Limited Funding Scenario – The investment return for Calendar Year 2019 is -20%. For the remainder of the 20-year period, the investment returns are equal to the assumed investment return rate. Employers contribute all required contributions to the Defined Contribution Plan in each year of the 20-year period; however, after Fiscal Year 2019/2020, the annual rate of growth of employer contributions to the Defined Benefit Plan is limited to the 3.1% per year average projected rate of State revenue growth.

The investment return rates used by calendar year are provided in the following schedule:

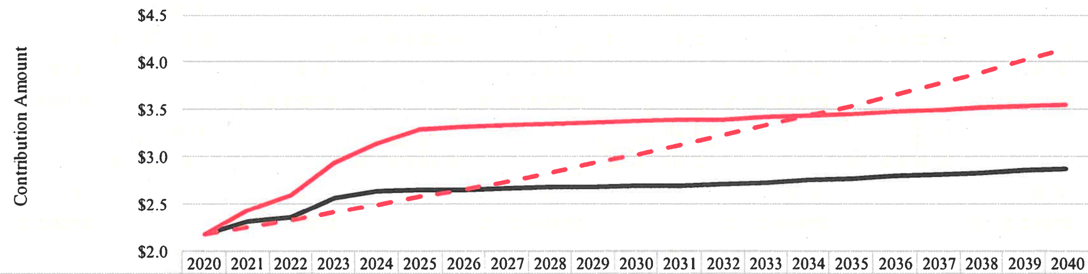
Calendar Year	**Baseline**	**Full Funding Scenario**	**Limited Funding Scenario**
2019*	7.250%	-20.000%	-20.000%
2020-2038	7.125%	7.125%	7.125%

*The scenarios are based on the assumed investment return rate for Calendar Year 2019 of 7.25% and do not reflect any actual 2019 investment performance. Pursuant to action taken by the SERS Board at its June 2019 meeting, the assumed investment return rate was reduced to 7.125% effective with the December 31, 2019 actuarial valuation.

Effect on the Actuarially Determined Contribution (ADC)

Chart 1 provides the projected contribution amounts by Fiscal Year for each scenario. The large loss is assumed to occur during Calendar Year 2019, would first be recognized in the December 31, 2019 actuarial valuation and would first be reflected as an increase to the ADC in Fiscal Year 2020/2021.

Chart 1
Effect of Large Investment Loss
Projected Contributions
($ Billions; Contributions for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Full Funding Scenario	2.18	2.42	2.59	2.93	3.13	3.28	3.31	3.33	3.35	3.36	3.37	3.38	3.39	3.41	3.43	3.45	3.47	3.49	3.51	3.53	3.55
Limited Funding Scenario	2.18	2.25	2.33	2.40	2.48	2.57	2.65	2.74	2.83	2.92	3.02	3.11	3.22	3.32	3.43	3.54	3.65	3.77	3.89	4.02	4.14

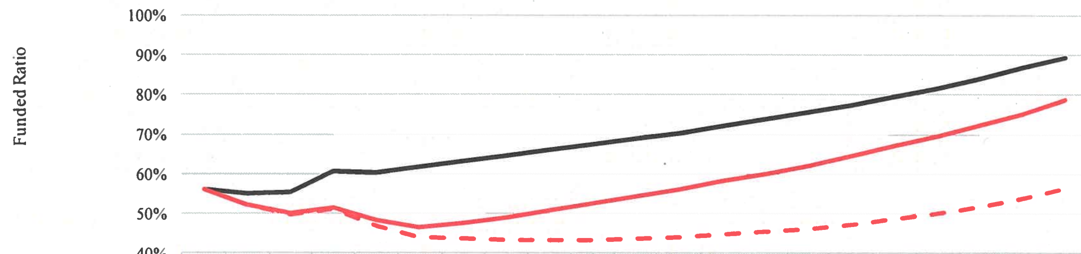
While SERS' 5-year asset smoothing method, which causes the hypothetical -20% return experienced in Calendar Year 2019 to be recognized over a 5-year period, dampens the effect on the ADC, the large investment loss causes the December 31, 2019 market value of assets to be $7.19 billion less as compared to the baseline. This shortfall will need to be funded through additional employer contributions. The ADC is adjusted for the shortfall and results in significantly higher contributions in the "Full Funding Scenario" compared to the baseline.

The "Limited Funding Scenario" would not generate sufficient increases in employer contributions to fund the ADC. Although contributions under the "Limited Funding Scenario" would gradually recover to the level under the "Full Funding Scenario" by Fiscal Year 2033/2034 and even be substantially higher by Fiscal Year 2039/2040, the lower contributions in the earlier years create a funding deficiency. The funding deficiency is shown by analyzing the effect on the funded ratio. Analysis of the effect on the funded ratio is provided in the following section. Detailed projections of the results are provided in Table 1 (Baseline), Table 2 (Full Funding Scenario), and Table 3 (Limited Funding Scenario), which follow the "Conclusions" section.

Effect on Funded Ratio

Chart 2 provides the projected funded ratios by Calendar Year for each scenario. The loss is assumed to occur during Calendar Year 2019 and would first be recognized as a reduction to the funded ratio in the December 31, 2019 actuarial valuation.

Chart 2
Effect of Large Investment Loss
Projected Funded Ratios
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Full Funding Scenario	56%	52%	50%	52%	48%	47%	48%	49%	51%	52%	54%	56%	58%	60%	62%	64%	67%	69%	72%	75%	79%
Limited Funding Scenario	56%	52%	50%	51%	47%	44%	43%	43%	43%	43%	44%	44%	45%	45%	46%	47%	48%	50%	52%	54%	56%

Again, SERS' 5-year asset smoothing method, which causes the hypothetical -20% return experienced in Calendar Year 2019 to be recognized over a 5-year period, dampens the effect on the funded ratio. The hypothetical large investment loss causes the December 31, 2023 funded ratio to decrease to 47%, substantially lower than the baseline December 31, 2023 funded ratio of 62% and the December 31, 2018 funded ratio of 56% before the investment loss occurred.

The Actuarially Determined Contribution (ADC) is adjusted to reflect the large investment loss and is contributed in the "Full Funding Scenario". These increased contributions cause the funded ratio to increase much more rapidly compared to the "Limited Funding Scenario" funded ratio. Although the December 31, 2038 funded ratio of 79% under the "Full Funding Scenario" is below the baseline funded ratio of 90%, it is substantially higher than the "Limited Funding Scenario" funded ratio of 56%. The funding deficiency under the "Limited Funding Scenario" causes the projected unfunded liability as of December 31, 2038 to be $11.8 billion higher than the unfunded liability under the "Full Funding Scenario". The ADC is designed to reflect investment performance and fully fund member benefits. Limited funding can substantially increase the future contributions needed to fund member benefits. Detailed projections of the results are provided in Table 1 (Baseline), Table 2 (Full Funding Scenario), and Table 3 (Limited Funding Scenario), which follow the "Conclusions" section.

Conclusions

A large investment loss in a given year will have a substantial impact on the employer contributions needed to fund benefits, the unfunded liability and the funded ratio. Our analyses of these scenarios have shown:

1. Although the Actuarially Determined Contribution (ADC) is designed to provide relatively predictable and stable contribution patterns, adjustments are required to reflect actual investment performance and to ensure member benefits are fully funded. When the ADC is not fully contributed, even though contribution levels are stable, as they are under the "Limited Funding Scenario", there is a funding deficiency that can substantially increase the future contributions needed to fund member benefits.

2. Each dollar of shortfall between the amount contributed and the ADC immediately increases the unfunded liability and reduces the funded ratio. By December 31, 2038, reduced contributions under the "Limited Funding Scenario" would increase the total unfunded liability by $11.8 billion compared to the "Full Funding Scenario".

3. A large investment loss could substantially reduce the funded ratio. In this scenario, the hypothetical -20% return in Calendar Year 2019 would cause the funded ratio to be as low as 47% in 2023. The calculation of the ADC reflects investment performance and would increase substantially to fund the investment shortfall. If the ADC is contributed each year, the funded ratio would be expected to return to 56%, the December 31, 2018 funded ratio just prior to the large investment loss, by December 31, 2029.

Table 1 – Baseline Projection of Results
(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.30	$6.66	34.5%	$53.22	$29.22	$24.00	$1.21	54.9%	$0.09	$3.59	3.3%
2020	2021/2022	$2.35	$6.85	34.3%	$53.83	$29.81	$24.02	$0.02	55.4%	$0.10	$3.70	3.3%
2021	2022/2023	$2.56	$7.05	36.3%	$50.30	$30.47	$19.83	($4.19)	60.6%	$0.65	$3.82	3.2%
2022	2023/2024	$2.62	$7.25	36.1%	$50.85	$30.74	$20.11	$0.28	60.4%	$0.65	$3.94	3.1%
2023	2024/2025	$2.64	$7.46	35.4%	$51.40	$31.72	$19.68	($0.43)	61.7%	$0.65	$4.06	3.2%
2024	2025/2026	$2.65	$7.68	34.5%	$51.91	$32.72	$19.19	($0.49)	63.0%	$0.65	$4.17	3.4%
2025	2026/2027	$2.66	$7.90	33.7%	$52.36	$33.73	$18.63	($0.56)	64.4%	$0.65	$4.27	3.6%
2026	2027/2028	$2.67	$8.13	32.8%	$52.75	$34.73	$18.02	($0.61)	65.8%	$0.65	$4.37	3.7%
2027	2028/2029	$2.68	$8.37	32.0%	$53.06	$35.72	$17.34	($0.68)	67.3%	$0.65	$4.48	3.9%
2028	2029/2030	$2.69	$8.61	31.2%	$53.30	$36.68	$16.62	($0.72)	68.8%	$0.65	$4.58	4.0%
2029	2030/2031	$2.69	$8.86	30.4%	$53.47	$37.63	$15.84	($0.78)	70.4%	$0.65	$4.69	4.2%
2030	2031/2032	$2.70	$9.12	29.6%	$53.60	$38.59	$15.01	($0.83)	72.0%	$0.66	$4.74	4.2%
2031	2032/2033	$2.72	$9.38	29.0%	$53.68	$39.56	$14.12	($0.89)	73.7%	$0.66	$4.82	4.2%
2032	2033/2034	$2.75	$9.65	28.5%	$53.70	$40.54	$13.16	($0.96)	75.5%	$0.66	$4.89	4.2%
2033	2034/2035	$2.77	$9.93	27.9%	$53.68	$41.56	$12.12	($1.04)	77.4%	$0.66	$4.95	4.2%
2034	2035/2036	$2.79	$10.22	27.3%	$53.63	$42.63	$11.00	($1.12)	79.5%	$0.67	$5.01	4.2%
2035	2036/2037	$2.81	$10.52	26.7%	$53.53	$43.75	$9.78	($1.22)	81.7%	$0.67	$5.07	4.2%
2036	2037/2038	$2.83	$10.82	26.2%	$53.43	$44.95	$8.48	($1.30)	84.1%	$0.68	$5.11	4.1%
2037	2038/2039	$2.85	$11.14	25.6%	$53.26	$46.19	$7.07	($1.41)	86.7%	$0.68	$5.19	4.1%
2038	2039/2040	$2.87	$11.46	25.0%	$53.06	$47.51	$5.55	($1.52)	89.5%	$0.69	$5.23	4.0%

Table 2 – Full Funding Scenario Projection of Results
(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.42	$6.66	36.3%	$53.22	$27.78	$25.44	$2.65	52.2%	$0.09	$3.59	3.2%
2020	2021/2022	$2.59	$6.85	37.8%	$53.83	$26.84	$26.99	$1.55	49.9%	$0.10	$3.70	3.0%
2021	2022/2023	$2.93	$7.05	41.6%	$50.30	$25.92	$24.38	($2.61)	51.5%	$0.65	$3.82	2.5%
2022	2023/2024	$3.13	$7.25	43.2%	$50.85	$24.56	$26.29	$1.91	48.3%	$0.65	$3.94	2.1%
2023	2024/2025	$3.28	$7.46	44.0%	$51.40	$23.91	$27.49	$1.20	46.5%	$0.65	$4.06	1.9%
2024	2025/2026	$3.31	$7.68	43.1%	$51.91	$24.75	$27.16	($0.33)	47.7%	$0.65	$4.17	1.9%
2025	2026/2027	$3.33	$7.90	42.2%	$52.36	$25.70	$26.66	($0.50)	49.1%	$0.65	$4.27	2.1%
2026	2027/2028	$3.35	$8.13	41.2%	$52.75	$26.73	$26.02	($0.64)	50.7%	$0.65	$4.37	2.3%
2027	2028/2029	$3.36	$8.37	40.1%	$53.06	$27.79	$25.27	($0.75)	52.4%	$0.65	$4.48	2.5%
2028	2029/2030	$3.37	$8.61	39.1%	$53.30	$28.88	$24.42	($0.85)	54.2%	$0.65	$4.58	2.7%
2029	2030/2031	$3.38	$8.86	38.1%	$53.47	$29.96	$23.51	($0.91)	56.0%	$0.65	$4.69	3.0%
2030	2031/2032	$3.39	$9.12	37.2%	$53.60	$31.08	$22.52	($0.99)	58.0%	$0.66	$4.74	3.0%
2031	2032/2033	$3.41	$9.38	36.4%	$53.68	$32.21	$21.47	($1.05)	60.0%	$0.66	$4.82	3.1%
2032	2033/2034	$3.43	$9.65	35.5%	$53.70	$33.37	$20.33	($1.14)	62.1%	$0.66	$4.89	3.1%
2033	2034/2035	$3.45	$9.93	34.7%	$53.68	$34.58	$19.10	($1.23)	64.4%	$0.66	$4.95	3.1%
2034	2035/2036	$3.47	$10.22	34.0%	$53.63	$35.85	$17.78	($1.32)	66.9%	$0.67	$5.01	3.1%
2035	2036/2037	$3.49	$10.52	33.2%	$53.53	$37.19	$16.34	($1.44)	69.5%	$0.67	$5.07	3.1%
2036	2037/2038	$3.51	$10.82	32.4%	$53.43	$38.63	$14.80	($1.54)	72.3%	$0.68	$5.11	3.0%
2037	2038/2039	$3.53	$11.14	31.7%	$53.26	$40.12	$13.14	($1.66)	75.3%	$0.68	$5.19	3.0%
2038	2039/2040	$3.55	$11.46	31.0%	$53.06	$41.70	$11.36	($1.78)	78.6%	$0.69	$5.23	2.9%

Table 3 – Limited Funding Scenario Projection of Results

(Dollars in Billions)

Calendar Year	Fiscal Year	Employer Contrib.	Payroll	Employer Contrib. Rate	Actuarial Accrued Liability	Assets	Unfunded Actuarial Accrued Liability	Change in Unfunded Liability from Prior Year	Funded Ratio	Service Cost	Benefit Payments	Ratio of Net Cash Flow to Assets
2018	2019/2020	$2.18	$6.47	33.7%	$51.78	$28.99	$22.79	-	56.0%	$0.08	$3.47	3.3%
2019	2020/2021	$2.25	$6.66	33.8%	$53.22	$27.78	$25.44	$2.65	52.2%	$0.09	$3.59	3.5%
2020	2021/2022	$2.33	$6.85	34.0%	$53.83	$26.75	$27.08	$1.64	49.7%	$0.10	$3.70	3.8%
2021	2022/2023	$2.40	$7.05	34.0%	$50.30	$25.60	$24.70	($2.38)	50.9%	$0.65	$3.82	4.1%
2022	2023/2024	$2.48	$7.25	34.2%	$50.85	$23.82	$27.03	$2.33	46.8%	$0.65	$3.94	4.6%
2023	2024/2025	$2.57	$7.46	34.5%	$51.40	$22.51	$28.89	$1.86	43.8%	$0.65	$4.06	5.0%
2024	2025/2026	$2.65	$7.68	34.5%	$51.91	$22.55	$29.36	$0.47	43.4%	$0.65	$4.17	5.1%
2025	2026/2027	$2.74	$7.90	34.7%	$52.36	$22.64	$29.72	$0.36	43.2%	$0.65	$4.27	5.1%
2026	2027/2028	$2.83	$8.13	34.8%	$52.75	$22.81	$29.94	$0.22	43.2%	$0.65	$4.37	5.1%
2027	2028/2029	$2.92	$8.37	34.9%	$53.06	$23.02	$30.04	$0.10	43.4%	$0.65	$4.48	5.1%
2028	2029/2030	$3.02	$8.61	35.1%	$53.30	$23.28	$30.02	($0.02)	43.7%	$0.65	$4.58	5.1%
2029	2030/2031	$3.11	$8.86	35.1%	$53.47	$23.55	$29.92	($0.10)	44.0%	$0.65	$4.69	5.1%
2030	2031/2032	$3.22	$9.12	35.3%	$53.60	$23.89	$29.71	($0.21)	44.6%	$0.66	$4.74	4.8%
2031	2032/2033	$3.32	$9.38	35.4%	$53.68	$24.29	$29.39	($0.32)	45.3%	$0.66	$4.82	4.6%
2032	2033/2034	$3.43	$9.65	35.5%	$53.70	$24.75	$28.95	($0.44)	46.1%	$0.66	$4.89	4.3%
2033	2034/2035	$3.54	$9.93	35.6%	$53.68	$25.31	$28.37	($0.58)	47.1%	$0.66	$4.95	4.0%
2034	2035/2036	$3.65	$10.22	35.7%	$53.63	$25.97	$27.66	($0.71)	48.4%	$0.67	$5.01	3.7%
2035	2036/2037	$3.77	$10.52	35.8%	$53.53	$26.74	$26.79	($0.87)	50.0%	$0.67	$5.07	3.4%
2036	2037/2038	$3.89	$10.82	36.0%	$53.43	$27.68	$25.75	($1.04)	51.8%	$0.68	$5.11	3.0%
2037	2038/2039	$4.02	$11.14	36.1%	$53.26	$28.73	$24.53	($1.22)	53.9%	$0.68	$5.19	2.7%
2038	2039/2040	$4.14	$11.46	36.1%	$53.06	$29.95	$23.11	($1.42)	56.4%	$0.69	$5.23	1.5%

4.4 Effect of Funding in Excess of the Actuarially Determined Contribution

It is the SERS funding policy to fully fund the Actuarially Determined Contribution (ADC), the annual employer contribution calculated by the actuary based on a defined actuarial cost method, asset valuation method and amortization method. Developing an ADC each year serves two primary purposes:

1. Ensures assets are accumulated to pay all benefits when due to members

2. Provides a relatively predictable and stable pattern of contributions to assist with budgeting

If, in any year, SERS employers fund amounts in excess of the ADC, the excess contribution amount is treated as an actuarial experience gain. Although the excess contribution amount is immediately recognized in the SERS assets, the gain is combined with all other sources of actuarial gains and losses that occurred in that same period, and the net amount is amortized over 30 years.

Contributing amounts in excess of the ADC results in numerous advantages, including:

- Immediate dollar-for-dollar increase in the SERS assets, and therefore a reduction of the same magnitude in the unfunded actuarial accrued liability,
- Decrease in future ADC amounts, thus providing some degree of relief for future budgets and
- Immediate increase in future funded ratios

Although funding in excess of the ADC is not generally expected, the following scenarios provide the projected effects of temporarily funding in excess of the ADC:

Baseline – All employers contribute the ADC in each year of the 20-year period.

Scenario Contribution – Employers collectively contribute $100 million in excess of the ADC in each of the first 10 years of the projection, then contribute the ADC for the remainder of the period. The contributions made are summarized in the following schedule:

Fiscal Year	Amount Contributed
2019/2020 through 2028/2029	ADC + $100 million
2029/2030 through 2039/2040	ADC

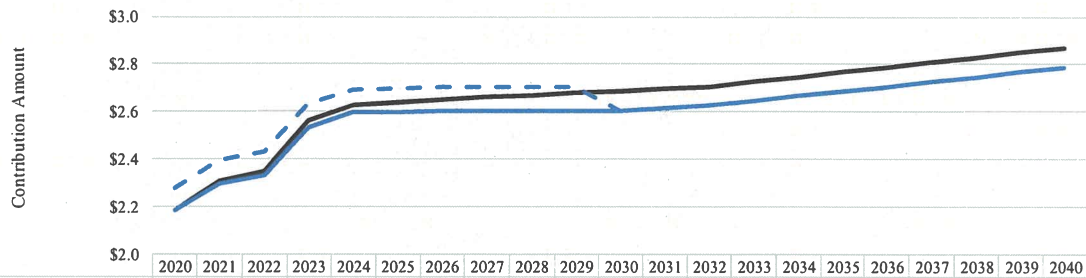
This scenario reflects 10 years of contributions in excess of the ADC followed by 10 years of contributions equal to the ADC.

Scenario ADC – The Actuarially Determined Contribution (ADC) reflecting the additional funding provided in the Scenario Contribution.

Effect on Actuarially Determined Contribution (ADC)

Chart 1 provides the sensitivity of the Actuarially Determined Contribution (ADC) to contributing amounts in excess of the ADC. The additional funding during Fiscal Year 2019/2020 through Fiscal Year 2028/2029 in this scenario increases SERS assets and decreases the SERS unfunded actuarial liabilities relative to the baseline. These lower unfunded liabilities cause the Scenario ADC to decrease relative to the baseline.

Chart 1
Funding in Excess of the Actuarially Determined Contribution (ADC)
Effect on ADC
($ Billions; ADC for Fiscal Year Ending)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Baseline	2.18	2.30	2.35	2.56	2.62	2.64	2.65	2.66	2.67	2.68	2.69	2.69	2.70	2.72	2.75	2.77	2.79	2.81	2.83	2.85	2.87
Scenario Contribution	2.28	2.39	2.43	2.63	2.69	2.70	2.70	2.70	2.70	2.70	2.60	2.61	2.62	2.64	2.66	2.68	2.70	2.72	2.75	2.77	2.79
Scenario ADC	2.18	2.29	2.33	2.53	2.59	2.60	2.60	2.60	2.60	2.60	2.60	2.61	2.62	2.64	2.66	2.68	2.70	2.72	2.75	2.77	2.79

The accumulated effect of the extra funding for Fiscal Year 2019/2020 through Fiscal Year 2028/2029 results in:

- An increase of about $1 billion (or about 2.7%) in SERS assets and, therefore, a decrease of about $1 billion in the SERS unfunded actuarial liability relative to the baseline.
- A decrease in the Fiscal Year 2029/2030 ADC by about $90 million (or about 3.3%), from $2.69 billion under the baseline to $2.60 billion under the Scenario ADC. The decreased ADC continues throughout the projection period.

The extra funding also reduces the future burden for employers since the Scenario ADC represents a smaller percentage of member funding payroll in future periods. Table 1 provides the effect of the extra funding on the future contribution rates (ADC Rate) as a percentage of payroll.

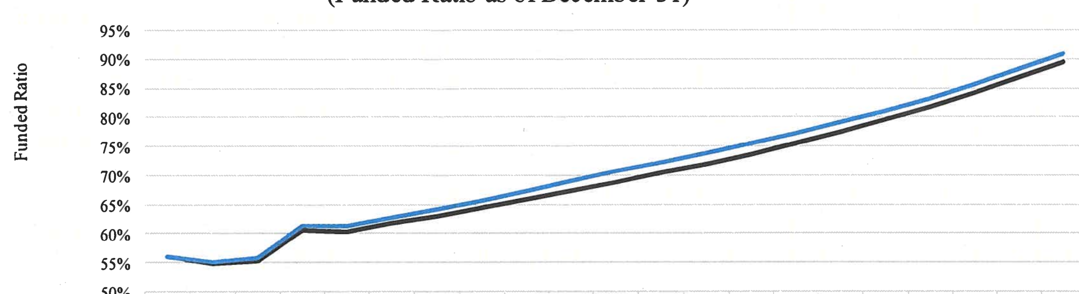
Table 1 –Projected ADC, Funding Payroll and Contribution Rates (ADC Rate)
(Dollars in Billions)

	Baseline			Scenario ADC		
Fiscal Year Ending (1)	ADC (2)	Payroll (3)	ADC Rate (4)	ADC (5)	Payroll (6)	ADC Rate (7)
2020	$2.18	$6.47	33.7%	$2.18	$6.47	33.7%
2021	$2.30	$6.66	34.5%	$2.29	$6.66	34.4%
2022	$2.35	$6.85	34.3%	$2.33	$6.85	34.0%
2023	$2.56	$7.05	36.3%	$2.53	$7.05	35.9%
2024	$2.62	$7.25	36.1%	$2.59	$7.25	35.7%
2025	$2.64	$7.46	35.4%	$2.60	$7.46	34.9%
2026	$2.65	$7.68	34.5%	$2.60	$7.68	33.9%
2027	$2.66	$7.90	33.7%	$2.60	$7.90	32.9%
2028	$2.67	$8.13	32.8%	$2.60	$8.13	32.0%
2029	$2.68	$8.37	32.0%	$2.60	$8.37	31.1%
2030	$2.69	$8.61	31.2%	$2.60	$8.61	30.2%
2031	$2.69	$8.86	30.4%	$2.61	$8.86	29.5%
2032	$2.70	$9.12	29.6%	$2.62	$9.12	28.7%
2033	$2.72	$9.38	29.0%	$2.64	$9.38	28.1%
2034	$2.75	$9.65	28.5%	$2.66	$9.65	27.6%
2035	$2.77	$9.93	27.9%	$2.68	$9.93	27.0%
2036	$2.79	$10.22	27.3%	$2.70	$10.22	26.4%
2037	$2.81	$10.52	26.7%	$2.72	$10.52	25.9%
2038	$2.83	$10.82	26.2%	$2.75	$10.82	25.4%
2039	$2.85	$11.14	25.6%	$2.77	$11.14	24.9%
2040	$2.87	$11.46	25.0%	$2.79	$11.46	24.3%

Effect on Funded Ratio

Chart 2 provides the sensitivity of the funded ratio to funding in excess of the ADC. The extra funding for Fiscal Year 2019/2020 through Fiscal Year 2028/2029 in this scenario increases the SERS assets relative to the baseline. These larger asset values cause the Scenario Funded Ratio to increase relative to the baseline funded ratio.

Chart 2
Funding in Excess of the Actuarially Determined Contribution (ADC)
Effect on Funded Ratio
(Funded Ratio as of December 31)



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Baseline	56%	55%	55%	61%	60%	62%	63%	64%	66%	67%	69%	70%	72%	74%	75%	77%	79%	82%	84%	87%	90%
Scenario Funded Ratio	56%	55%	56%	61%	61%	63%	64%	66%	67%	69%	71%	72%	74%	75%	77%	79%	81%	83%	86%	88%	91%

The extra funding for Fiscal Year 2019/2020 through Fiscal Year 2028/2029 in this scenario causes the December 31, 2029 funded ratio to increase to 72%, higher than the baseline December 31, 2029 funded ratio of 70% and the December 31, 2018 funded ratio of 56% before the extra funding began.

The effect on the funded ratio continues until the extra funding is fully amortized over the 30-year period. The December 31, 2038 funded ratio reflecting the extra funding is 91%, slightly higher than the baseline December 31, 2038 funded ratio of 90%. The Scenario Funded Ratio would not return to the baseline value until December 31, 2060, when the amortization credit for the extra funding is fully amortized.

Conclusions

Even temporary periods of contributing amounts in excess of the ADC can have favorable effects on both the future contribution burden and the funded ratio. This hypothetical scenario of extra contributions has shown:

1. The $1.0 billion of extra contributions over the 10-year period decreased future annual employer contributions by as much as $90 million (or 1.0% of payroll) in a single year and decreased the total future contributions by about $2.5 billion.

2. Each dollar of excess between the amount contributed and the baseline ADC immediately decreases the unfunded liability and increases the funded ratio. The funded ratio is expected to steadily increase in the baseline scenario from 56% in 2018 to 90% in 2038. In the extra funding scenario, the funded ratio is expected to exceed the baseline funded ratio by 1-2% throughout the period from December 31, 2020 through December 31, 2038.

3. The ADC is designed to provide relatively predictable and stable contribution patterns. When actual contributions exceed the ADC, the resulting decrease in future ADC amounts provides a degree of relief to employers in meeting future budgets.

   A noteworthy example of SERS employers contributing in excess of the ADC comes from one of the provisions of Act 2017-5, the recent Pennsylvania pension reform legislation. Act 2017-5 (Act 5) included a "plow-back" financing feature whereby, in order to accelerate the funding of SERS, in any future year in which there was projected to be savings as a result of this legislation, additional employer contributions equal to the amount of that annual savings would be assessed as a percentage of all covered compensation. By "plowing back" into the SERS fund many years of projected savings, rather than using that savings to meet non-pension obligations, the funding of SERS is enhanced, in the form of an accelerated decline in the SERS unfunded actuarial accrued liability and an accelerated increase in the SERS funded ratio. Therefore, out of a period of 23 fiscal years following the enactment of Act 5 (through Fiscal Year 2041/2042), additional employer contribution amounts (ranging from as low as 0.10% to as high as 0.93% of covered payroll) are now mandated under law for 13 of those fiscal years.

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ATTACHMENT C

STEPSTONE
inside private markets

Semi-Annual Board Update

For the period ending June 30, 2019

Report Prepared For:

pennsylvania
STATE EMPLOYEES' RETIREMENT SYSTEM

Attachment to Board Motions relating to Commission Recommendation #24

Disclaimer on this Page - Redacted

Table of Contents

I. Overview

StepStone Group LP ("StepStone") was engaged by Pennsylvania State Employees' Retirement System ("SERS") to provide Private Equity Advisory services for prospective investment opportunities as well as portfolio monitoring and reporting. StepStone monitors new and existing private equity investments for SERS at both the fund level and underlying portfolio company level to provide detailed performance and exposure analysis. The following report represents SERS' portfolio of Private Investments (the "Portfolio").

Since inception through June 30, 2019, SERS has committed US$13.3 billion to 305 partnerships, of which 176 are active. This quarterly monitoring report covers the performance of the Portfolio as of June 30, 2019, as well as significant activity that occurred during the second quarter of 2019. Natural Resource partnerships are included in Buyout as of July 1, 2016. SERS consolidated 171 Fund investments under Keystone Legacy Fund as of July 1, 2018.

Portfolio Performance Assessment

As of June 30, 2019, the Portfolio managed by SERS consisted of the following (all amounts herein US$ millions unless otherwise noted):

	INCEPTION TO DATE	INCEPTION TO DATE	INCEPTION TO DATE		
US$ in millions	JUNE 30, 2019	MARCH 31, 2019	JUNE 30, 2018	QUARTERLY Δ	ANNUAL Δ
Number of Managers	112	112	108	-	4
Number of Investments	305	301	291	4	14
Number of Active Managers	63	63	61	-	2
Number of Active Investments	176	171	162	5	14
Committed Capital[1]	$13,250.3	$12,950.3	$12,211.9	$300.0	$1,038.3
Contributed Capital[2]	16,363.9	16,166.9	15,670.9	197.0	693.0
Distributed Capital[3]	22,195.1	21,952.7	21,243.6	242.5	951.6
Market Value	3,985.3	3,919.6	3,902.5	65.7	82.8
Total Value	26,180.4	25,872.2	25,146.0	308.2	1,034.4
Unfunded Commitment	2,868.4	2,729.3	2,091.5	139.1	777.0
Total Exposure[4]	6,853.7	6,648.9	5,993.9	204.8	859.7
Total Gain/(Loss)	**$9,816.5**	**$9,705.3**	**$9,475.1**	**$111.1**	**$341.3**
DPI[5]	1.36x	1.36x	1.36x	0.00x	0.00x
TVM[6]	1.60x	1.60x	1.60x	0.00x	(0.00x)
IRR[7]	12.23%	12.23%	12.28%	(0) bps	(5) bps

Note: Portfolio excludes T.Rowe Price Stock Distribution Account. **Past performance is not necessarily indicative of future results** and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.

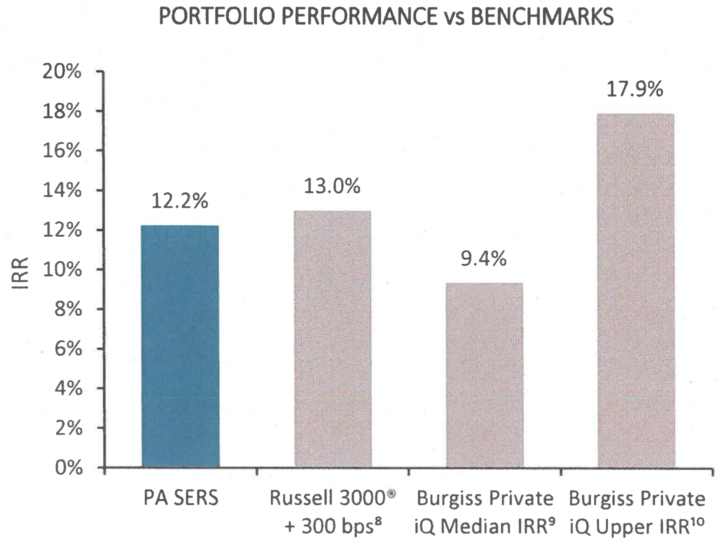
Portfolio Performance vs. Benchmarks

The Portfolio's performance is measured against two benchmarks, the Russell 3000® and Burgiss Private iQ.

The following graph illustrates Portfolio IRR performance versus benchmarks as of June 30, 2019.

StepStone believes the Russell 3000® Index plus 300 bps from inception appropriately reflects the opportunity cost of investing in Buyout, Venture, and Special Situations investments versus publicly traded common stocks and therefore is an appropriate benchmark for SERS.

SERS' returns include Buyout, Venture Capital, and Special Situations investments from vintage years 1980 to 2019.



SERS' Core Venture Capital, Buyout, and Special Situations investments have a since inception IRR of 16.5%, 15.2%, and 13.9% respectively.

	1 YEAR RETURN	3 YEAR RETURN	5 YEAR RETURN	10 YEAR RETURN
SERS Combined Portfolio (IRR)	**9.0%**	**11.7%**	**8.3%**	**13.4%**
Burgiss Private iQ Pooled PE Benchmark[11]	11.0%	14.7%	11.3%	14.0%
Burgiss Private iQ All PE Top-Quartile[12]	18.4%	20.2%	18.0%	19.5%
Russell 3000®[8]	9.0%	14.0%	10.2%	14.7%
Russell 3000® + 300 bps[8]	12.0%	17.0%	13.2%	17.7%
SERS Core Buyout (IRR)	**10.1%**	**14.2%**	**11.8%**	**16.2%**
Burgiss Private iQ Pooled Buyout Benchmark[11]	8.8%	15.1%	10.9%	14.3%
Burgiss Private iQ Buyout Top-Quartile[12]	17.3%	23.4%	19.2%	21.0%
SERS Core Venture Capital (IRR)	**24.1%**	**21.5%**	**15.6%**	**20.4%**
Burgiss Private iQ Pooled VC Benchmark[11]	20.1%	17.3%	15.5%	15.3%
Burgiss Private iQ VC Top-Quartile[12]	24.8%	21.6%	20.8%	20.8%
SERS Core Special Situations (IRR)	**13.8%**	**12.0%**	**7.9%**	**17.0%**
Burgiss Private iQ Pooled SS Benchmark[11]	4.3%	8.6%	6.6%	11.2%
Burgiss Private iQ SS Top-Quartile[12]	9.9%	13.0%	12.1%	13.1%
SERS Keystone Legacy Fund (IRR)	**(3.3%)**	**5.2%**	**3.5%**	**9.4%**
Burgiss Private iQ Pooled PE Benchmark[11]	11.0%	14.7%	11.3%	14.0%
Burgiss Private iQ All PE Top-Quartile[12]	18.4%	20.2%	18.0%	19.5%

Note: Burgiss Private iQ data is continuously updated and is therefore subject to change. The referenced indices are shown for general market comparisons and are not meant to represent any specific fund. An investor cannot directly invest in an index. Moreover, indices do not reflect commissions or fees that may be charged to an investment product based on the index, which may materially affect the performance data presented.

Past performance is not necessarily indicative of future results and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.

II. Market Overview

Executive Summary

Global equity markets advanced during the second quarter of 2019 as U.S.-China trade tensions diminished near the end of the quarter and investor sentiment improved due to major central banks indicating accommodative monetary policy if necessary. The MSCI Emerging Markets Index declined 0.3%, as trade uncertainty weighed on Chinese and South Korean stocks. The MSCI Europe Index gained 2.9%, despite a sharp drop in May, as European Central Bank President, Mario Draghi, hinted at further monetary policy easing if the inflation outlook fails to improve. The S&P 500 Total Return Index achieved a new record high during the quarter, returning 4.3%, as the Federal Reserve indicated that there may be rate cuts in the coming months. Elevated trade tensions with China rattled markets in May as the U.S. increased tariffs on US$200 billion of Chinese goods from 10% to 25%, and China retaliated with measures on US$60 billion of U.S. exports. However, markets calmed in June as optimism grew that the dispute would be resolved when leaders of the two countries met at the G20 summit.

In private markets, U.S. leveraged buyout ("LBO") debt volume decreased by 53.6% quarter-over-quarter, from US$36.6 billion to US$17.0 billion, 50.8% lower than the second quarter of 2018 and 10.5% lower than the 10-year quarterly average of US$19.0 billion. According to data from S&P, purchase price multiples for U.S. LBOs increased to 11.3x EBITDA in the second quarter, up 10.2% from 10.3x EBITDA in the prior quarter, and above the 10-year average of 9.7x EBITDA. Average debt multiples of large corporate U.S. LBO loans remained at 5.7x for the quarter, above the 10-year average of 5.2x. Equity contributions for U.S. LBOs increased to 46.8%, a 10.9% increase quarter-over-quarter and above the 10-year average of 41.8%.[13]

Fundraising for global private equity totaled US$152.9 billion in the second quarter of 2019, a 15.4% decrease compared to the prior quarter and a 45.0% increase from the second quarter of 2018. Geographically, the U.S. represented 65.8% of total funds raised in the quarter, higher than the 10-year average of 59.1%. Funds raised in Europe, Asia, and the Rest of World made up 18.0%, 9.6% and 6.6% of global fundraising for the quarter, respectively. Invested capital for private equity funds increased 13.1% quarter-over-quarter and decreased 1.5% year-over-year, with US$88.0 billion invested in 3,475 deals. A significant portion of the capital deployed was in the Information Technology sector, accounting for 38.1% compared to the 10-year average of 35.9%.[14]

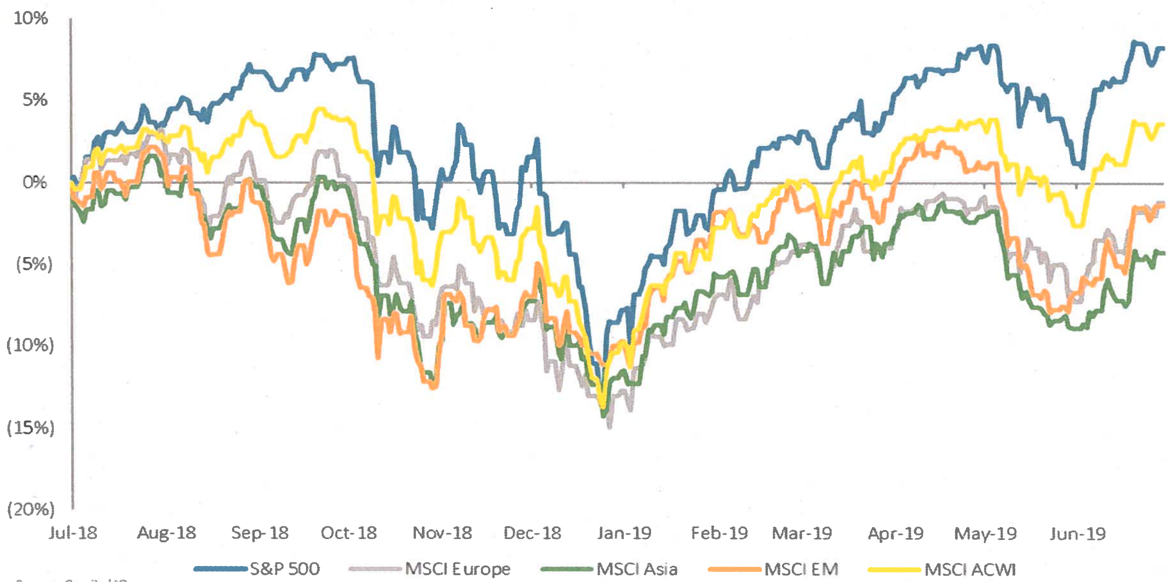
Private equity-backed IPO transaction volume increased in the second quarter with US$21.8 billion raised in 42 IPOs. The amount raised through IPOs increased 457.6% compared to the prior quarter and 134.8% compared to the second quarter of 2018. The largest IPOs of the quarter were completed by Uber Technologies, Inc. (NYSE: UBER), a provider of technology applications that enable providers of ridesharing and meal preparation and delivery services to transact with end-users worldwide, which raised US$8.1 billion, and Avantor Inc (NYSE: AVTR), a developer of products and services to customers in the biopharma, healthcare, education and government, and advanced technologies and applied materials industries, which raised US$3.3 billion. Together these deals represented 53.7% of the total value for all IPOs in the quarter. M&A activity decreased in the second quarter with a total value of US$87.7 billion, a 50.2% decrease compared to the prior quarter and a 59.5% decrease compared to the second quarter of 2018. The largest M&A deals of the quarter were the US$19.7 billion purchase of L3 Technologies, Inc. by L3Harris Technologies, Inc. (NYSE: LHX) and the US$8.0 billion purchase of ARRIS International Limited by CommScope Holding Company, Inc. Together these deals represent 31.6% of the total value for all deals in the quarter.[15]

Capital Markets Overview

Public Equity Markets

Global public markets grew, and several key market indexes hit record highs during the quarter as U.S.-China trades tensions eased and major banks around the world made it clear that the era of easy monetary policy is far from over. U.S. markets fueled global growth as investors took comfort in the growing likelihood of future interest rate cuts. Financials, Materials, and Information Technology sectors for U.S. equities increased 5.4%, 4.7%, and 4.6% for the quarter, respectively. Although global markets grew over the quarter, uncertainty with U.S.-China trade negotiations remains a concern amongst investors.

1-Year Global Public Indices Returns



Source: Capital IQ

The following table shows the returns of four major MSCI indices, as well as the S&P 500 and the S&P 500 Total Return Index, over various time horizons through June 30, 2019. Returns for time periods greater than one year are annualized. During the quarter, U.S. markets increased 4.3% followed by MSCI ACWI at 2.9%, and MSCI Europe at 2.9%, while MSCI Emerging Markets declined 0.3% and MSCI Asia declined 0.6%.

Regional Indices

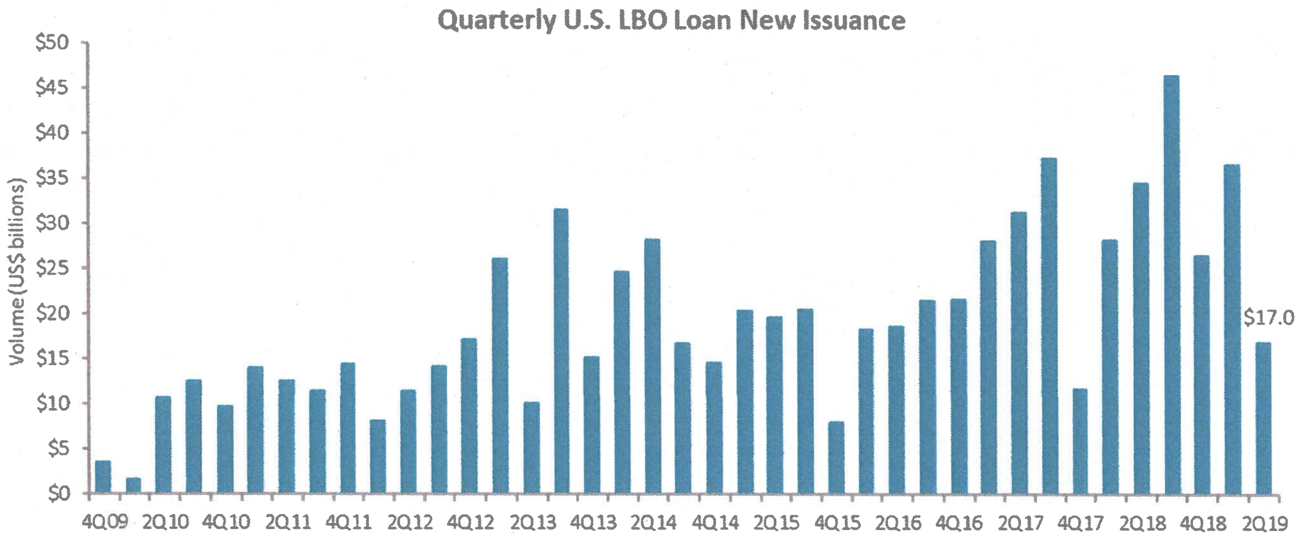
	3 Mo	1 Yr	3 Yr	5 Yr	10 Yr
MSCI Asia	(0.6%)	(4.3%)	7.7%	2.6%	4.6%
MSCI Europe	2.9%	(1.2%)	6.0%	(1.6%)	3.9%
MSCI EM	(0.3%)	(1.4%)	8.1%	0.1%	3.3%
MSCI ACWI	2.9%	3.6%	9.4%	4.1%	7.9%
S&P 500	3.8%	8.2%	11.9%	8.5%	12.3%
S&P 500 Total Return*	4.3%	10.4%	14.2%	10.7%	14.7%

For the period ended June 30, 2019
*Includes reinvestment of dividends.
Source: Capital IQ

The referenced indices are shown for general market comparisons and are not meant to represent any particular fund. An investor cannot directly invest in an index. Moreover, indices do not reflect commissions or fees that may be charged to an investment product based on the index, which may materially affect the performance data presented.

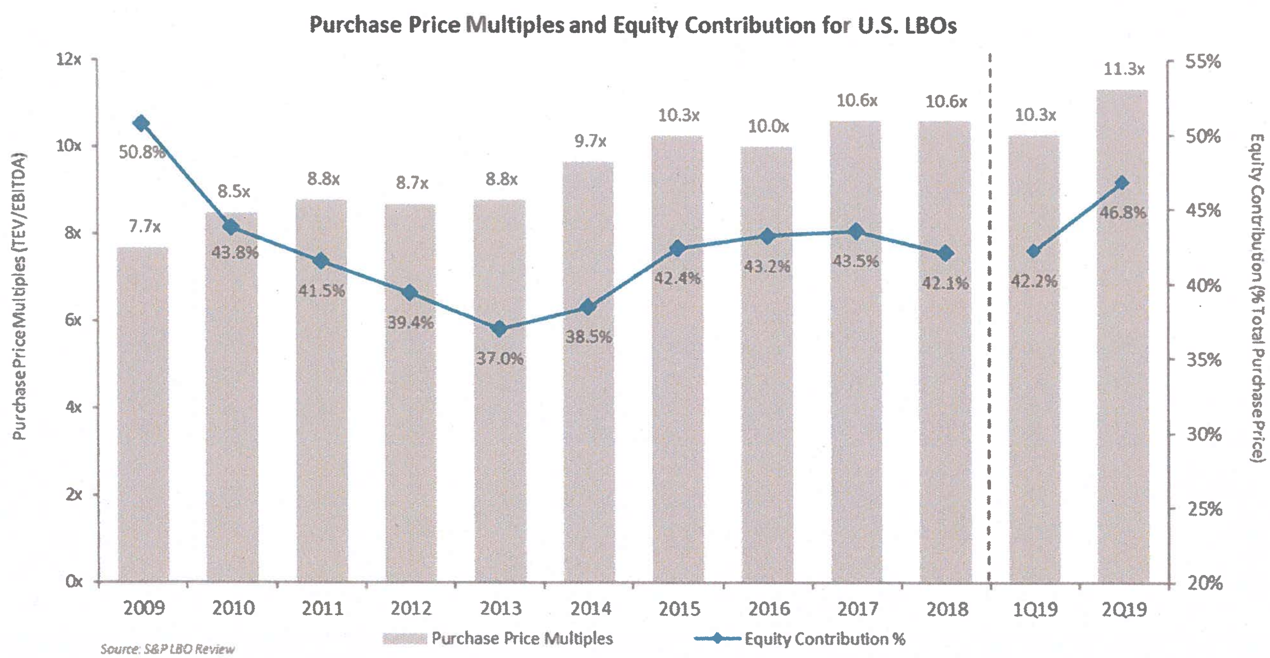
Debt Markets

During the second quarter of 2019, U.S. LBO new loan issuance totaled US$17.0 billion, representing a decrease of 53.6% from the prior quarter and a decrease of 50.8% from the second quarter of 2018. The following chart shows the quarterly volume of U.S. LBO new loan issuance for the past ten years.



Source: S&P LBO Review

The weighted average purchase price multiple for U.S. LBO deals was 11.3x total enterprise value ("TEV") to EBITDA in the second quarter, an increase from the prior quarter and above the 10-year average of 9.7x. Average debt multiples of large corporate U.S. LBO loans remained at 5.7x EBITDA, as equity contributions for U.S. LBOs decreased from 42.2% to 46.8%. The following chart compares purchase price multiples and equity contribution percentages for U.S. LBO deals.



Source: S&P LBO Review

Private Equity Market Overview

All Private Equity

The table below shows the pooled Internal Rate of Return ("IRR") performance of global private equity investments by sector over various investment horizons through June 30, 2019. The All Private Equity benchmark had an IRR of 3.5% for the quarter. Four out of five sectors were positive for the quarter, led by Venture Capital with 5.4%, followed by Small/Middle Buyouts with 3.2%, Large Buyouts with 3.0%, and Mezzanine with 1.9%, and Energy with (2.9%).

Sector	3 Mo	1 Yr	3 Yr	5 Yr	10 Yr
Small/Middle Buyouts (<$3bn)	3.2%	10.7%	15.5%	11.5%	14.0%
Large Buyouts (>$3bn)	3.0%	10.0%	16.2%	12.2%	15.4%
Mezzanine	1.9%	6.5%	9.3%	8.3%	10.0%
Energy	(2.9%)	(10.3%)	4.0%	(2.9%)	4.9%
Venture Capital	5.4%	20.2%	17.2%	15.5%	15.4%
All Private Equity	**3.5%**	**11.3%**	**15.0%**	**11.5%**	**14.1%**

Source: Burgiss PrivateiQ

Fundraising

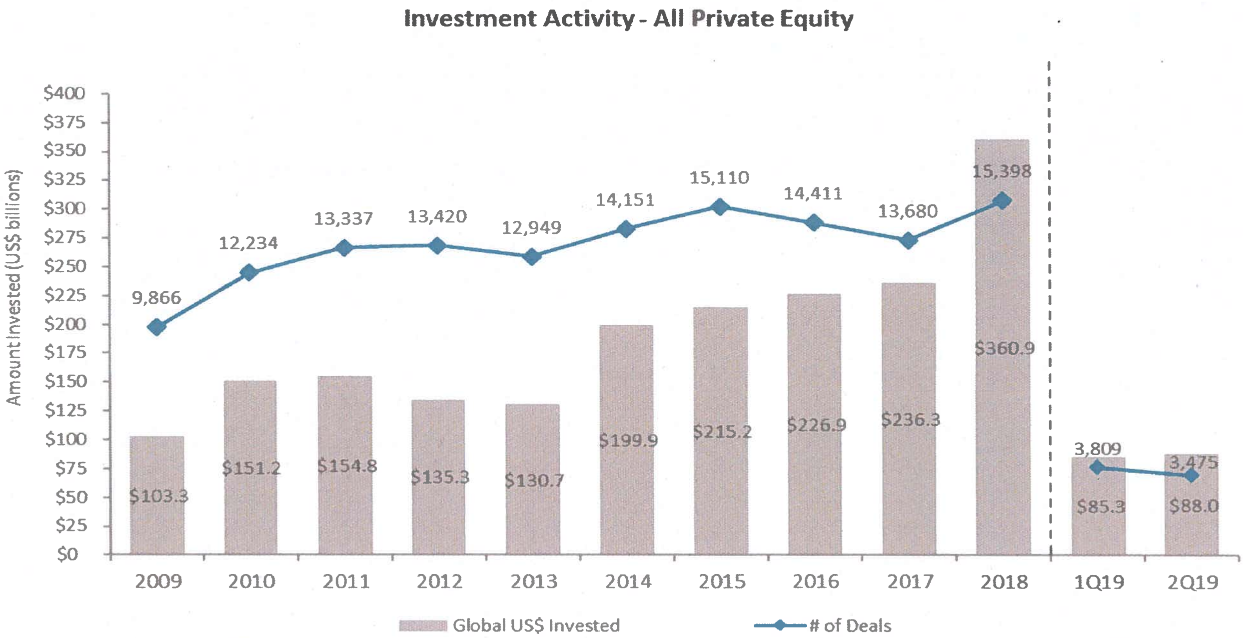
Global private equity fundraising totaled US$152.9 billion in the second quarter, representing a decrease of 15.4% quarter-over-quarter and an increase of 50.0% compared to the second quarter of 2018. Buyout fundraising totaled US$115.6 billion, decreasing 12.3% quarter-over-quarter and increasing 57.3% compared to the prior year period. Venture Capital raised US$23.1 billion in the second quarter, an increase of 3.6% quarter-over-quarter and an increase of 6.4% compared to the second quarter of 2018. Geographically, the U.S. represented 65.8% of total funds raised in the quarter, higher than the 10-year average of 59.1%. Funds raised in Europe, Asia, and the Rest of World made up 18.0%, 9.6% and 6.6%, respectively, of global fundraising for the quarter. The chart below shows annual private equity fundraising activity across all sectors.

Regional Fundraising by Year – All Private Equity

Source: Thomson ONE

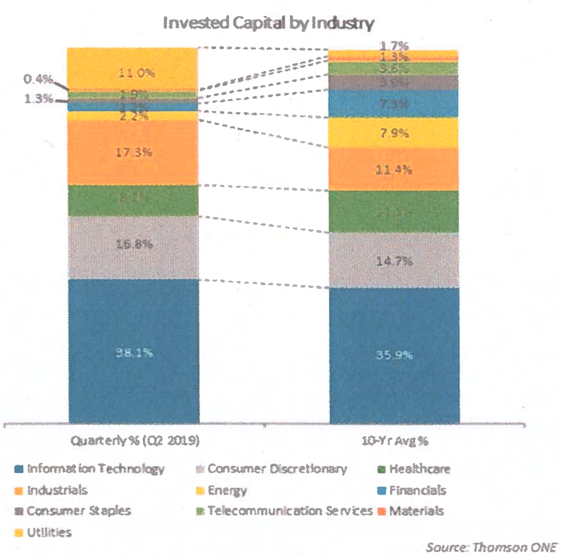
Investment Activity

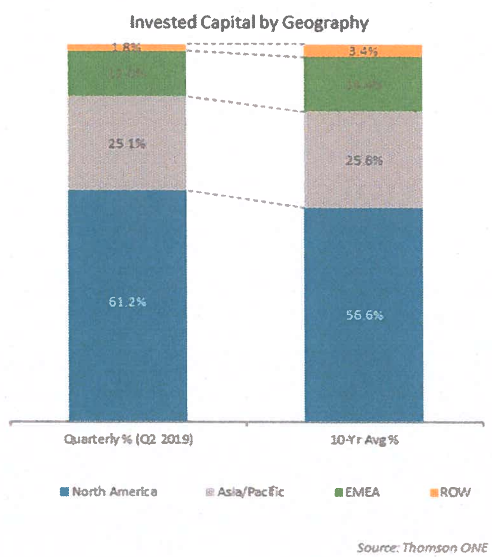
Private equity funds invested US$88.0 billion globally during the second quarter, representing a quarter-over-quarter increase of 3.2% and a decrease of 13.7% from the second quarter of 2018. The average investment size during the quarter was US$25.3 million, an increase of 13.1% compared to the average investment size of US$22.4 million in the first quarter.



Source: Thomson ONE

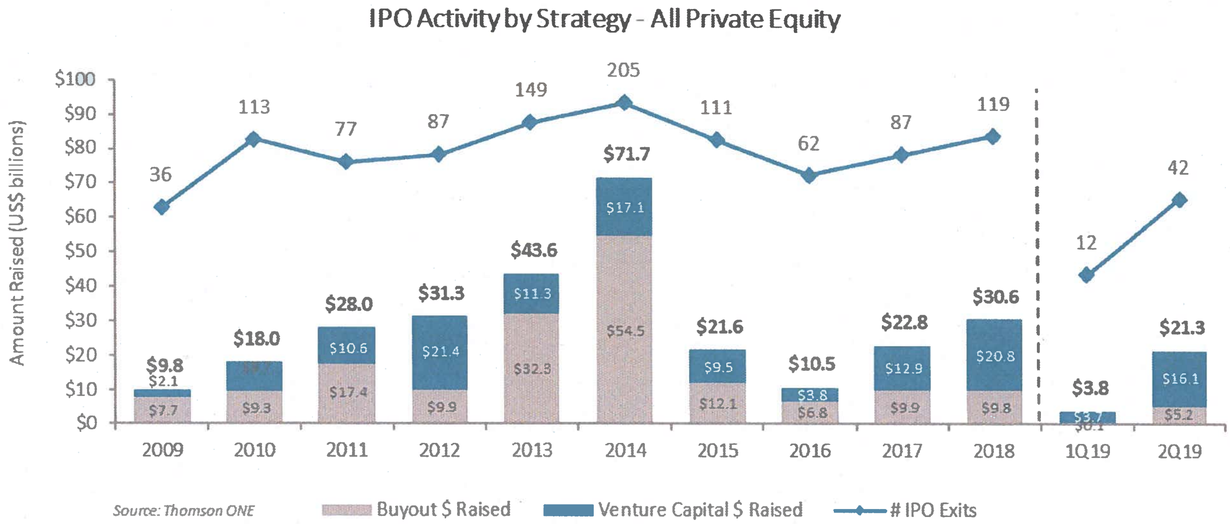
The graphs below depict the percentage of invested capital by industry and geography for the second quarter of 2019 and over the last ten years. The Information Technology sector had the largest departure from its 10-year average, accounting for US$33.5 billion of transactions, or 38.1% of total capital invested by private equity firms, compared to its 10-year average of 35.9%. Considering geography, investment activity was below average in North America, comprising 61.2% of total capital invested compared to its 10-year historical average of 56.6%.



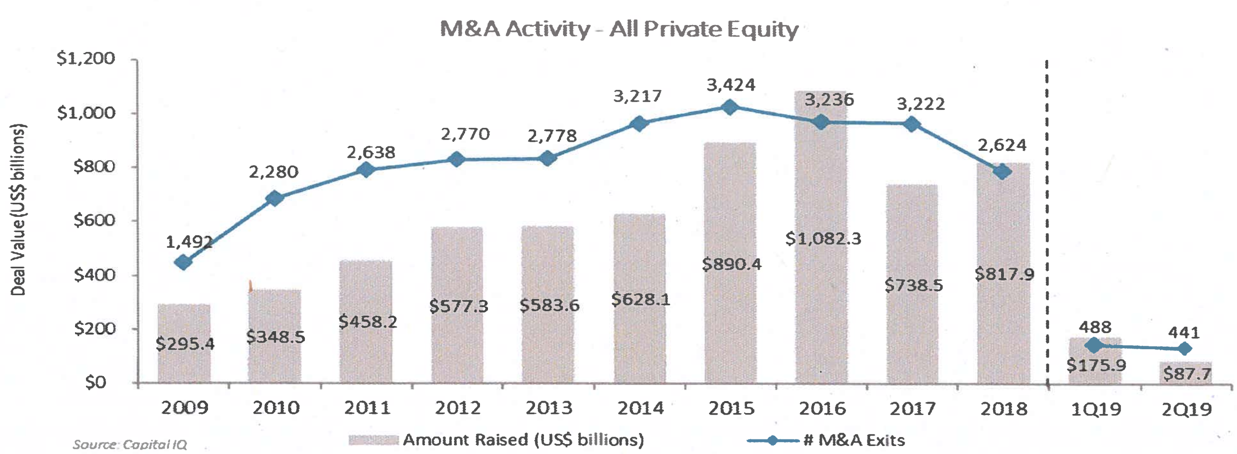


Deal Environment

In the second quarter, the number of private equity-backed IPOs increased 250.0%, from 12 to 42, and the amount raised increased 457.6%, from US$3.8 billion to US$21.3 billion, compared to the prior quarter. The IPOs were comprised of 33 venture capital-backed IPOs that raised a total of US$16.1 billion and nine IPO from buyouts that raised US$5.2 billion. The largest IPOs of the quarter were completed by Uber Technologies, Inc. (NYSE: UBER), a provider of peer-to-peer on-demand ridesharing, and meal preparation and delivery services worldwide, which raised US$8.1 billion, and Avantor Inc (NYSE: AVTR), a developer of products and services to customers in the biopharma, healthcare, education and government, and advanced technologies and applied materials industries, which raised US$3.3 billion. Together these deals represented 53.7% of the total value for all IPOs in the quarter. The graph below shows the amount raised and the number of IPOs on the NYSE and NASDAQ.



The number of private equity-backed Mergers and Acquisitions ("M&A") declined 9.6%, and the total value of M&A deals decreased 35.4% compared to the prior quarter. In the second quarter, there were 441 private-equity backed M&A deals totaling US$87.7 billion. The largest M&A deals of the quarter were the US$19.7 billion purchase of L3 Technologies, Inc. by L3Harris Technologies, Inc. (NYSE: LHX) and the US$8.0 billion purchase of ARRIS International Limited by CommScope Holding Company, Inc. Together these deals represent 31.6% of the total value for all deals in the quarter. The graph below shows the deal value and the number of M&A deals.



III. SERS Portfolio Review

Summary

During the second quarter of 2019, SERS made total contributions of US$197.0 million (including US$9.6 million in fees) and received US$242.5 million in distributions, for a net cash inflow of US$45.4 million during the period. With US$4.0 billion in market value and US$2.9 billion in unfunded commitments as of June 30, 2019, SERS' total exposure to private equity is approximately US$6.9 billion.

New Investment Commitments

The Portfolio made four new commitments for the period, April 1, 2019 through June 30, 2019.

New Investment Commitments Q2 2019

Fund	Closing Date	Sector	Geographic Focus	Commitments (US$)
ASF VIII B	5/31/2019	Special Situations	Global	$100.0
ASF VIII PA Co-Invest	5/31/2019	Special Situations	Global	$50.0
Blackstone Capital Partners VIII	6/27/2019	Buyout	Global	$75.0
Permira VII	6/28/2019	Buyout	Europe	$76.1
Total				$301.1

Subsequent Investment Commitments

The Portfolio made one new commitment for the period, July 1, 2019 through September 30, 2019.

New Investment Commitments Q3 2019

Fund	Closing Date	Sector	Geographic Focus	Commitments (US$)
Wind Point IX	8/1/2019	Buyout	North America	$75.0
Total				$75.0

Performance

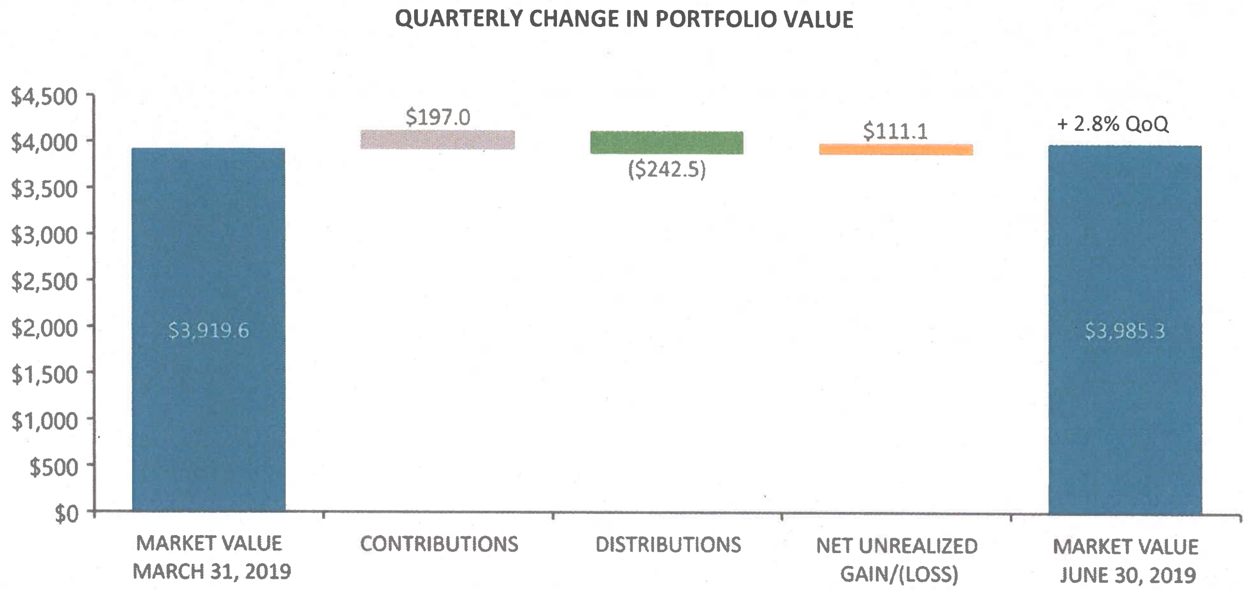
Quarterly Performance

The following table details the quarterly change in value by contributions, distributions, and unrealized gains and losses which occurred during the past eight quarters, net of any partnership fees and expenses.

	2017		2018				2019	
US$ in millions	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Beginning Market Value	$4,038.8	$4,064.6	$4,034.4	$4,010.5	$3,902.5	$3,989.5	$3,791.1	$3,919.6
Contributed Capital	185.8	161.5	117.9	110.4	142.5	185.9	167.6	197.0
Distributed Capital	(289.9)	(316.3)	(226.3)	(373.2)	(187.7)	(283.5)	(237.9)	(242.5)
Appreciation/(Depreciation)[13]	**$129.7**	**$124.6**	**$84.5**	**$154.8**	**$132.3**	**($100.8)**	**$198.8**	**$111.1**
Ending Market Value	4,064.6	4,034.4	4,010.5	3,902.5	3,989.5	3,791.1	3,919.6	3,985.3
Unfunded Commitment	2,190.2	2,088.5	2,143.6	2,591.5	2,681.2	2,728.9	2,729.3	2,868.4
Total Exposure	**$6,254.8**	**$6,122.9**	**$6,154.1**	**$6,493.9**	**$6,670.7**	**$6,519.9**	**$6,648.9**	**$6,853.7**
Since Inception IRR	12.3%	12.3%	12.3%	12.3%	12.3%	12.2%	12.2%	12.2%

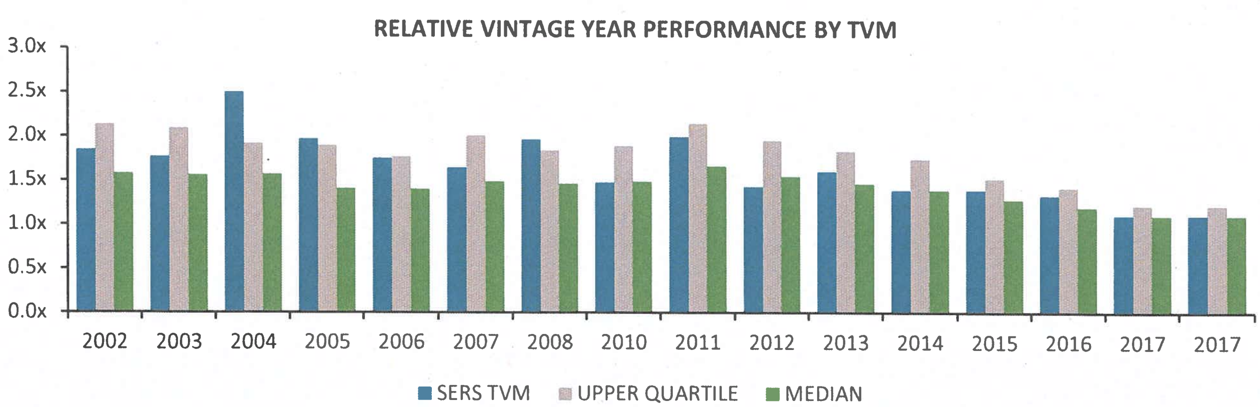
Valuation Movement

The valuation of the Portfolio increased by US$111.1 million, or 2.8% (on a net, after-fees basis) during the second quarter, primarily driven by Buyout-focused partnership investments.



Performance by Vintage Year

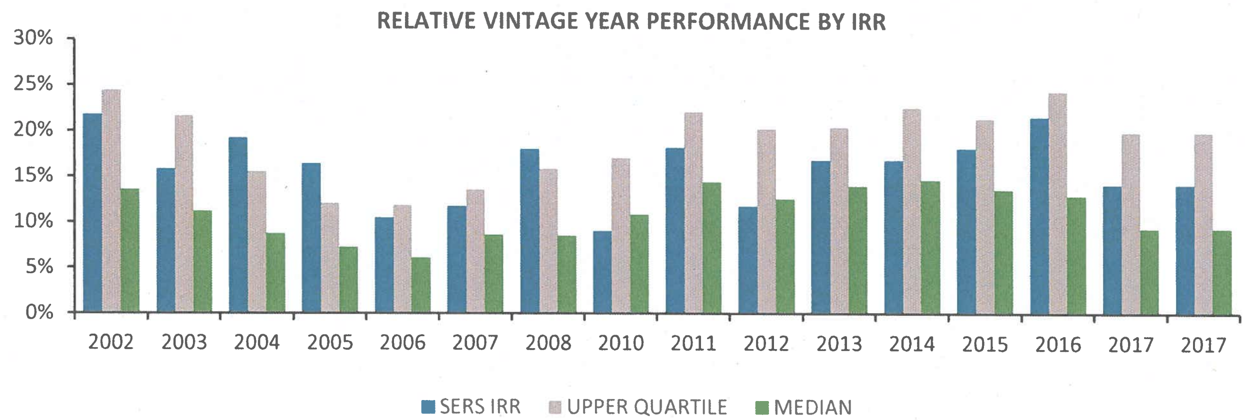
The following graph illustrates Portfolio investment performance by vintage year as of June 30, 2019 relative to the upper quartile and median Global Private Equity TVM benchmarks as provided by Burgiss Private iQ. Performance of funds that are less than two years old is not meaningful. In aggregate, 13 out of 15 vintage years shown have outperformed the median and three have outperformed the upper quartile.



Note: Vintage years prior to 2001 have a market value of US$16.4 million, representing 0.4% of the Portfolio's total market value as of June 30, 2019. **Past performance is not necessarily indicative of future results** and there can be no assurance that the fund will achieve comparable results or avoid substantial losses. No assurance can be given that the performance of unrealized investments has not significantly changed from the date the performance reflected herein was determined.

Performance by IRR

The following graph illustrates Portfolio investment performance by vintage year as of June 30, 2019 relative to the upper quartile and median Global Private Equity IRR benchmarks as provided by Burgiss Private iQ. In aggregate, 13 out of 15 vintage years shown have outperformed the median and three have outperformed the upper quartile.



Past performance is not necessarily indicative of future results and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.

Diversification

Geographic Focus

(US$ in millions)

	MARKET VALUE		UNFUNDED		TOTAL EXPOSURE	
	$	% OF TOTAL	$	% OF TOTAL	$	% OF TOTAL
North America	2,079.8	52.2%	1,292.0	45.0%	3,371.8	49.2%
Europe	155.8	3.9%	329.1	11.5%	485.0	7.1%
Global	324.4	8.1%	482.5	16.8%	807.0	11.8%
Asia	456.1	11.4%	238.1	8.3%	694.2	10.1%
Emerging Markets	86.3	2.2%	40.8	1.4%	127.1	1.9%
Keystone Legacy Fund	882.7	22.1%	485.8	16.9%	1,368.5	20.0%
Total	**$3,985.3**	**100.0%**	**$2,868.4**	**100.0%**	**$6,853.6**	**100.0%**

By Investment Manager

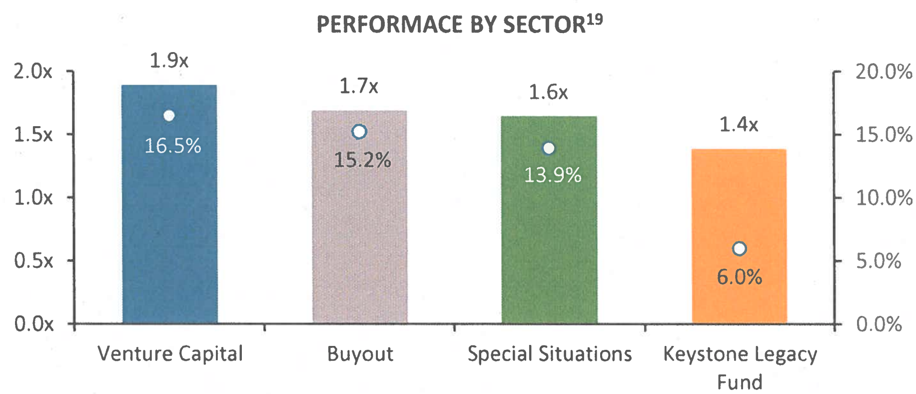
As of June 30, 2019, the top 20 managers comprising US$5.0 billion, or 73% of total exposure. The remaining 44 active managers comprised 27% of total exposure as of quarter-end.

Core Portfolio Periodic Returns vs. Russell 3000® Index

	1 YEAR RETURN	3 YEAR RETURN	5 YEAR RETURN	10 YEAR RETURN	SINCE INCEPTION
SERS Core Portfolio (IRR)[18]	**13.8%**	**15.4%**	**11.8%**	**17.2%**	**15.4%**
Russell 3000®	9.0%	14.0%	10.2%	14.7%	10.0%
Russell 3000® + 300 bps	12.0%	17.0%	13.2%	17.7%	13.0%
PA SERS Outperformance/(Underperformance)					
Russell 3000®	4.8%	1.3%	1.6%	2.6%	5.5%
Russell 3000® + 300 bps	1.8%	(1.7%)	(1.4%)	(0.4%)	2.5%

Performance by Sector

Venture Capital is the best performing sector generating an IRR of 16.5% and a TVM of 1.9x as of June 30, 2019.

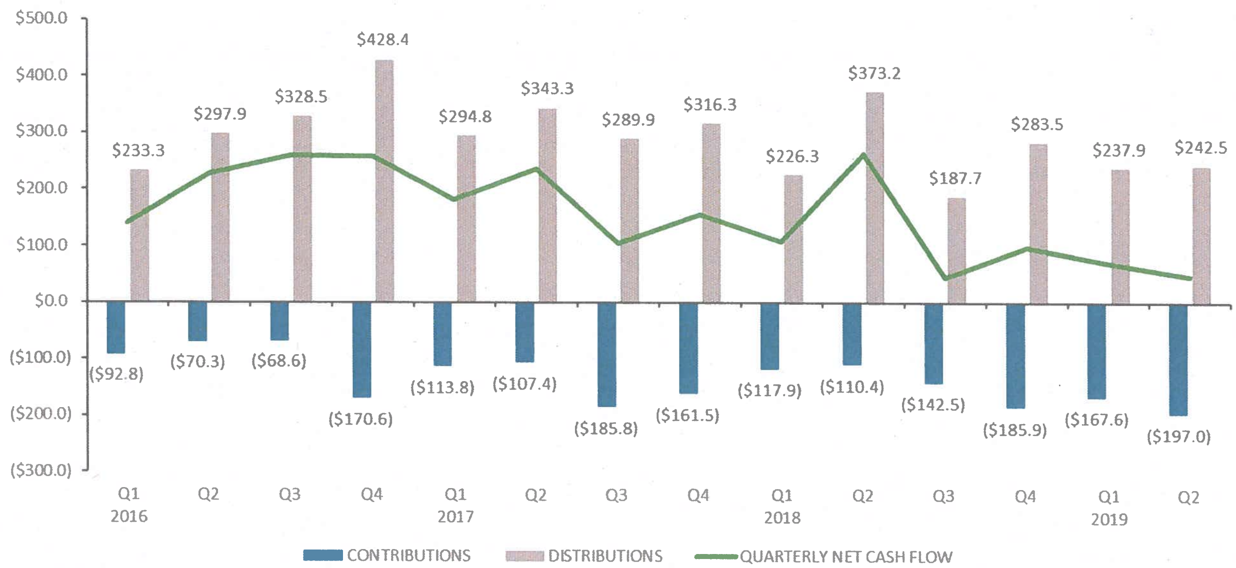


The referenced indices are shown for general market comparisons and are not meant to represent any particular fund. An investor cannot directly invest in an index. Moreover, indices do not reflect commissions or fees that may be charged to an investment product based on the index, which may materially affect the performance data presented.

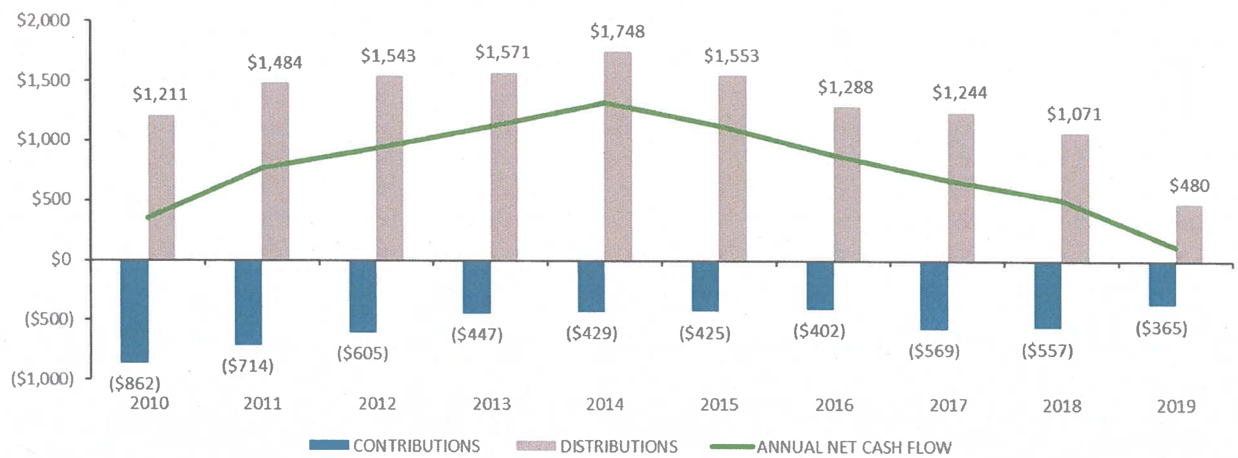
Portfolio Cash Flow Analysis

During the second quarter of 2019, the Portfolio made US$197.0 million of contributions and received US$242.5 million of distributions, for a net cash inflow of US$45.4 million. The portfolio has been cash flow positive for 38 consecutive quarters. The graphs below illustrate recent cash flow activity by quarter and year.

Quarterly Cash Flow Activity

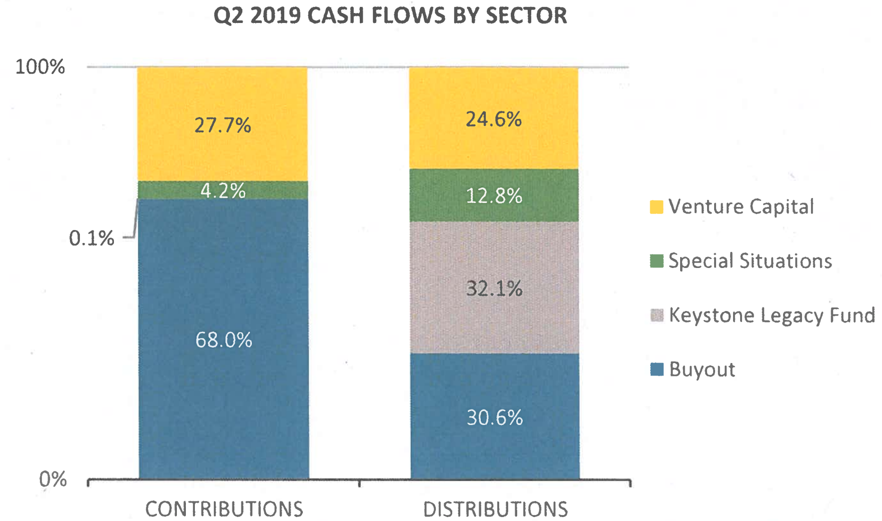


Annual Cash Flow Activity



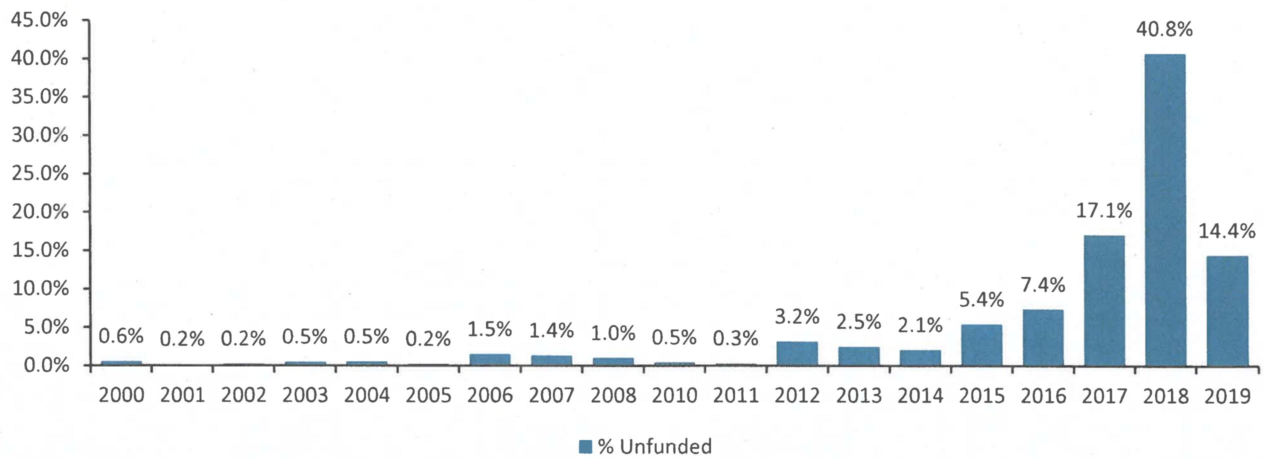
Cash Flow by Sector

Buyout funds were the most active in terms of cash flow activity during the second quarter of 2019, drawing down US$134.1 million, or 68.0% of total contributions during the quarter, and distributing US$74.1 million, or 30.6% of total distributions during the quarter.



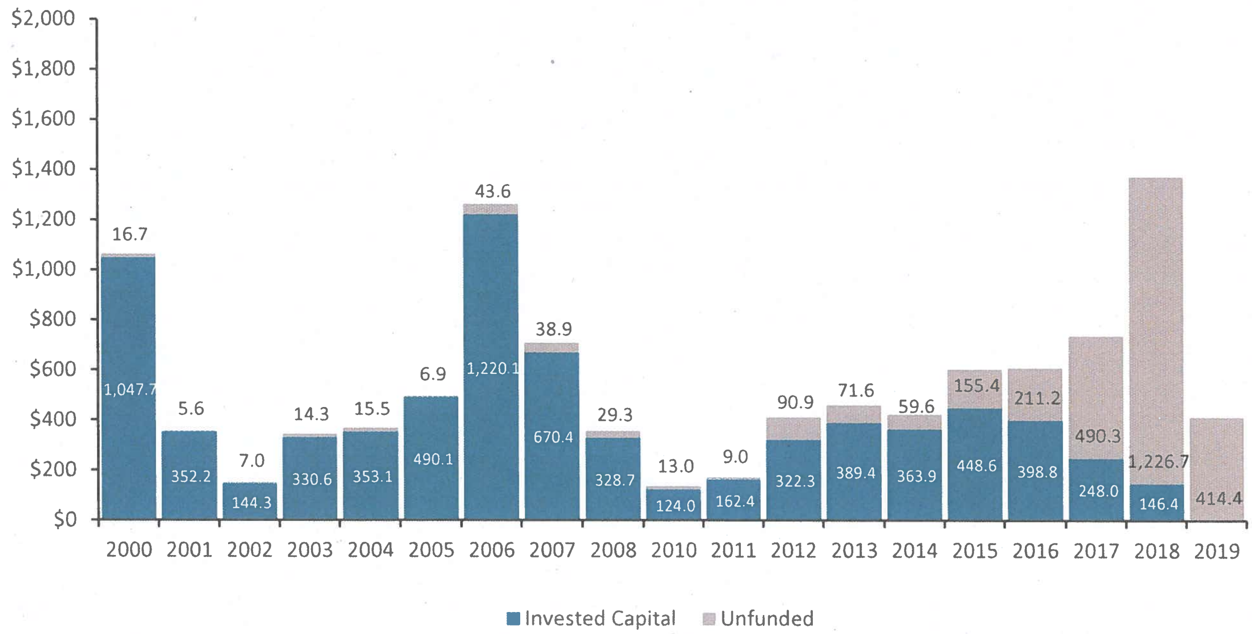
Unfunded % by Vintage Year

The following chart provides unfunded commitments by vintage year as a percentage of the Portfolio's total unfunded commitments. Vintage years 2015 through 2019 make up 85.1% of the Portfolio's unfunded commitments.



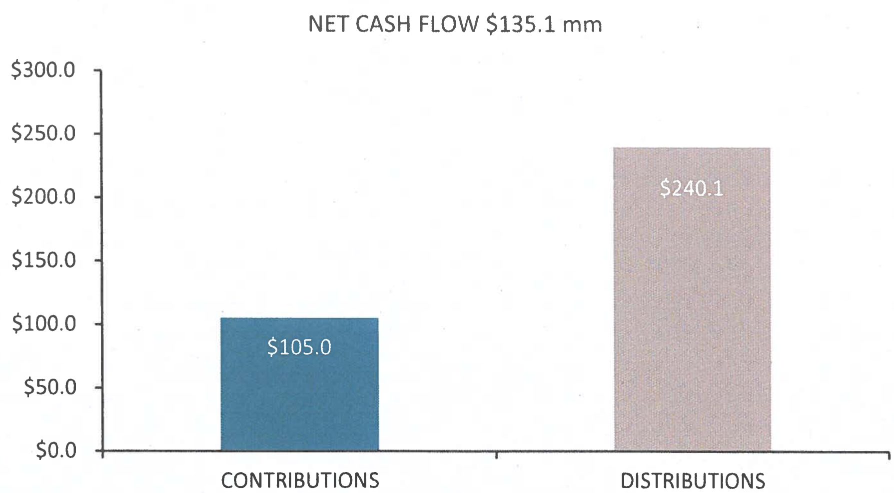
Invested Capital to Unfunded by Vintage Year

The following chart provides invested capital and unfunded capital commitments by vintage year.



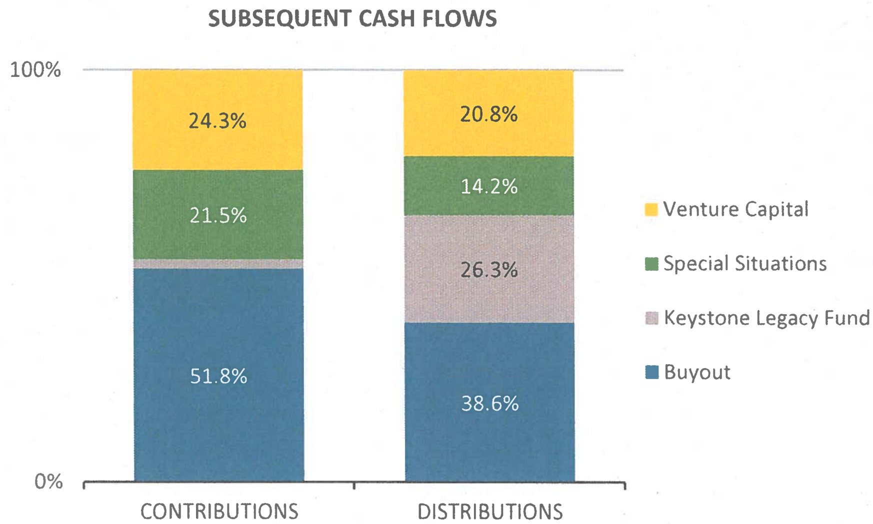
Subsequent Cash Flow Activity

Subsequent to quarter-end through September 30, 2019, the Portfolio made US$105.0 million of contributions and received US$240.1 million of distributions, for a net cash inflow of US$135.1 million, an increase of 197% from the previous quarter total.



Subsequent Cash Flow by Sector

The largest concentration of net cash flows during Q3 2019 was Keystone Legacy Fund, which resulted in a net cash inflow of US$60.5 million.



IV. End Notes

[1] Commitment reflects original commitment including fx fluctuations for non-usd funds.
[2] Contributed Capital includes contributions for investments, management fees and expenses to underlying partnership investments. Contributions do not include since inception non-core cash flows
[3] Includes stock distributions. Distributions do not include since inception non-core cash flows.
[4] Total Exposure represents the sum of Market Value and Unfunded Commitment.
[5] DPI, or Distributed to Paid-In Multiple, is a performance metric that measures distributions received relative to capital invested. DPI is calculated as Distributed Capital divided by Contributed Capital. Includes since inception cash flows for all non-core funds.
[6] TVM, or Total Value Multiple, is a performance metric that measures total value created by the Portfolio relative to capital invested, without consideration for time. TVM is calculated as Total Value, which is comprised of Market Value plus Distributed Capital, divided by Contributed Capital. TVM net of StepStone's fees is 1.6x. Includes since inception cash flows for all non-core funds.
[7] IRR, or Internal Rate of Return, is a performance metric that is calculated based on the Portfolio's daily cash flows and market value as of quarter-end. IRR is net of manager's fees, expenses and carried interest. IRR net of StepStone's fees is 12.22% as of June 30, 2019. Includes since inception cash flows for all non-core funds.
[8] Benchmark is a dollar-weighted calculation of quarterly changes in the Russell 3000® Index. Russell Investment Group is the source and owner of the trademark, service marks and copyrights related to the Russell Indexes. Russell® is a trademark of Russell Investment Group. Returns shown are time-weighted (TWR).
[9] Benchmark is provided by Burgiss Private iQ and reflects Global Private Equity Funds (excluding Real Assets and Real Estate) Median IRR as of June 30, 2019, for funds with vintage years 1980 to 2019. Returns shown are dollar-weighted (IRR).
[10] Benchmark is provided by Burgiss Private iQ and reflects Global Private Equity Funds (excluding Real Assets and Real Estate) Upper Quartile IRR as of June 30, 2019, for funds with vintage years 1980 to 2019. Returns shown are dollar-weighted (IRR).
[11] Benchmark is provided by Burgiss Private iQ and reflects Global pooled returns for Buyout (including Natural Resources), Venture Capital, Special Situations (including Distressed and Mezzanine), and all Private Equity (excluding Real Assets and Real Estate), respectively, as of June 30, 2019, for funds with vintage years 1980 to 2019. Returns shown are dollar-weighted (IRR).
[12] Benchmark is provided by Burgiss Private iQ and reflects Global Upper Quartile IRR for Buyout (including Natural Resources), Venture Capital, Special Situations (including Distressed and Mezzanine), and all Private Equity (excluding Real Assets and Real Estate), respectively, as of June 30, 2019, for funds with vintage years 1980 to 2019. Returns shown are dollar-weighted (IRR).
[13] S&P US LBO Review, Q2 2019.
[14] Thomson ONE data as of September 10, 2019. Please note, all data in this report from Thomson ONE is subject to revision as further data is made available.
[15] Capital IQ Transaction Screening Report as of September 10, 2019.
[16] Appreciation/ (Depreciation) represents realized and unrealized gains/(losses) during the quarter, which is comprised of the difference between Ending Market Value and Beginning Market Value plus Contributed Capital minus Distributed Capital.
Past performance is not necessarily indicative of future results and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.
[17] Other includes sub-sectors secondaries, early stage, late stage and mezzanine, which represented 2% or less of the total exposure.
[18] Benchmark is a dollar-weighted calculation of quarterly changes in the Russell 3000® Index. Russell Investment Group is the source and owner of the trademark, service marks and copyrights related to the Russell Indexes. Russell® is a trademark of Russell Investment Group. Returns shown are time-weighted (TWR).
[19] Buyout, Venture Capital, and Special Situations sectors represent PASERS core portfolio of investment returns within each sector. Keystone Legacy Fund contains Buyout, Venture Capital, and Special Situation Funds defined as non-core by PASERS.

V. Exhibits

Exhibit A – Investments by Vintage Year

<u>Commonwealth of Pennsylvania State Employees' Retirement System</u>
Schedule of Investments by Vintage Year
As of June 30, 2019

VINTAGE	FUND	SECTOR	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
1997	Apollo Investment Fund IV	Buyout	$75,000,000	$74,838,620	$124,814,033	$85,586	$50,060,999	1.7x	8.5%	Second	Second
1997 Total			$75,000,000	$74,838,620	$124,814,033	$85,586	$50,060,999	1.7x	8.5%	Second	Second
1998	HarbourVest IPEP III	Buyout	40,000,000	39,400,000	61,092,165	80,994	21,773,159	1.6x	8.6%	Second	Second
1998 Total			$40,000,000	$39,400,000	$61,092,165	$80,994	$21,773,159	1.6x	8.6%	Second	Second
1999	HarbourVest Partners VI	Venture Capital	200,000,000	196,586,055	250,693,463	1,629,031	55,736,439	1.3x	3.6%	Second	Second
1999	Lexington Capital Partners III	Special Situations	35,000,000	34,516,449	43,363,378	[redacted]					
1999	New Enterprise Associates IX	Venture Capital	20,000,000	19,600,000	7,978,301	1,620,554	(10,001,145)	0.5x	(5.7%)	Third	Fourth
1999	TPG Partners III	Buyout	75,000,000	64,119,169	165,990,273	[redacted]					
1999 Total			$330,000,000	$314,821,673	$468,025,415						
2000	ABRY Partners IV	Buyout	35,000,000	25,497,290	74,633,973						
2000	Apollo Investment Fund V	Buyout	50,000,000	44,972,146	122,507,048	431,965	77,966,867	2.7x	38.8%	First	First
2000	Audax Private Equity Fund	Buyout	35,000,000	36,839,098	56,057,910	[redacted]					
2000	Blackstone Communications Partners I	Buyout	25,000,000	25,114,042	30,998,189	170,714	6,054,861	1.2x	6.3%	Second	Second
2000	Francisco Partners	Buyout	50,000,000	47,769,948	61,464,903	452,058	14,147,013	1.3x	4.4%	Second	Second
2000	Madison Dearborn Capital Partners IV	Buyout	90,000,000	90,365,390	169,072,775	3,310,614	82,017,998	1.9x	14.2%	First	First
2000	New Enterprise Associates X	Venture Capital	35,000,000	35,028,000	33,995,586	7,421,557	6,389,143	1.2x	2.6%	Third	Third
2000	Permira European Fund II	Buyout	48,000,000	45,672,612	91,464,087	424,143	46,215,618	2.0x	21.6%	First	First
2000	Providence Equity Partners IV	Buyout	25,000,000	23,420,840	56,065,270	[redacted]					
2000 Total			$393,000,000	$374,679,366	$696,259,741						
2001	ABRY Mezzanine Partners	Special Situations	30,000,000	26,731,187	49,707,116						
2001	Blackstone Capital IV	Buyout	75,000,000	69,086,898	191,122,894	3,216,423	125,252,419	2.8x	36.2%	First	First
2001	Lexington Capital Partners V	Special Situations	75,000,000	74,623,418	125,170,164	[redacted]					
2001 Total			$180,000,000	$170,441,503	$366,000,174						
2002	Berkshire Fund VI	Buyout	20,000,000	18,819,615	54,873,734						
2002	GTCR VIII	Buyout	75,000,000	69,393,599	120,471,948						
2002 Total			$95,000,000	$88,213,214	$175,345,682						
2003	HarbourVest Partners VII	Venture Capital	75,000,000	73,687,500	105,087,881	14,082,848	45,483,229	1.6x	6.9%	Third	Second
2003	Kelso VII	Buyout	40,000,000	41,194,550	65,845,731	767,495	25,418,676	1.6x	11.5%	Second	Second
2003	New Enterprise Associates 11	Venture Capital	25,000,000	25,000,000	62,741,850	3,098,379	40,840,229	2.6x	15.6%	Second	First
2003	Permira European Fund III	Buyout	115,960,000	127,340,454	217,778,356	512,326	90,950,228	1.7x	26.1%	First	Second
2003	TPG Partners IV	Buyout	30,000,000	27,981,463	57,968,285	[redacted]					
2003 Total			$285,960,000	$295,203,966	$509,422,103						
2004	ABRY Partners V	Buyout	45,000,000	41,742,771	83,293,903						
2004	AXA Secondary Fund III	Special Situations	26,000,000	21,737,894	37,244,706						
2004	AXA Secondary Fund III-2	Special Situations	14,000,000	11,677,210	19,062,764						
2004	LLR Equity Partners II	Buyout	25,000,000	25,000,000	44,945,591	232,851	20,178,442	1.8x	12.2%	Second	Second
2004	Oaktree Capital Management	Special Situations	40,000,000	40,582,060	138,594,329	[redacted]					
2004	OCM Opportunities Fund V	Special Situations	40,000,000	40,003,507	65,911,274						
2004	Providence Equity Partners V	Buyout	45,000,000	42,692,171	51,743,883						
2004 Total			$235,000,000	$223,435,614	$440,796,449						
2005	Apollo Investment Fund VI	Buyout	40,000,000	38,911,805	64,467,407	746,105	26,301,706	1.7x	8.7%	Second	Second
2005	Audax Private Equity Fund II	Buyout	25,000,000	25,517,152	45,240,610	[redacted]					
2005	HIPEP V-Asia Pacific & Rest of World	Buyout	30,000,000	28,245,316	34,310,232	6,622,595	12,687,511	1.4x	6.3%	Third	Second
2005	Lexington Capital Partners VI	Special Situations	50,000,000	53,066,325	69,215,321	[redacted]					
2005	Lightspeed Venture Partners VII	Venture Capital	18,000,000	18,000,000	49,449,448						
2005	Newbridge Asia IV	Buyout	40,000,000	38,903,378	85,845,344						
2005	OCM Opportunities Fund VI	Special Situations	40,000,000	40,000,000	63,171,009						
2005	OCM/GFI Power Opportunities Fund II	Buyout	25,000,000	13,470,852	41,644,215						
2005 Total			$268,000,000	$256,114,829	$453,343,587						
2006	ABRY Senior Equity II	Special Situations	30,000,000	28,282,103	44,960,375						
2006	Asia Alternatives Capital Partners	Buyout	50,000,000	25,180,175	41,648,780	4,665,880	21,134,485	1.8x	11.2%	Second	First
2006	AXA Secondary Fund IV	Special Situations	80,000,000	70,134,752	98,638,689	[redacted]					
2006	Berkshire Fund VII	Buyout	32,000,000	32,612,736	60,660,471						
2006	Blackstone Capital Partners V	Buyout	150,000,000	149,951,913	241,388,866	7,301,370	98,738,323	1.7x	7.6%	Second	Second
2006	Centerbridge Capital Partners I	Special Situations	50,000,000	57,490,446	113,038,748	6,736,353	62,284,655	2.1x	19.4%	First	First
2006	Eureka II	Buyout	20,000,000	21,884,526	20,777,356	7,318,077	6,210,907	1.3x	5.1%	Third	Third
2006	Francisco Partners II	Buyout	30,000,000	29,383,916	41,240,515	5,064,784	16,921,382	1.6x	10.1%	Second	Second
2006	Great Hill Equity Partners III	Buyout	35,000,000	35,000,000	41,935,541	[redacted]					
2006	GTCR IX	Buyout	50,000,000	47,916,718	86,149,702						
2006	HarbourVest Partners VIII	Venture Capital	100,000,000	98,000,000	130,568,903	58,444,775	91,013,678	1.9x	10.9%	Second	First
2006	Hellman & Friedman Capital Partners VI	Buyout	125,000,000	119,913,412	218,556,925	6,130,684	104,774,197	1.9x	12.9%	First	First
2006	Madison Dearborn Capital Partners V	Buyout	75,000,000	71,558,278	113,628,059	1,576,124	43,645,905	1.6x	7.2%	Second	Second
2006	Meritech Capital Partners III	Venture Capital	35,000,000	35,000,000	190,791,007	[redacted]					
2006	New Enterprise Associates 12	Venture Capital	35,000,000	35,631,130	45,554,802	4,442,250	14,365,922	1.4x	6.6%	Second	Second

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Investments by Vintage Year

As of June 30, 2019

VINTAGE	FUND	SECTOR	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
2006	NewSpring Growth Capital II	Venture Capital	$10,000,000	$9,850,000	$13,962,639	[redacted]					
2006	OCM Principal Opportunities Fund IV	Special Situations	20,000,000	20,400,000	34,019,822						
2006	Permira IV	Buyout	127,779,198	137,762,438	203,511,684	18,401,131	84,150,377	1.6x	8.6%	Second	Second
2006	TA X	Buyout	70,000,000	69,732,009	90,382,009	771,911	[redacted]				
2006	TPG Partners V	Buyout	100,000,000	92,531,812	125,076,000	7,054,651	39,598,839	1.4x	5.0%	Third	Second
2006 Total			$1,224,779,198	$1,188,216,365	$1,956,490,892	[redacted]					
2007	ABRY Advanced Securities Fund	Special Situations	25,000,000	23,508,684	38,682,209						
2007	Advent Latin American Private Equity Fund IV	Buyout	30,000,000	30,797,073	39,725,921	6,444,835	15,373,683	1.5x	9.2%	Second	Second
2007	Asia Alternatives Capital Partners II	Buyout	50,000,000	28,867,904	38,236,443	30,160,736	39,529,275	2.4x	17.7%	First	First
2007	Audax Private Equity Fund III	Buyout	37,000,000	42,498,691	80,644,845	2,410,188	40,556,342	2.0x	15.0%	First	Second
2007	Battery Ventures VIII	Venture Capital	25,000,000	25,050,751	55,602,642	[redacted]					
2007	Dover Street VII	Special Situations	30,000,000	28,696,128	38,403,160	3,221,740	12,928,772	1.5x	9.5%	Second	Third
2007	Energy Spectrum Partners V	Buyout	28,326,735	27,661,855	51,487,729	139,992	23,965,866	1.9x	31.7%	First	Second
2007	Insight Venture Partners VI	Venture Capital	30,000,000	32,244,177	73,211,458	8,388,669	49,355,951	2.5x	19.2%	First	First
2007	JMI Equity Fund VI	Venture Capital	40,000,000	40,000,246	67,630,800	[redacted]					
2007	Kelso VIII	Buyout	150,000,000	146,269,405	164,521,918	30,779,441	49,031,954	1.3x	6.3%	Third	Third
2007	OCM Opportunities Fund VII	Special Situations	40,000,000	40,000,000	53,450,728	[redacted]					
2007	OCM Opportunities Fund VII b	Special Situations	40,000,000	36,000,000	61,488,034						
2007	Providence Equity Partners VI	Buyout	50,000,000	53,946,228	58,171,556						
2007	TPG Asia V	Buyout	22,500,000	21,964,311	26,447,030	4,484,817	8,967,536	1.4x	6.5%	Third	Third
2007	Weathergage Venture Capital	Venture Capital	25,000,000	22,875,000	29,841,174	17,657,284	24,623,458	2.1x	12.3%	Second	First
2007 Total			$622,826,735	$600,380,453	$877,545,645	[redacted]					
2008	ABRY Partners VI	Buyout	50,000,000	59,994,861	107,608,270						
2008	Advent International GPE VI-A	Buyout	35,000,000	35,146,325	67,433,549	6,571,805	38,859,029	2.1x	16.9%	First	First
2008	Battery Ventures VIII Side Car Fund	Venture Capital	9,000,000	6,803,790	17,412,210	[redacted]					
2008	Great Hill Equity Partners IV	Buyout	25,000,000	25,125,662	56,840,270						
2008	H.I.G. Bayside Debt & LBO Fund II	Special Situations	30,000,000	30,996,778	45,748,556						
2008	Lightspeed Venture Partners VIII	Venture Capital	15,000,000	14,550,000	27,045,680						
2008	LLR Equity Partners III	Buyout	30,000,000	29,108,722	51,222,009	5,404,040	27,517,326	1.9x	15.2%	Second	First
2008	Madison Dearborn Capital Partners VI	Buyout	50,000,000	51,131,247	83,530,324	25,114,672	57,513,749	2.1x	23.6%	First	First
2008	TPG Partners VI	Buyout	45,000,000	50,111,214	64,622,335	11,249,919	25,761,040	1.5x	10.4%	Second	Second
2008 Total			$289,000,000	$302,968,599	$521,463,204	[redacted]					
2010	Advent Latin American Private Equity Fund V	Buyout	15,000,000	14,430,000	7,200,000	9,642,880	2,412,880	1.2x	3.3%	Fourth	Fourth
2010	Avenue Special Situations Fund VI	Special Situations	20,000,000	20,068,464	20,720,289	[redacted]					
2010	Oaktree Power Opportunities Fund III	Buyout	25,000,000	17,464,459	22,150,923						
2010	OCM Opportunities Fund VIII	Special Situations	12,500,000	12,583,425	17,430,778						
2010	OCM Opportunities Fund VIIIb	Special Situations	12,500,000	12,500,000	12,123,310						
2010	Weathergage Venture Capital II	Venture Capital	25,000,000	23,250,000	13,736,090	38,759,161	29,245,251	2.3x	15.5%	Second	First
2010 Total			$110,000,000	$100,296,348	$93,361,391	[redacted]					
2011	ABRY Partners VII	Buyout	30,000,000	37,852,221	48,702,195						
2011	Asia Alternatives Korea Buyout Investors (Hahn & Co)	Buyout	7,000,000	8,643,252	9,137,898	5,702,293	6,196,939	1.7x	13.5%	Third	Second
2011	Berkshire Fund VIII	Buyout	30,000,000	30,492,170	29,747,778	[redacted]					
2011	Francisco Partners III	Buyout	20,000,000	20,275,777	31,902,241	15,016,264	26,642,728	2.3x	20.8%	Second	First
2011	H.I.G. Growth Buyouts & Equity Fund II	Buyout	15,000,000	14,656,287	4,086,778	[redacted]					
2011	Insight Venture Partners VII	Venture Capital	20,000,000	21,319,992	35,746,037	22,683,421	37,109,466	2.7x	22.1%	Second	First
2011	JMI Equity Fund VII	Venture Capital	10,000,000	9,780,000	12,047,439	[redacted]					
2011	Meritech Capital Partners IV	Venture Capital	20,000,000	19,400,000	24,718,878						
2011 Total			$152,000,000	$162,419,700	$196,089,244						
2012	Advent International GPE VII-B	Buyout	40,000,000	37,600,000	33,752,625	33,141,296	29,293,921	1.8x	16.1%	Second	Second
2012	Asia Alternatives Capital Partners III	Buyout	50,000,000	53,341,818	34,787,177	49,410,042	30,855,401	1.6x	13.7%	Second	Second
2012	AXA Secondary Fund V B	Special Situations	75,000,000	61,682,742	86,729,624	[redacted]					
2012	Carlyle Energy Mezzanine Opportunities Fund	Buyout	50,000,000	64,797,142	26,707,945	22,168,152	(15,921,045)	0.8x	(10.9%)	Fourth	Fourth
2012	NewSpring Growth Capital III	Venture Capital	25,000,000	23,361,239	10,192,997	[redacted]					
2012	Penn Asia Investors	Buyout	133,000,000	81,472,349	36,002,134	90,496,040	45,025,825	1.6x	16.2%	Second	Second
2012 Total			$373,000,000	$322,255,290	$228,172,502	[redacted]					
2013	Eureka Growth Capital III	Buyout	20,000,000	14,652,268	13,614,722	13,251,765	12,214,219	1.8x	47.7%	First	First
2013	FSN Capital IV	Buyout	46,049,703	37,755,593	47,457,821	[redacted]					
2013	H.I.G. Bayside Loan Opp. Fund III	Special Situations	50,000,000	40,418,122	30,839,392						
2013	H.I.G. Europe Capital Partners II	Buyout	27,544,596	16,364,744	3,985,287						
2013	Incline Equity Partners III	Buyout	15,000,000	15,701,555	20,874,842	14,772,698	19,945,985	2.3x	33.9%	First	First
2013	Insight Venture Partners VIII	Venture Capital	50,000,000	52,250,000	54,139,530	49,994,405	51,883,934	2.0x	16.7%	Second	First
2013	KPS Special Situations Fund IV	Special Situations	25,000,000	15,892,288	7,178,052	12,725,182	4,010,946	1.3x	20.2%	Second	Fourth
2013	LBC Credit Partners III	Special Situations	50,000,000	46,718,245	42,649,375	[redacted]		1.2x	8.3%	Third	Fourth
2013	LLR Equity Partners IV	Buyout	50,000,000	45,485,764	44,684,210	42,917,983	42,116,430	1.9x	26.7%	First	First

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Investments by Vintage Year

As of June 30, 2019

VINTAGE	FUND	SECTOR	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
2013	Oaktree Opportunities Fund IX	Special Situations	$50,000,000	$50,000,000	$21,447,715	[redacted]					
2013	Platinum Equity Capital Partners III	Special Situations	50,000,000	45,516,573	61,303,698	18,899,947	34,687,072	1.8x	38.0%	First	Second
2013	Sentinel Capital Partners V	Buyout	10,000,000	8,671,252	4,324,736						
2013 Total			$443,594,299	$389,426,405	$352,499,379	[redacted]					
2014	ABRY Partners VIII	Buyout	25,000,000	28,901,530	11,682,961	[redacted]					
2014	Capvis Equity IV	Buyout	49,855,591	42,153,784	33,984,236	18,296,760	10,127,213	[redacted]			
2014	GTCR Fund XI	Buyout	25,000,000	22,337,831	15,362,006	[redacted]			25.8%	First	[redacted]
2014	Hahn & Company II	Buyout	50,000,000	49,358,451	9,040,888	[redacted]					
2014	Hellman & Friedman Capital Partners VIII	Buyout	50,000,000	49,055,284	4,699,979	53,622,042	9,266,737	1.2x	15.9%	Second	Fourth
2014	Horizon Impact Fund	Buyout	50,000,000	39,004,802	10,399,736	47,868,354	19,263,288	1.5x	17.3%	Second	Second
2014	Horizon Strategic Fund - Carlyle Group	Buyout	100,000,000	86,130,870	26,652,737	93,283,807	33,805,674	1.4x	10.8%	Third	Second
2014	JMI Equity Fund VIII	Venture Capital	25,000,000	25,600,000	11,546,162	[redacted]					
2014	Meritech Capital Partners V	Venture Capital	23,000,000	21,332,500	5,531,882	[redacted]					
2014 Total			$397,855,591	$363,875,051	$128,900,586						
2015	ADV Opportunities Fund I	Special Situations	50,000,000	53,420,909	7,425,158	58,455,617	12,459,866	1.2x	8.3%	Third	Third
2015	Advent Latin American Private Equity Fund VI	Buyout	25,000,000	17,425,000	5,000,000	17,733,054	5,308,054	1.3x	18.3%	Second	Second
2015	Audax Private Equity Fund V	Buyout	50,000,000	36,836,467	13,303,726	33,196,070	9,663,329	1.3x	16.7%	Second	Third
2015	Blackstone Capital Partners VII	Buyout	50,000,000	29,222,806	2,961,871	32,693,502	6,432,567	1.2x	17.4%	Second	Third
2015	Centerbridge Capital Partners III	Special Situations	30,000,000	19,320,874	6,196,230	19,850,912	6,726,268	1.3x	14.9%	Second	Second
2015	Clearlake Capital Partners IV	Special Situations	15,000,000	17,747,942	9,919,448	[redacted]					
2015	Francisco Partners IV	Buyout	25,000,000	24,656,280	13,481,280	32,404,368	21.229,368	1.9x	27.3%	First	First
2015	H.I.G. Bayside Loan Opp. Fund IV	Special Situations	25,000,000	17,671,163	10,688,197						
2015	H.I.G. Brazil and Latin America Partners	Buyout	50,000,000	20,988,594	9,139	[redacted]					
2015	Insight Venture Partners IX	Venture Capital	50,000,000	49,250,000	8,503,088	91,627,148	50,880,236	2.0x	29.4%	First	First
2015	Lightspeed India Partners I	Venture Capital	15,000,000	13,155,000	-						
2015	Primavera Capital Fund II	Buyout	50,000,000	52,132,478	3,728,092	[redacted]					
2015	Ridgemont Equity Partners II	Buyout	50,000,000	46,314,670	15,029,495	[redacted]					
2015	RRJ Capital Master Fund III	Special Situations	50,000,000	37,642,913	11,191,862	38,038,405	11,587,354	1.3x	16.5%	Second	Second
2015	Sterling Group Partners IV	Buyout	20,000,000	12,792,335	432,248	14,100,696	1,740,610	1.1x	7.9%	Third	Fourth
2015 Total			$555,000,000	$448,577,430	$107,869,836	[redacted]					
2016	Advent International GPE VIII-B	Buyout	50,000,000	42,050,000	-	51,749,782	9,699,782	1.2x	15.7%	Second	Second
2016	ASF VII B	Special Situations	100,000,000	34,740,238	5,735,152	[redacted]					
2016	ASF VII PA Co-Invest	Special Situations	50,000,000	21,643,723	998,004	[redacted]					
2016	FSN Capital V	Buyout	77,189,328	35,336,314	7,278,360	[redacted]					
2016	Permira VI	Buyout	56,202,000	38,480,132	-	45,249,807	6,769,675	1.2x	14.7%	Second	Third
2016	Providence Strategic Growth II	Venture Capital	60,000,000	63,619,121	38,573,480	[redacted]					
2016	Vista Equity Partners Fund VI	Buyout	150,000,000	162,890,528	35,980,028	[redacted]					
2016 Total			$543,391,328	$398,760,056	$88,565,024	[redacted]					
2017	Apollo Investment Fund IX	Buyout	85,400,000	8,174,793	884	NM	NM	NM	NM	NM	NM
2017	Asia Alternatives Capital Partners V	Buyout	50,000,000	7,353,488	143,561	NM	NM	NM	NM	NM	NM
2017	CVC Capital Partners VII	Buyout	91,202,040	14,786,945	318,774	NM	NM	NM	NM	NM	NM
2017	GTCR Fund XII	Buyout	32,500,000	8,047,000	286,544	[redacted]			NM	NM	[redacted]
2017	Horizon Impact Fund B	Buyout	100,000,000	38,750,000	-	NM	NM	NM	NM	NM	NM
2017	Insight Venture Partners X	Venture Capital	100,000,000	71,000,000	34,245	NM	NM	NM	NM	NM	NM
2017	Silver Lake Partners V	Buyout	78,000,000	31,307,930	-	NM	NM	NM	NM	NM	NM
2017	TDR Capital IV	Buyout	83,638,400	1,823,120	-	NM	NM	NM	NM	NM	NM
2017	Wind Point Partners VIII	Buyout	100,000,000	66,797,671	15,747,005	[redacted]					
2017 Total			$720,740,440	$248,040,947	$16,531,013						
2018	Audax Private Equity Fund VI	Buyout	75,000,000	-	-	NM	NM	NM	NM	NM	NM
2018	Clearlake Capital Partners V	Special Situations	55,000,000	26,430,270	830,199	NM	NM	NM	NM	NM	NM
2018	Hahn & Company III	Buyout	56,250,000	12,084,171	1,656	[redacted]					
2018	Hahn & Company III – Supplemental Fund	Buyout	18,750,000	7,592,032	1,126						
2018	Hellman & Friedman Capital Partners IX	Buyout	90,000,000	-	-	NM	NM	NM	NM	NM	NM
2018	Keystone Legacy Fund	Keystone Legacy Fund	500,000,000	5,759,594,929	7,116,342,924	882,711,978	2,239,459,973	1.4x	6.0%	NM	NM
2018	LLR Equity Partners V	Buyout	75,000,000	29,569,792	2,706,267	NM	NM	NM	NM	NM	NM
2018	NGP Keystone	Buyout	25,000,000	-	-	NM	NM	NM	NM	NM	NM
2018	NGP XII	Buyout	75,000,000	22,009,102	113,471	NM	NM	NM	NM	NM	NM
2018	Providence Strategic Growth III	Venture Capital	75,000,000	52,669,218	2,549,236	[redacted]					
2018	TCV X	Venture Capital	75,000,000	3,750,000	-	NM	NM	NM	NM	NM	NM
2018	Thoma Bravo Fund XIII	Buyout	75,000,000	26,793,430	-	NM	[redacted]	NM	NM	NM	NM
2018	TSG8	Buyout	100,000,000	1,362,253	-	[redacted]					
2018	Vista Equity Partners Fund VII	Buyout	75,000,000	10,276,037	11,098						
2018 Total			$1,370,000,000	$5,952,131,233	$7,122,555,977						

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Investments by Vintage Year

As of June 30, 2019

VINTAGE	FUND	SECTOR	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
2019	ASF VIII B	Special Situations	$100,000,000	$10,000	$0	[redacted]					
2019	ASF VIII PA Co-Invest	Special Situations	50,000,000	-	-						
2019	Blackstone Capital Partners VIII	Buyout	75,000,000	-	-	NM	NM	NM	NM	NM	NM
2019	Permira VII	Buyout	75,000,000	-	-	NM	NM	NM	NM	NM	NM
2019	Primavera Capital Fund III	Buyout	75,000,000	38,743,493	89,979	[redacted]					
2019	Providence Strategic Growth IV	Venture Capital	75,000,000	-	-						
2019 Total			$450,000,000	$38,753,493	$89,979						
Total: Active Investments			$9,154,147,590	$12,353,250,156	$14,985,234,019	$3,985,255,450	$6,617,239,314	1.5x	9.1%	Second	Second
Total: Liquidated Investments			$4,096,120,724	$4,010,681,840	$7,209,909,915	$0	$3,199,228,076	1.8x	16.5%	First	Second
Total: Commonwealth of Pennsylvania State Employees' Retirement System			$13,250,268,315	$16,363,931,996	$22,195,143,935	$3,985,209,504	$9,816,421,443	1.6x	12.2%	Second	Second

1. Commitment reflects original commitment including fx flucuations for non-usd funds.

2. Contributions includes management fees and expenses.

3. IRR performance for investments held less than two years is not meaningful.

4. Fund quartile rankings provided by Burgiss Private iQ as of June 30, 2019, and represents sector-comparable funds aggregated by vintage year, asset class and geography, with special situation funds benchmarked to All Private Equity. Total Buyout, Venture Capital and Special Situations are benchmarked by sector-comparable funds, which includes vintages in which SERS made commitments. Vintage year benchmarks compares Burgiss Private iQ vintage year by Global All Private Equity Benchmarks

Note: Keystone Legacy Fund performance represents since inception returns for all non-core funds combined and contributions and distributions reflect since inception cash flows for the non-core portfolio.

These figures have been prepared by Stepstone on behalf of SERS and have not been provided by any General Partner.

Past performance is not necessarily indicative of future results and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.

Exhibit B – Investments by Sector

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Private Equity Investments by Sector

As of June 30, 2019

SECTOR	FUND	VINTAGE	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
Buyout	ABRY Partners IV	2000	$35,000,000	$25,497,290	$74,633,973	[redacted]					
Buyout	ABRY Partners V	2004	45,000,000	41,742,771	83,293,903						
Buyout	ABRY Partners VI	2008	50,000,000	59,994,861	107,608,270						
Buyout	ABRY Partners VII	2011	30,000,000	37,852,221	48,702,195						
Buyout	ABRY Partners VIII	2014	25,000,000	28,901,530	11,682,961						
Buyout	Advent International GPE VI-A	2008	35,000,000	35,146,325	67,433,549	6,571,805	38,859,029	2.1x	16.9%	First	First
Buyout	Advent International GPE VII-B	2012	40,000,000	37,600,000	33,752,625	33,141,296	29,293,921	1.8x	16.1%	Second	Second
Buyout	Advent International GPE VIII-B	2016	50,000,000	42,050,000	-	51,749,782	9,699,782	1.2x	15.7%	Second	Second
Buyout	Advent Latin American Private Equity Fund IV	2007	30,000,000	30,797,073	39,725,921	6,444,835	15,373,683	1.5x	9.2%	Second	Second
Buyout	Advent Latin American Private Equity Fund V	2010	15,000,000	14,430,000	7,200,000	9,642,880	2,412,880	1.2x	3.3%	Fourth	Fourth
Buyout	Advent Latin American Private Equity Fund VI	2015	25,000,000	17,425,000	5,000,000	17,733,054	5,308,054	1.3x	18.3%	Second	Second
Buyout	Apollo Investment Fund IV	1997	75,000,000	74,838,620	124,814,033	85,586	50,060,999	1.7x	8.5%	Second	Second
Buyout	Apollo Investment Fund IX	2017	85,400,000	8,174,793	884	NM	NM	NM	NM	NM	NM
Buyout	Apollo Investment Fund V	2000	50,000,000	44,972,146	122,507,048	431,965	77,966,867	2.7x	38.8%	First	First
Buyout	Apollo Investment Fund VI	2005	40,000,000	38,911,805	64,467,407	746,105	26,301,706	1.7x	8.7%	Second	Second
Buyout	Asia Alternatives Capital Partners	2006	50,000,000	25,180,175	41,648,780	4,665,880	21,134,485	1.8x	11.2%	Second	First
Buyout	Asia Alternatives Capital Partners II	2007	50,000,000	28,867,904	38,236,443	30,160,736	39,529,275	2.4x	17.7%	First	First
Buyout	Asia Alternatives Capital Partners III	2012	50,000,000	53,341,818	34,787,177	49,410,042	30,855,401	1.6x	13.7%	Second	Second
Buyout	Asia Alternatives Capital Partners V	2017	50,000,000	7,353,488	143,561	NM	NM	NM	NM	NM	NM
Buyout	Asia Alternatives Korea Buyout Investors (Hahn & Co)	2011	7,000,000	8,643,252	9,137,898	5,702,293	6,196,939	1.7x	13.5%	Third	Second
Buyout	Audax Private Equity Fund	2000	35,000,000	36,839,098	56,057,910	[redacted]					
Buyout	Audax Private Equity Fund II	2005	25,000,000	25,517,152	45,240,610						
Buyout	Audax Private Equity Fund III	2007	37,000,000	42,498,691	80,644,845	2,410,188	40,556,342	2.0x	15.0%	First	Second
Buyout	Audax Private Equity Fund V	2015	50,000,000	36,836,467	13,303,726	33,196,070	9,663,329	1.3x	16.7%	Second	Third
Buyout	Audax Private Equity Fund VI	2018	75,000,000	-	-	NM	NM	NM	NM	NM	NM
Buyout	Berkshire Fund VI	2002	20,000,000	18,819,615	54,873,734	[redacted]					
Buyout	Berkshire Fund VII	2006	32,000,000	32,612,736	60,660,471						
Buyout	Berkshire Fund VIII	2011	30,000,000	30,492,170	29,747,778						
Buyout	Blackstone Capital IV	2001	75,000,000	69,086,898	191,122,894	3,216,423	125,252,419	2.8x	36.2%	First	First
Buyout	Blackstone Capital Partners V	2006	150,000,000	149,951,913	241,388,866	7,301,370	98,738,323	1.7x	7.6%	Second	Second
Buyout	Blackstone Capital Partners VII	2015	50,000,000	29,222,806	2,961,871	32,693,502	6,432,567	1.2x	17.4%	Second	Third
Buyout	Blackstone Capital Partners VIII	2019	75,000,000	-	-	NM	NM	NM	NM	NM	NM
Buyout	Blackstone Communications Partners I	2000	25,000,000	25,114,042	30,998,189	170,714	6,054,861	1.2x	6.3%	Second	Second
Buyout	Capvis Equity IV	2014	49,855,591	42,153,784	33,984,236	18,296,760	10,127,213	[redacted]			
Buyout	Carlyle Energy Mezzanine Opportunities Fund	2012	50,000,000	64,797,142	26,707,945	22,168,152	(15,921,045)	0.8x	(10.9%)	Fourth	Fourth
Buyout	CVC Capital Partners VII	2017	91,202,040	14,786,945	318,774	NM	NM	NM	NM	NM	NM
Buyout	Energy Spectrum Partners V	2007	28,326,735	27,661,855	51,487,729	[redacted]					
Buyout	Eureka Growth Capital III	2013	20,000,000	14,652,268	13,614,722	13,251,765	12,214,219	1.8x	47.7%	First	First
Buyout	Eureka II	2006	20,000,000	21,884,526	20,777,356	7,318,077	6,210,907	1.3x	5.1%	Third	Third
Buyout	Francisco Partners	2000	50,000,000	47,769,948	61,464,903	452,058	14,147,013	1.3x	4.4%	Second	Second
Buyout	Francisco Partners II	2006	30,000,000	29,383,916	41,240,515	5,064,784	16,921,382	1.6x	10.1%	Second	Second
Buyout	Francisco Partners III	2011	20,000,000	20,275,777	31,902,241	15,016,264	26,642,728	2.3x	20.8%	Second	First
Buyout	Francisco Partners IV	2015	25,000,000	24,656,280	13,481,280	32,404,368	21,229,368	1.9x	27.3%	First	First
Buyout	FSN Capital IV	2013	46,049,703	37,755,593	47,457,821	[redacted]					
Buyout	FSN Capital V	2016	77,189,328	35,336,314	7,278,360						
Buyout	Great Hill Equity Partners III	2006	35,000,000	35,000,000	41,935,541						
Buyout	Great Hill Equity Partners IV	2008	25,000,000	25,125,662	56,840,270						
Buyout	GTCR Fund XI	2014	25,000,000	22,337,831	15,362,006	[redacted]			25.8%	First	[redacted]
Buyout	GTCR Fund XII	2017	32,500,000	8,047,000	286,544	[redacted]			NM	NM	[redacted]
Buyout	GTCR IX	2006	50,000,000	47,916,718	86,149,702	[redacted]					
Buyout	GTCR VIII	2002	75,000,000	69,393,599	120,471,948						
Buyout	H.I.G. Brazil and Latin America Partners	2015	50,000,000	20,988,594	9,139	[redacted]					
Buyout	H.I.G. Europe Capital Partners II	2013	27,544,596	16,364,744	3,985,287						
Buyout	H.I.G. Growth Buyouts & Equity Fund II	2011	15,000,000	14,656,287	4,086,778						
Buyout	Hahn & Company II	2014	50,000,000	49,358,451	9,040,888						
Buyout	Hahn & Company III	2018	56,250,000	12,084,171	1,656						
Buyout	Hahn & Company III – Supplemental Fund	2018	18,750,000	7,592,032	1,126						
Buyout	HarbourVest IPEP III	1998	40,000,000	39,400,000	61,092,165	80,994	21,773,159	1.6x	8.6%	Second	Second
Buyout	Hellman & Friedman Capital Partners IX	2018	90,000,000	-	-	NM	NM	NM	NM	NM	NM

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Private Equity Investments by Sector

As of June 30, 2019

SECTOR	FUND	VINTAGE	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
Buyout	Hellman & Friedman Capital Partners VI	2006	$125,000,000	$119,913,412	$218,556,925	$6,130,684	$104,774,197	1.9x	12.9%	First	First
Buyout	Hellman & Friedman Capital Partners VIII	2014	50,000,000	49,055,284	4,699,979	53,622,042	9,266,737	1.2x	15.9%	Second	Fourth
Buyout	HIPEP V-Asia Pacific & Rest of World	2005	30,000,000	28,245,316	34,310,232	6,622,595	12,687,511	1.4x	6.3%	Third	Second
Buyout	Horizon Impact Fund	2014	50,000,000	39,004,802	10,399,736	47,868,354	19,263,288	1.5x	17.3%	Second	Second
Buyout	Horizon Impact Fund B	2017	100,000,000	38,750,000	-	NM	NM	NM	NM	NM	NM
Buyout	Horizon Strategic Fund - Carlyle Group	2014	100,000,000	86,130,870	26,652,737	93,283,807	33,805,674	1.4x	10.8%	Third	Second
Buyout	Incline Equity Partners III	2013	15,000,000	15,701,555	20,874,842	14,772,698	19,945,985	2.3x	33.9%	First	First
Buyout	Kelso VII	2003	40,000,000	41,194,550	65,845,731	767,495	25,418,676	1.6x	11.5%	Second	Second
Buyout	Kelso VIII	2007	150,000,000	146,269,405	164,521,918	30,779,441	49,031,954	1.3x	6.3%	Third	Third
Buyout	LLR Equity Partners II	2004	25,000,000	25,000,000	44,945,591	232,851	20,178,442	1.8x	12.2%	Second	Second
Buyout	LLR Equity Partners III	2008	30,000,000	29,108,722	51,222,009	5,404,040	27,517,326	1.9x	15.2%	Second	First
Buyout	LLR Equity Partners IV	2013	50,000,000	45,485,764	44,684,210	42,917,983	42,116,430	1.9x	26.7%	First	First
Buyout	LLR Equity Partners V	2018	75,000,000	29,569,792	2,706,267	NM	NM	NM	NM	NM	NM
Buyout	Madison Dearborn Capital Partners IV	2000	90,000,000	90,365,390	169,072,775	3,310,614	82,017,998	1.9x	14.2%	First	First
Buyout	Madison Dearborn Capital Partners V	2006	75,000,000	71,558,278	113,628,059	1,576,124	43,645,905	1.6x	7.2%	Second	Second
Buyout	Madison Dearborn Capital Partners VI	2008	50,000,000	51,131,247	83,530,324	25,114,672	57,513,749	2.1x	23.6%	First	First
Buyout	Newbridge Asia IV	2005	40,000,000	38,903,378	85,845,344	[redacted]					
Buyout	NGP Keystone	2018	25,000,000	-	-	NM	NM	NM	NM	NM	NM
Buyout	NGP XII	2018	75,000,000	22,009,102	113,471	NM	NM	1.0x	NM	NM	NM
Buyout	Oaktree Power Opportunities Fund III	2010	25,000,000	17,464,459	22,150,923	[redacted]					
Buyout	OCM/GFI Power Opportunities Fund II	2005	25,000,000	13,470,852	41,644,215	[redacted]					
Buyout	Penn Asia Investors	2012	133,000,000	81,472,349	36,002,134	90,496,040	45,025,825	1.6x	16.2%	Second	Second
Buyout	Permira European Fund II	2000	48,000,000	45,672,612	91,464,087	424,143	46,215,618	2.0x	21.6%	First	First
Buyout	Permira European Fund III	2003	115,960,000	127,340,454	217,778,356	512,326	90,950,228	1.7x	26.1%	First	Second
Buyout	Permira IV	2006	127,779,198	137,762,438	203,511,684	18,401,131	84,150,377	1.6x	8.6%	Second	Second
Buyout	Permira VI	2016	56,202,000	38,480,132	-	45,249,807	6,769,675	1.2x	14.7%	Second	Third
Buyout	Permira VII	2019	75,000,000	-	-	NM	NM	NM	NM	NM	NM
Buyout	Primavera Capital Fund II	2015	50,000,000	52,132,478	3,728,092	[redacted]					
Buyout	Primavera Capital Fund III	2019	75,000,000	38,743,493	89,979	[redacted]					
Buyout	Providence Equity Partners IV	2000	25,000,000	23,420,840	56,065,270	[redacted]					
Buyout	Providence Equity Partners V	2004	45,000,000	42,692,171	51,743,883	[redacted]					
Buyout	Providence Equity Partners VI	2007	50,000,000	53,946,228	58,171,556	[redacted]					
Buyout	Ridgemont Equity Partners II	2015	50,000,000	46,314,670	15,029,495	[redacted]					
Buyout	Sentinel Capital Partners V	2013	10,000,000	8,671,252	4,324,736	[redacted]					
Buyout	Silver Lake Partners V	2017	78,000,000	31,307,930	-	NM	NM	NM	NM	NM	NM
Buyout	Sterling Group Partners IV	2015	20,000,000	12,792,335	432,248	14,100,696	1,740,610	1.1x	7.9%	Third	Fourth
Buyout	TA X	2006	70,000,000	69,732,009	90,382,009	771,911	[redacted]				
Buyout	TDR Capital IV	2017	83,638,400	1,823,120	-	NM	NM	NM	NM	NM	NM
Buyout	Thoma Bravo Fund XIII	2018	75,000,000	26,793,430	-	NM	[redacted]	NM	NM	NM	NM
Buyout	TPG Asia V	2007	22,500,000	21,964,311	26,447,030	4,484,817	8,967,536	1.4x	6.5%	Third	Third
Buyout	TPG Partners III	1999	75,000,000	64,119,169	165,990,273	[redacted]					
Buyout	TPG Partners IV	2003	30,000,000	27,981,463	57,968,285	869,647	30,856,469	2.1x	15.3%	Second	First
Buyout	TPG Partners V	2006	100,000,000	92,531,812	125,076,000	7,054,651	39,598,839	1.4x	5.0%	Third	Second
Buyout	TPG Partners VI	2008	45,000,000	50,111,214	64,622,335	11,249,919	25,761,040	1.5x	10.4%	Second	Second
Buyout	TSG8	2018	100,000,000	1,362,253	-	[redacted]					
Buyout	Vista Equity Partners Fund VI	2016	150,000,000	162,890,528	35,980,028	[redacted]					
Buyout	Vista Equity Partners Fund VII	2018	75,000,000	10,276,037	11,098	[redacted]					
Buyout	Wind Point Partners VIII	2017	100,000,000	66,797,671	15,747,005	[redacted]					
Buyout Total			**$5,744,147,590**	**$4,243,556,675**	**$4,996,727,325**	**$1,832,389,593**	**$2,585,560,243**	**1.6x**	**13.6%**	**Second**	**Second**
Keystone Legacy Fund	Keystone Legacy Fund	2018	500,000,000	5,759,594,929	7,116,342,924	882,711,978	2,239,459,973	1.4x	6.0%	NM	NM
Keystone Legacy Fund Total			**$500,000,000**	**$5,759,594,929**	**$7,116,342,924**	**$882,711,978**	**$2,239,459,973**	**1.4x**	**6.0%**	**NM**	**NM**
Special Situations	ABRY Advanced Securities Fund	2007	25,000,000	23,508,684	38,682,209	[redacted]					
Special Situations	ABRY Mezzanine Partners	2001	30,000,000	26,731,187	49,707,116	[redacted]					
Special Situations	ABRY Senior Equity II	2006	30,000,000	28,282,103	44,960,375	[redacted]					
Special Situations	ADV Opportunities Fund I	2015	50,000,000	53,420,909	7,425,158	58,455,617	12,459,866	1.2x	8.3%	Third	Third
Special Situations	ASF VII B	2016	100,000,000	34,740,238	5,735,152	[redacted]					
Special Situations	ASF VII PA Co-Invest	2016	50,000,000	21,643,723	998,004	[redacted]					
Special Situations	ASF VIII B	2019	100,000,000	10,000	-	[redacted]					
Special Situations	ASF VIII PA Co-Invest	2019	50,000,000	-	-	[redacted]					

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Private Equity Investments by Sector

As of June 30, 2019

SECTOR	FUND	VINTAGE	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
Special Situations	Avenue Special Situations Fund VI	2010	$20,000,000	$20,068,464	$20,720,289	[redacted]					
Special Situations	AXA Secondary Fund III	2004	26,000,000	21,737,894	37,244,706						
Special Situations	AXA Secondary Fund III-2	2004	14,000,000	11,677,210	19,062,764						
Special Situations	AXA Secondary Fund IV	2006	80,000,000	70,134,752	98,638,689						
Special Situations	AXA Secondary Fund V B	2012	75,000,000	61,682,742	86,729,624						
Special Situations	Centerbridge Capital Partners I	2006	50,000,000	57,490,446	113,038,748	6,736,353	62,284,655	2.1x	19.4%	First	First
Special Situations	Centerbridge Capital Partners III	2015	30,000,000	19,320,874	6,196,230	19,850,912	6,726,268	1.3x	14.9%	Second	Second
Special Situations	Clearlake Capital Partners IV	2015	15,000,000	17,747,942	9,919,448	[redacted]					
Special Situations	Clearlake Capital Partners V	2018	55,000,000	26,430,270	830,199	NM	NM	NM	NM	NM	NM
Special Situations	Dover Street VII	2007	30,000,000	28,696,128	38,403,160	3,221,740	12,928,772	1.5x	9.5%	Second	Third
Special Situations	H.I.G. Bayside Debt & LBO Fund II	2008	30,000,000	30,996,778	45,748,556	[redacted]					
Special Situations	H.I.G. Bayside Loan Opp. Fund III	2013	50,000,000	40,418,122	30,839,392						
Special Situations	H.I.G. Bayside Loan Opp. Fund IV	2015	25,000,000	17,671,163	10,688,197						
Special Situations	KPS Special Situations Fund IV	2013	25,000,000	15,892,288	7,178,052	12,725,182	4,010,946	1.3x	20.2%	Second	Fourth
Special Situations	LBC Credit Partners III	2013	50,000,000	46,718,245	42,649,375	[redacted]		1.2x	8.3%	Third	Fourth
Special Situations	Lexington Capital Partners III	1999	35,000,000	34,516,449	43,363,378	[redacted]					
Special Situations	Lexington Capital Partners V	2001	75,000,000	74,623,418	125,170,164						
Special Situations	Lexington Capital Partners VI	2005	50,000,000	53,066,325	69,215,321						
Special Situations	Oaktree Capital Management	2004	40,000,000	40,582,060	138,594,329						
Special Situations	Oaktree Opportunities Fund IX	2013	50,000,000	50,000,000	21,447,715						
Special Situations	OCM Opportunities Fund V	2004	40,000,000	40,003,507	65,911,274						
Special Situations	OCM Opportunities Fund VI	2005	40,000,000	40,000,000	63,171,009						
Special Situations	OCM Opportunities Fund VII	2007	40,000,000	40,000,000	53,450,728						
Special Situations	OCM Opportunities Fund VII b	2007	40,000,000	36,000,000	61,488,034						
Special Situations	OCM Opportunities Fund VIII	2010	12,500,000	12,583,425	17,430,778						
Special Situations	OCM Opportunities Fund VIIIb	2010	12,500,000	12,500,000	12,123,310						
Special Situations	OCM Principal Opportunities Fund IV	2006	20,000,000	20,400,000	34,019,822						
Special Situations	Platinum Equity Capital Partners III	2013	50,000,000	45,516,573	61,303,698	18,899,947	34,687,072	1.8x	38.0%	First	Second
Special Situations	RRJ Capital Master Fund III	2015	50,000,000	37,642,913	11,191,862	38,038,405	11,587,354	1.3x	16.5%	Second	Second
Special Situations Total			**$1,565,000,000**	**$1,212,454,833**	**$1,493,276,864**	**$564,065,630**	**$844,887,662**	**1.7x**	**15.2%**	**First**	**First**
Venture Capital	Battery Ventures VIII	2007	25,000,000	25,050,751	55,602,642	[redacted]					
Venture Capital	Battery Ventures VIII Side Car Fund	2008	9,000,000	6,803,790	17,412,210						
Venture Capital	HarbourVest Partners VI	1999	200,000,000	196,586,055	250,693,463	1,629,031	55,736,439	1.3x	3.6%	Second	Second
Venture Capital	HarbourVest Partners VII	2003	75,000,000	73,687,500	105,087,881	14,082,848	45,483,229	1.6x	6.9%	Third	Second
Venture Capital	HarbourVest Partners VIII	2006	100,000,000	98,000,000	130,568,903	58,444,775	91,013,678	1.9x	10.9%	Second	First
Venture Capital	Insight Venture Partners IX	2015	50,000,000	49,250,000	8,503,088	91,627,148	50,880,236	2.0x	29.4%	First	First
Venture Capital	Insight Venture Partners VI	2007	30,000,000	32,244,177	73,211,458	8,388,669	49,355,951	2.5x	19.2%	First	First
Venture Capital	Insight Venture Partners VII	2011	20,000,000	21,319,992	35,746,037	22,683,421	37,109,466	2.7x	22.1%	Second	First
Venture Capital	Insight Venture Partners VIII	2013	50,000,000	52,250,000	54,139,530	49,994,405	51,883,934	2.0x	16.7%	Second	First
Venture Capital	Insight Venture Partners X	2017	100,000,000	71,000,000	34,245	NM	NM	NM	NM	NM	NM
Venture Capital	JMI Equity Fund VI	2007	40,000,000	40,000,246	67,630,800	[redacted]					
Venture Capital	JMI Equity Fund VII	2011	10,000,000	9,780,000	12,047,439						
Venture Capital	JMI Equity Fund VIII	2014	25,000,000	25,600,000	11,546,162						
Venture Capital	Lightspeed India Partners I	2015	15,000,000	13,155,000	-						
Venture Capital	Lightspeed Venture Partners VII	2005	18,000,000	18,000,000	49,449,448						
Venture Capital	Lightspeed Venture Partners VIII	2008	15,000,000	14,550,000	27,045,680						
Venture Capital	Meritech Capital Partners III	2006	35,000,000	35,000,000	190,791,007						
Venture Capital	Meritech Capital Partners IV	2011	20,000,000	19,400,000	24,718,878						
Venture Capital	Meritech Capital Partners V	2014	23,000,000	21,332,500	5,531,882						
Venture Capital	New Enterprise Associates 11	2003	25,000,000	25,000,000	62,741,850	3,098,379	40,840,229	2.6x	15.6%	Second	First
Venture Capital	New Enterprise Associates 12	2006	35,000,000	35,631,130	45,554,802	4,442,250	14,365,922	1.4x	6.6%	Second	Second
Venture Capital	New Enterprise Associates IX	1999	20,000,000	19,600,000	7,978,301	1,620,554	(10,001,145)	0.5x	(5.7%)	Third	Fourth
Venture Capital	New Enterprise Associates X	2000	35,000,000	35,028,000	33,995,586	7,421,557	6,389,143	1.2x	2.6%	Third	Third
Venture Capital	NewSpring Growth Capital II	2006	10,000,000	9,850,000	13,962,639	[redacted]					
Venture Capital	NewSpring Growth Capital III	2012	25,000,000	23,361,239	10,192,997						
Venture Capital	Providence Strategic Growth II	2016	60,000,000	63,619,121	38,573,480						
Venture Capital	Providence Strategic Growth III	2018	75,000,000	52,669,218	2,549,236						
Venture Capital	Providence Strategic Growth IV	2019	75,000,000	-	-						
Venture Capital	TCV X	2018	75,000,000	3,750,000	-	NM	NM	NM	NM	NM	NM

Commonwealth of Pennsylvania State Employees' Retirement System

Schedule of Private Equity Investments by Sector

As of June 30, 2019

SECTOR	FUND	VINTAGE	COMMITMENT[1]	CONTRIBUTIONS[2]	DISTRIBUTIONS	MARKET VALUE	GAIN/LOSS	TVM	IRR[3]	IRR RANK[4]	TVM RANK[4]
Venture Capital	Weathergage Venture Capital	2007	$25,000,000	$22,875,000	$29,841,174	$17,657,284	$24,623,458	2.1x	12.3%	Second	First
Venture Capital	Weathergage Venture Capital II	2010	25,000,000	23,250,000	13,736,090	38,759,161	29,245,251	2.3x	15.5%	Second	First
Venture Capital Total			**$1,345,000,000**	**$1,137,643,719**	**$1,378,886,906**	**$706,088,249**	**$947,331,436**	**1.8x**	**10.7%**	**Second**	**First**
Total: Active Investments			$9,154,147,590	$12,353,250,156	$14,985,234,019	$3,985,255,450	$6,617,239,314	1.5x	9.1%	Second	Second
Total: Liquidated Investments			$4,096,120,724	$4,010,681,840	$7,209,909,915	$0	$3,199,228,076	1.8x	16.5%	First	Second
Total: Commonwealth of Pennsylvania State Employees' Retirement System			**$13,250,268,315**	**$16,363,931,996**	**$22,195,143,935**	**$3,985,255,450**	**$9,816,467,389**	**1.6x**	**12.2%**	**Second**	**Second**

1. Commitment reflects original commitment including fx flucuations for non-usd funds.
2. Contributions includes management fees and expenses.
3. IRR performance for investments held less than two years is not meaningful.
4. Fund quartile rankings provided by Burgiss Private iQ as of June 30, 2019, and represents sector-comparable funds aggregated by vintage year, asset class and geography, with special situation funds benchmarked to All Private Equity. Total Buyout, Venture Capital and Special Situations are benchmarked by sector-comparable funds, which includes vintages in which SERS made commitments. Vintage year benchmarks compares Burgiss Private iQ vintage year by Global All Private Equity Benchmarks.

Note: Keystone Legacy Fund performance represents since inception returns for all non-core funds combined and contributions and distributions reflect since inception cash flows for the non-core portfolio.

These figures have been prepared by Stepstone on behalf of SERS and have not been provided by any General Partner.

Past performance is not necessarily indicative of future results and there can be no assurance that the fund will achieve comparable results or avoid substantial losses.

Definitions on Pages 29-35 - Redacted

ATTACHMENT D

PENNSYLVANIA SERS

pennsylvania
STATE EMPLOYEES' RETIREMENT SYSTEM

REAL ESTATE SEMI-ANNUAL PERFORMANCE REVIEW (2Q19)

December 3, 2019

BOSTON | ATLANTA | CHARLOTTE | CHICAGO | DETROIT | LAS VEGAS | PORTLAND | SAN FRANCISCO

Attachment to Board Motions relating to Commission Recommendation #24

TABLE OF CONTENTS

1. REAL ESTATE SEMI-ANNUAL PERFORMANCE REPORT

AS OF JUNE 30, 2019

NEPC, LLC

PORTFOLIO PERFORMANCE SUMMARY

The table below displays trailing time period performance for the Pennsylvania State Employees Retirement System ("PA SERS") Real Estate Portfolio as of June 30, 2019, along with select benchmarks

- The real estate portfolio had a strong trailing 1-year return, generating a total return of 9.0%, substantially outperforming both the core and non-core benchmarks
- [redacted]
- The Plan's Real Estate Performance is benchmarked against the NCREIF-ODCE Index (pool of open-end core funds) and ThomsonOne Benchmark (pool of closed-end value-add/opportunity funds), the two most widely used indices for real estate benchmarking
- The S&P 500 Index reflects one measure of opportunity cost of investing in real estate versus publicly traded common stocks

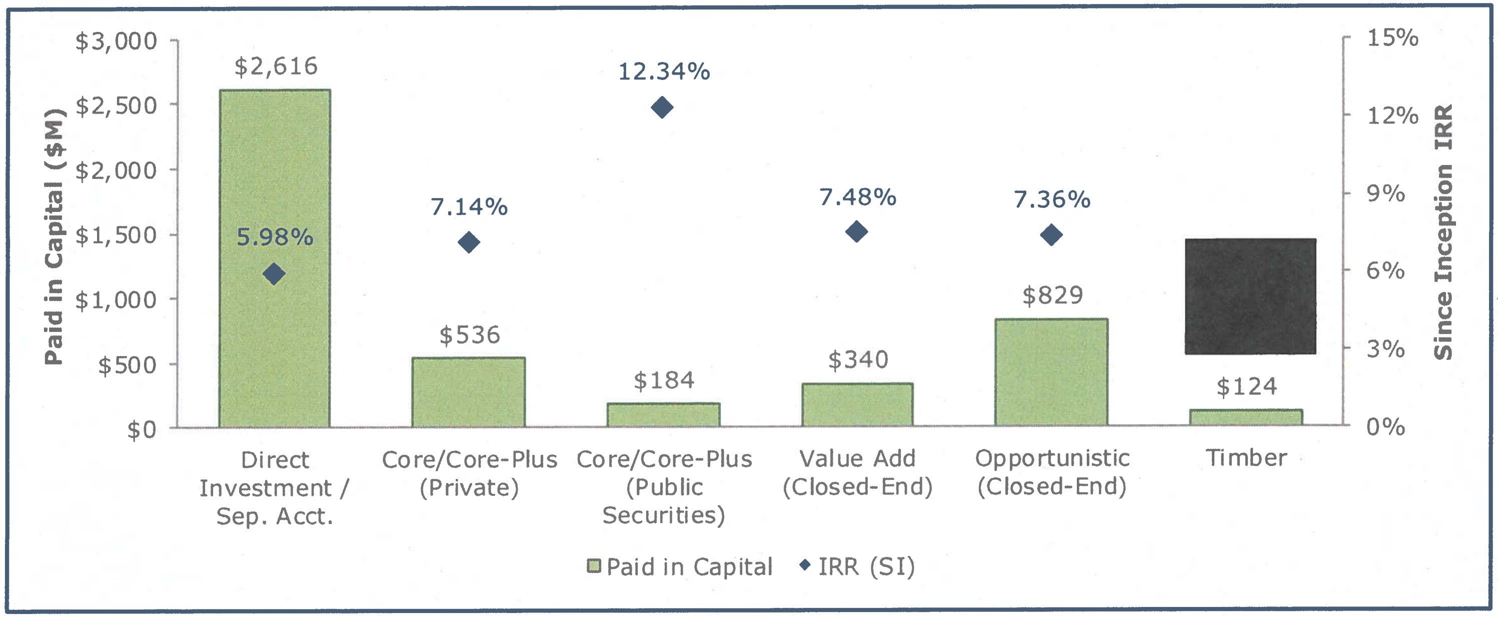
Portfolio Performance	YTD	1 Year	3 Year	5 Year	10 Year	Inception
Total Pennsylvania State Employees Retirement System	**6.1%**	**9.0%**	**1.3%**	**4.7%**	**7.2%**	**7.1%**
[redacted]						
NFI-ODCE Index [1]	***2.0%***	***5.5%***	***6.6%***	***8.8%***	***8.9%***	***N/A***
Thomson-One/Cambridge Real Estate Index [2]	***4.0%***	***6.6%***	***9.5%***	***10.2%***	***10.1%***	***N/A***
S&P 500 Index	***18.5%***	***10.4%***	***14.2%***	***10.7%***	***14.7%***	***N/A***

Data as of June 30, 2019. Sources include NCREIF, Thomson-One/Cambridge Associates, Manager data, and NEPC. Additional notes:

1. NFI-ODCE Index represents pooled returns of open-end comingled core funds in the ODCE Index; returns shown are time-weighted, net of fees.
2. Thomson-One/Cambridge Benchmark represents pooled horizon internal rate of return (IRR) calculations, net of fees, across 1,076 real estate funds (including value-add/opportunistic) from 1986 to 2018.
3. The timing and magnitude of fund cash flows are integral to the IRR performance. Benchmark indices that are time weighted measures should not be directly compared to dollar-weighted IRR calculations. Index data is continuously updated and is therefore subject to change.
4. Returns shown do not take into account risk/volatility of underlying strategies.

PERFORMANCE BY INVESTMENT STRATEGY

In aggregate, current (active) investments in the portfolio, which are not fully liquidated, can be summarized in the following:

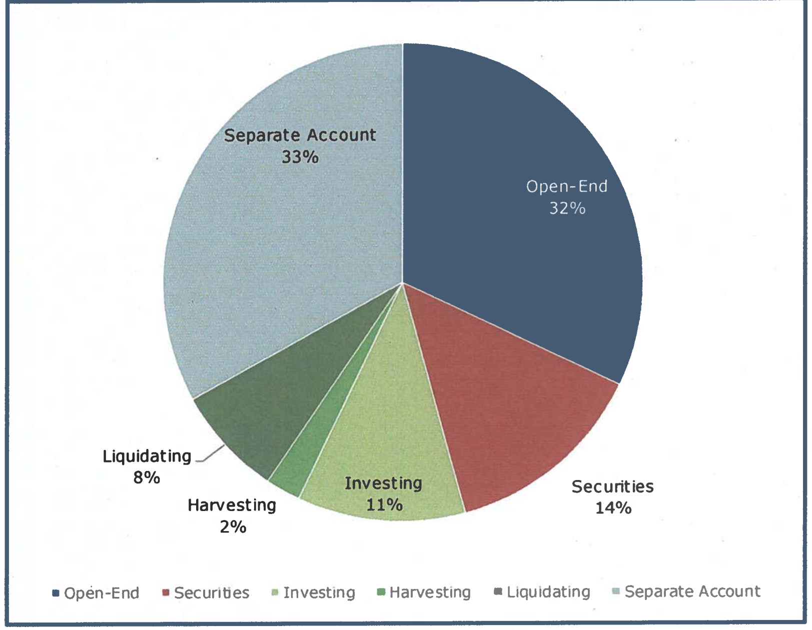


Investment Strategy (Active)	Commitment Amount	Paid in Capital	Capital to be Funded	Cumulative Distributions	Valuation	Total Value	Net Benefit	Call Ratio	DPI Ratio	TVPI Ratio	IRR (SI)
Direct Investment / Sep. Acct.	2,617,915,801	2,616,222,207	1,693,594	3,324,323,137	632,807,196	3,957,130,333	1,337,847,547	100%	1.27	1.51	5.98%
Core/Core-Plus (Private)	1,025,558,525	535,951,554	489,606,971	181,713,078	618,004,271	799,717,349	263,765,795	52%	0.34	1.49	7.14%
Core/Core-Plus (Public Securities)	183,616,773	183,616,773	0	36,168,336	264,952,776	301,121,112	117,504,339	100%	0.20	1.64	12.34%
Value Add (Closed-End)	624,414,747	339,643,988	284,770,760	361,672,405	114,844,428	476,516,834	120,951,883	54%	1.02	1.34	7.48%
Opportunistic (Closed-End)	1,061,477,955	829,220,565	232,257,390	920,157,793	294,134,063	1,214,291,856	369,681,157	78%	1.09	1.44	7.36%
Timber	124,231,969	124,231,969	0	242,367,376	[redacted]	[redacted]	[redacted]	100%	1.95	[redacted]	[redacted]
Total (Active Funds)	**5,637,215,770**	**4,628,887,055**	**1,008,328,715**	**5,066,402,125**	[redacted]	[redacted]	[redacted]	**82%**	**1.09**	[redacted]	[redacted]

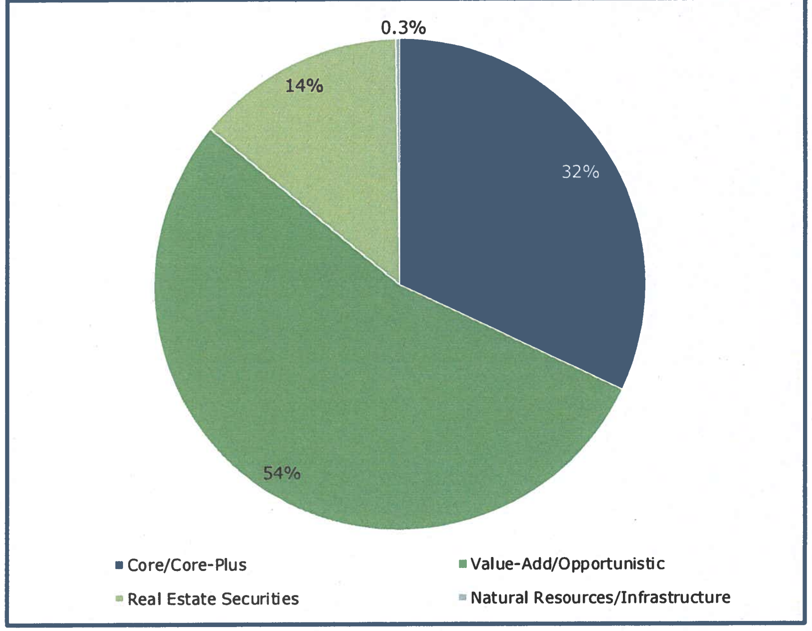
Data as of June 30, 2019. Liquidated investments not shown. Returns shown do not take into account risk/volatility of underlying strategies.

PORTFOLIO COMPOSITION

Allocation by Structure & Lifecycle



Allocation by Strategy

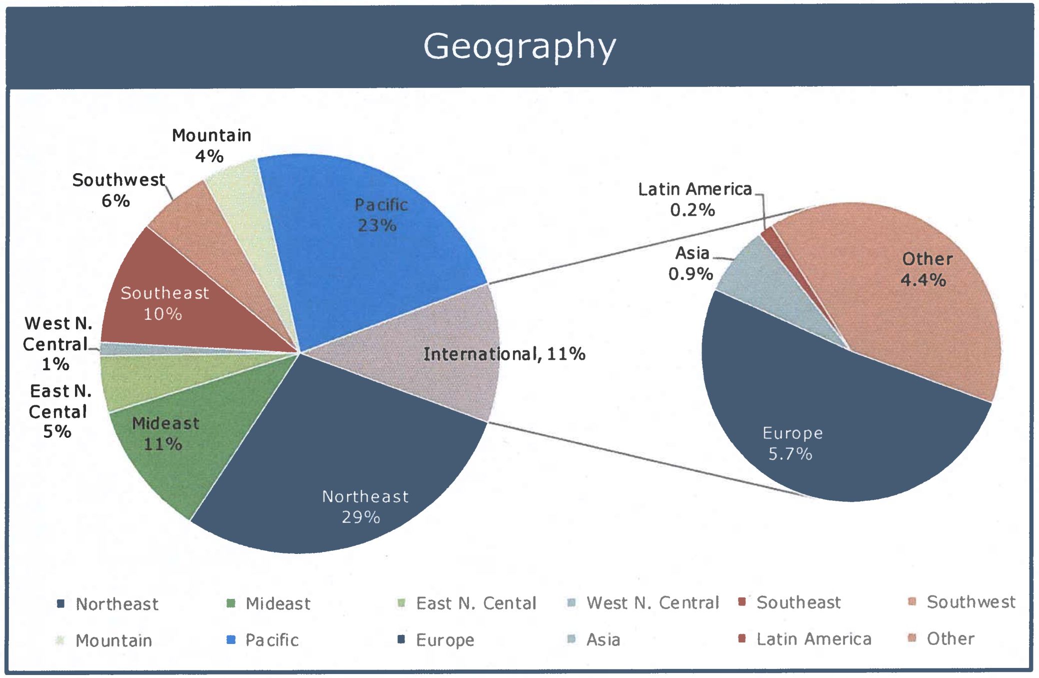


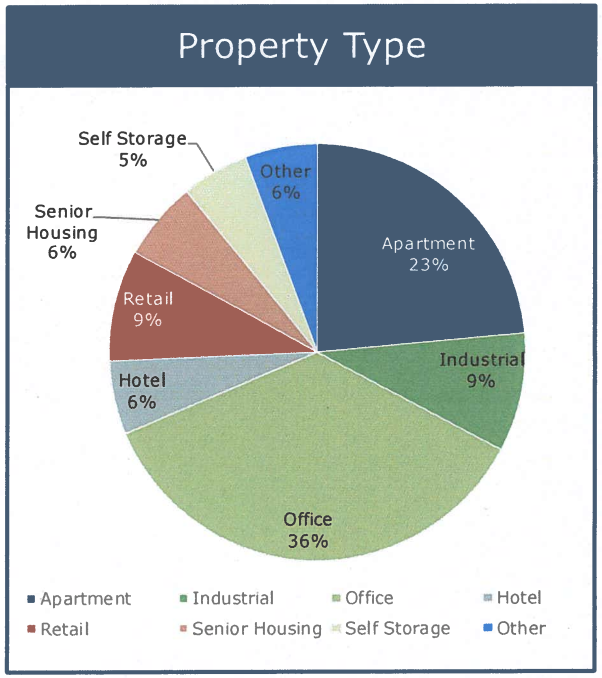
Structure / Lifecycle Stage	Commitment	Called Capital	Call Ratio	Uncalled Capital	Realized Value	Unrealized Value	Total Value	Gain / Loss	TVPI Ratio	DPI Ratio	RVPI
Open-End	1,025,558,525	535,951,554	52%	489,606,971	181,713,078	618,004,271	799,717,349	263,765,795	1.5x	0.3x	1.2x
Securities	183,616,773	183,616,773	100%	0	36,168,336	264,952,776	301,121,112	117,504,339	1.6x	0.2x	1.4x
Investing	455,145,833	200,163,633	44%	254,982,200	10,760,068	219,331,616	230,091,683	25,679,996	1.1x	0.1x	1.1x
Harvesting	89,663,402	64,794,451	72%	24,868,951	68,040,786	46,200,113	114,240,899	49,560,026	1.8x	1.1x	0.7x
Liquidating	941,083,467	903,906,469	96%	37,176,998	1,203,029,344	[redacted]	[redacted]	[redacted]	[redacted]	1.3x	[redacted]
Separate Account	2,742,147,771	2,740,454,177	100%	1,693,594	3,566,690,513	638,267,489	4,204,958,002	1,461,443,247	1.5x	1.3x	0.2x
Total	**5,637,215,770**	**4,628,887,055**	**82%**	**1,008,328,715**	**5,066,402,125**	[redacted]	[redacted]	[redacted]	[redacted]	**1.1x**	[redacted]

Data as of June 30, 2019. Returns shown do not take into account risk/volatility of underlying strategies.

PORTFOLIO DIVERSIFICATION

- **The Pennsylvania SERS real estate portfolio is broadly diversified by property type and geography within the U.S.**
- **Staff and NEPC have intentionally grown the portfolio's international exposure in recent years**
  - 11% of the portfolio is now invested outside the US, with 5.7% in Europe



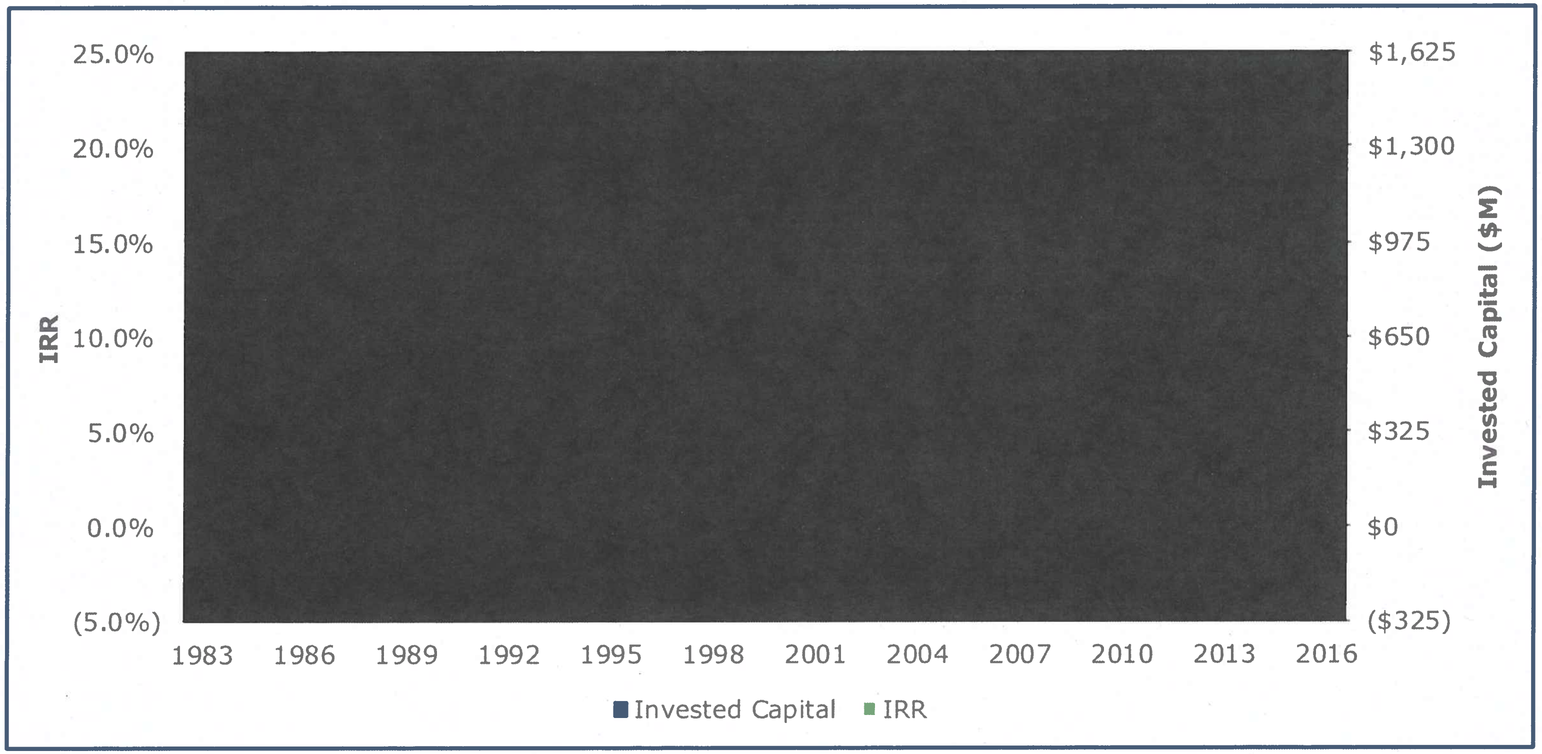


Data as of June 30, 2019. Breakouts provided by Managers.

HISTORICAL PERFORMANCE BY VINTAGE

The following chart illustrates capital invested and inception-to-date performance by vintage year as of June 30, 2019

- Inconsistent pacing has negatively impacted portfolio performance
- Staff and NEPC are focused on maintaining a consistent investment pacing schedule to mitigate the risk of heavy capital investments in poor vintage years



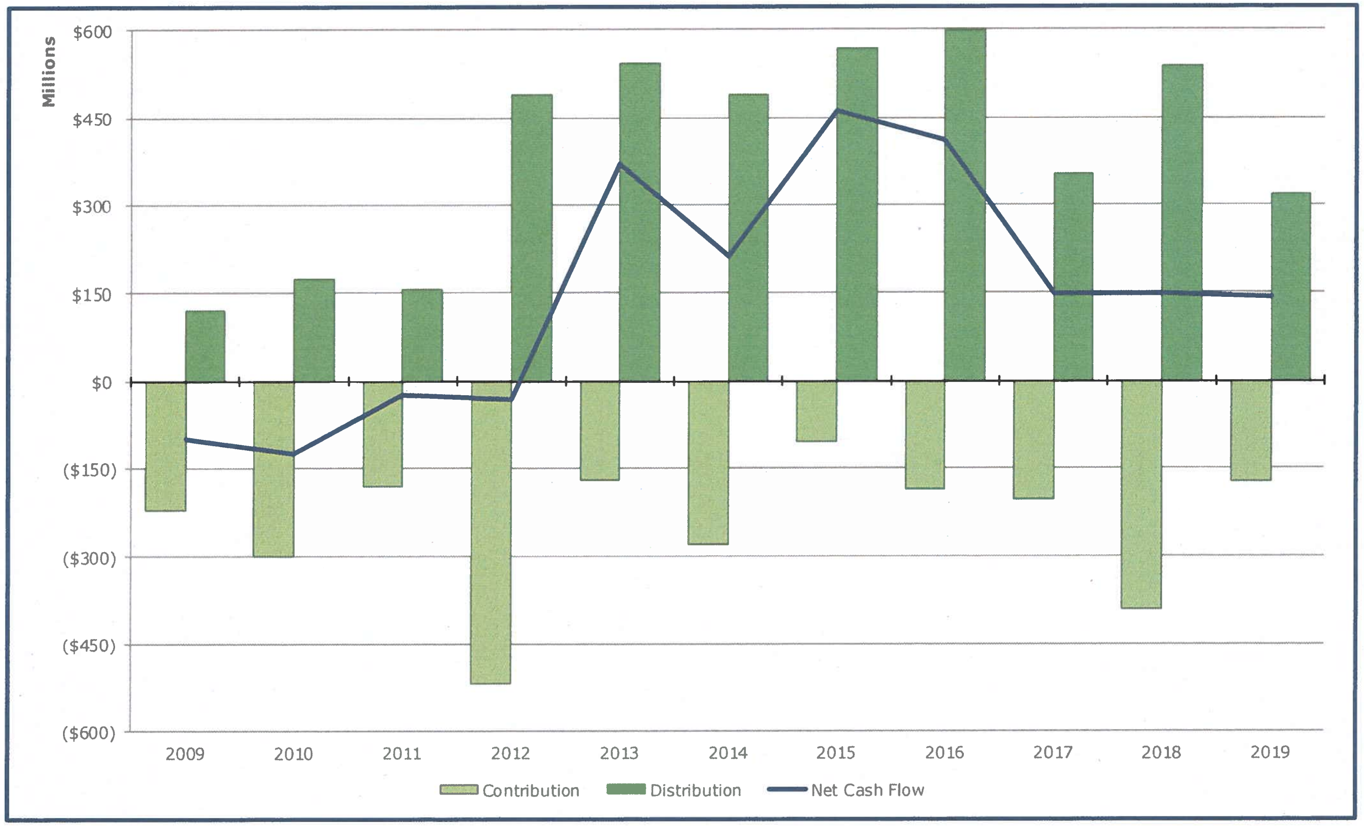
[redacted]

Data as of June 30, 2019. Notes:
1. Vintage years 2017 and later are excluded as data is less meaningful.
2. For separate accounts, the date of initial commitment or investment is used as the vintage year.

10-YEAR CASH FLOWS

The chart below illustrates the capital invested, distributed, and net cash flows for the real estate portfolio over the past 10 calendar years (and YTD 2019)

- The portfolio has been cash flow positive since 2013
- Drawdowns have increased in recent years, a trend which may continue in the near-term as recent commitments will call capital and the portfolio continues to grow



Data as of June 30, 2019. Offsetting cash flows have been excluded, such as assets that were transferred from one account to another.

2. REAL ESTATE PORTFOLIO CONSTRUCTION UPDATE

2019 REAL ESTATE PORTFOLIO UPDATE

- **In 2019, Staff and NEPC continued the portfolio repositioning that had been underway for the past several years**
- **New commitments in 2019 followed several target themes and initiatives:**
  - Focus on strategic partnerships with high quality managers
  - Expand the allocation to non-US real estate
  - Favor core-plus strategies over core
  - Allocate to attractive niche sectors
- **Looking ahead, the real estate pacing and strategic plan will be updated and presented to the Investment Committee**
  - This update (likely to be presented in Q1 2020) will provide more details on the objectives and expectations of the real estate portfolio going forward, and will incorporate the new asset allocation budget

[redacted]

NEPC

PORTFOLIO ACTIVITY SUMMARY

Real Assets Portfolio Sub-Strategy	Core/Core Plus	Value-Add/ Opportunistic	RE Securities	Real Assets (Timber, Infrastructure, etc.)
Return Profile	Income Driven	Income + Capital Appreciation	Income + Capital Markets	Various
Current Exposure (NAV) (as of 6/30/19)	*32%*	*54%*	*14%*	*< 1%*
Current Target Allocation	*35% +/- 20%*	*55% +/- 15%*	*10% +/- 10%*	*0-20%*
2019 YTD Activity	Henderson Park Enhanced Income ($300M) *(European Core+)*	Blue Moon Senior Housing II ($100M) *Prudential Senior Housing VI ($100M)* *Activum SG VI (€100M)*	Maintained Allocation	Timber portfolio liquidation continued

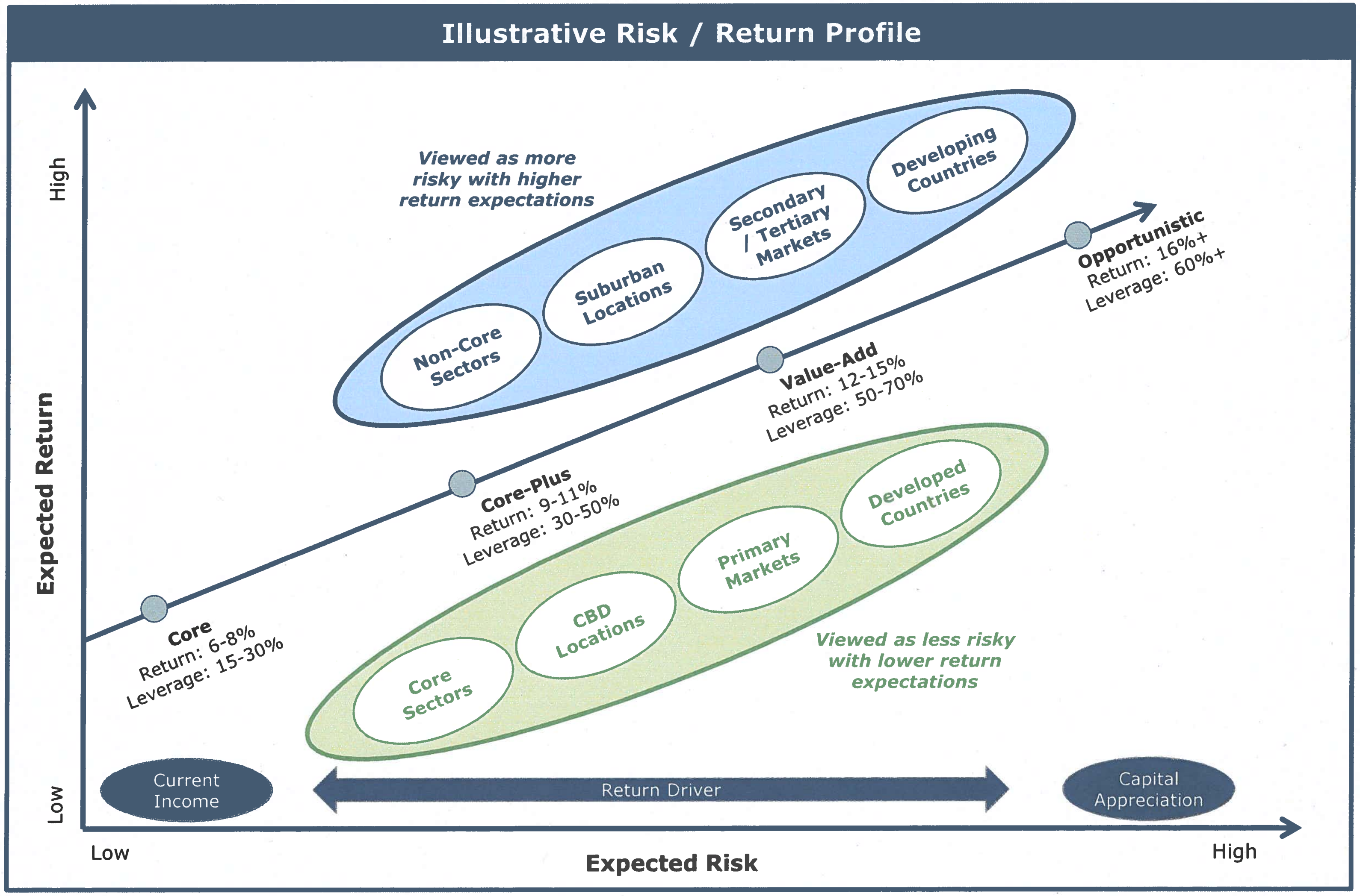
[redacted]

SPECTRUM OF REAL ESTATE INVESTMENT STRATEGIES

	Real Estate Investment Style / Overview	Investment Strategy	Portfolio Role	Considerations
Core Strategies	**Core / Core-Plus** • Return driver: income • Primary vehicle: open-end funds • Historical avg. returns: 7-8% / 8%-10% • Leverage: 15-40% / 40%-50% • Hold period: long-term	Stabilized income producing assets	• Current income • Broad exposure to commercial real estate (asset class beta) • Inflation protection	• Vehicles are semi-liquid (entrance/exit queues) • Limited alpha producing opportunities
	RE Securities • Return driver: income • Primary vehicle: REIT funds • Historical avg. returns: 7-9% • Leverage: 30-50% • Hold period: long-term	Stabilized income producing assets	• Current income (dividends) • Long-term exposure to commercial real estate (beta) • Long-term inflation protection	• Volatility • Equity correlation
Non-Core Strategies	**Value-Add** • Return driver: income/appreciation • Primary vehicle: varies • Historical avg returns: 8-10% • Leverage: 40-70% • Hold period: 3-5 years	Properties requiring lease-up, repositioning, renovation or rehabilitation	• Provides part current income and capital appreciation • Some inflation protection	• Vehicles are semi-liquid or illiquid • Vintage year is important • Higher leverage vs core • Poor benchmarks
	Opportunistic • Return driver: appreciation • Primary vehicle: closed-end funds • Historical avg. returns: 10-12% • Leverage: 60%+ • Hold period: varies	Distressed investments, recapitalizations, development, etc.	• Real estate alpha through capital appreciation with minimal current income	• Vehicles are illiquid • Vintage year is important • High leverage • Poor benchmarks

NEPC

RELATIVE EXPECTED RISK RETURN PROFILE



Notes:
- Debt-related strategies can span the illustrative risk / return spectrum depending on the specific strategy
- Manager-specific risk, operations and leverage can skew expected risk / return profile

APPENDIX 1:
INVESTMENT LEVEL PERFORMANCE

AS OF JUNE 30, 2019

ACTIVE INVESTMENTS

Investments			Trailing Period Returns (IRR) %							
Investment Name	Vintage Year	Commitment	QTD	YTD	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	Since Inception
AG Asia Realty Fund, L.P.	2007	25,000,000	[redacted]							
Apollo Real Estate Investment Fund III, L.P.	1998	50,000,000								
Blackstone Property Partners, L.P.	2017	300,000,000								NM
Blackstone Real Estate Partners IV, L.P.	2003	25,000,000								11.83%
Blackstone Real Estate Partners V, L.P.	2006	50,000,000								10.71%
Blackstone Real Estate Partners VI, L.P.	2007	75,000,000								12.77%
Blackstone Real Estate Partners VII, L.P.	2011	75,000,000								16.67%
Blue Moon Senior Housing II Sidecar L.P.	2019	50,000,000								
Blue Moon Senior Housing II, L.P.	2019	50,000,000								
BPG Investment Partnership IX, L.P.	2012	25,000,000	[redacted]							
BPG Investment Partnership V, L.P.	1999	25,000,000								
BPG Investment Partnership VI, L.P.	2002	25,000,000								
BPG Investment Partnership VII, L.P.	2005	25,000,000								
BPG Investment Partnership VIII, L.P.	2007	15,588,238								
C-III Recovery Fund III, L.P.	2017	100,000,000								
CenterSquare Real Estate Securities	2002	183,616,773	1.81%	18.46%	16.98%	9.18%	11.15%	11.72%	20.02%	12.34%
Clerestory Small Cap Real Estate Fund I - TE, L.P.	2010	18,000,000	[redacted]							
Colony Investors VIII, L.P.	2007	22,500,000								
Forest Separate Account	1992	124,231,969	-0.91%	-1.74%	-2.76%	-5.17%	-2.05%	-0.10%	-1.73%	4.32%
Heitman America Real Estate Trust, L.P.	2007	100,000,000	[redacted]							
Heitman Separate Account	1988	813,635,039								
Henderson Park Enhanced Income Fund, SCSp	2019	300,000,000	[redacted]							
HotelAVE Separate Account	2018	59,048,685	NM	NM	NM					NM
LaSalle Separate Account	1994	444,715,936	-0.06%	-1.37%	9.55%	8.63%	10.68%	13.96%	13.38%	9.70%
LaSalle Takeover Account	2018	236,217,434	NM	NM	NM					NM
LEM Real Estate High-Yield Debt & Preferred Equity Fund III, L.P.	2013	25,000,000	5.16%	7.61%	17.33%	18.11%	20.47%			23.67%
Lowe GTO Separate Account	2012	349,069,212	[redacted]							
Lowe Separate Account	1994	715,229,496								
Lubert-Adler Real Estate Fund VII, L.P.	2014	25,000,000	0.21%	1.29%	9.65%	8.92%				7.32%
Mesirow Financial Real Estate Value Fund III, L.P.	2018	25,000,000	NM	NM	NM					NM
Oak Street Real Estate Capital Fund IV, L.P.	2017	100,000,000	[redacted]							
Oak Street Real Estate Capital Net Lease Property Fund, L.P.	2018	300,000,000								
PLA Residential Fund III, L.P.	2008	29,654,968								
PLA Retail Fund I, L.P.	2006	25,000,000								
Rockpoint Finance Fund I, L.P.	2007	50,000,000								
Rockpoint Real Estate Fund II, L.P.	2005	35,000,000								
Rockpoint Real Estate Fund III, L.P.	2007	50,000,000								
Rockpoint Real Estate Fund V, L.P.	2015	50,000,000								

Data as of June 30, 2019.

ACTIVE INVESTMENTS (CONTINUED)

Investments			Trailing Period Returns (IRR) %							
Investment Name	Vintage Year	Commitment	QTD	YTD	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	Since Inception
Scout Fund I-A, L.P.	2009	75,000,000	129.86%	135.08%	140.93%	-7.21%	0.82%	16.28%	18.19%	15.31%
Scout Fund II-A, L.P.	2016	30,000,000	4.27%	6.92%	11.53%					6.88%
Senior Housing Partners IV, L.P.	2011	25,000,000	[redacted]							
Senior Housing Partners V, L.P.	2015	50,000,000								
Senior Housing Partners VI, L.P.	2019	100,000,000								
SRE Opportunity Fund III Select, L.P.	2018	50,000,000								
SRE Opportunity Fund III, L.P.	2018	50,000,000								
Starwood Global Opportunity Fund VII-A, L.P.	2006	35,000,000								
Starwood Global Opportunity Fund VIII, L.P.	2009	50,000,000								
Starwood Opportunity Fund VI, L.P.	2001	50,000,000								
Trumbull Property Fund, L.P.	1988	25,558,525	-3.90%	-3.28%	0.59%	4.33%	7.01%	7.68%	7.67%	6.93%
ValStone Opportunity Fund V, LLC	2014	14,663,402	-0.13%	3.36%	8.05%	4.64%				8.41%
Westbrook Real Estate Fund V, L.P.	2004	25,000,000	16.50%	16.31%	15.90%	4.43%	34.29%	24.01%	10.93%	43.59%
Westbrook Real Estate Fund VI, L.P.	2006	35,000,000	-4.33%	-1.68%	-1.38%	-0.72%	0.74%	13.06%	1.61%	0.24%
Westbrook Real Estate Fund VII, L.P.	2007	50,000,000	0.17%	0.48%	0.52%	0.94%	5.11%	11.67%	9.15%	2.98%
Westbrook Real Estate Fund VIII, L.P.	2009	50,000,000	0.11%	0.37%	1.14%	3.41%	5.56%	9.08%		11.50%
Total			[redacted]							

Data as of June 30, 2019.

PERFORMANCE BY STRATEGY

Investments		Commitments		Contributions & Distributions			Valuations			Performance		
Investment Name	Vintage Year	Commitment	Unfunded Commitment	Paid In Capital	Additional Fees	Cumulative Distributions	Valuation	Total Value	Net Benefit	DPI	TVPI	IRR
Core												
Heitman America Real Estate Trust, L.P.	2007	$100,000,000	$0	$100,000,000	[redacted]	$76,516,263	[redacted]					
Trumbull Property Fund, L.P.	1988	$25,558,525	$0	$25,558,525	$0	$104,908,574	$39,619,354	$144,527,928	$118,969,403	4.10	5.65	6.93%
Total Core		$125,558,525	$0	$125,558,525	[redacted]	$181,424,837	[redacted]					
Core Plus												
Blackstone Property Partners, L.P.	2017	$300,000,000	$0	$300,000,000	NM	$0	NM	NM	NM	NM	NM	NM
Henderson Park Enhanced Income Fund, SCSp	2019	$300,000,000	$206,000,000	$94,000,000	[redacted]	$0	[redacted]					
Oak Street Real Estate Capital Net Lease Property Fund, L.P.	2018	$300,000,000	$283,606,971	$16,393,029	NM	$288,241	NM	[redacted]				
Total Core Plus		$900,000,000	$489,606,971	$410,393,029	[redacted]	$288,241	[redacted]					
Direct Investment												
Heitman Separate Account	1988	$813,635,039	$0	$813,635,039	[redacted]	$1,092,759,873	[redacted]					
HotelAVE Separate Account	2018	$59,048,685	$0	$59,048,685		$2,000,000	NM	NM	NM	NM	NM	NM
LaSalle Separate Account	1994	$444,715,936	$0	$444,715,936		$778,848,456	$172,769,569	$951,618,025	$503,841,511	1.74	2.13	9.70%
Lasalle Takeover Account	2018	$236,217,434	$1,693,594	$234,523,840		$9,885,602	NM	NM	NM	NM	NM	NM
Lowe GTO Separate Account	2012	$349,069,212	$0	$349,069,212	$0	$369,841,373	$361,735	$370,203,108	$21,133,896	[redacted]		
Lowe Separate Account	1994	$715,229,496	$0	$715,229,496	$0	$1,070,987,833	$714,100	$1,071,701,933	$356,472,437			
Total Direct Investment		$2,617,915,801	$1,693,594	$2,616,222,207	[redacted]	$3,324,323,137	[redacted]					
REIT												
CenterSquare Real Estate Securities	2002	$183,616,773	$0	$183,616,773	[redacted]	$36,168,336	$264,952,776	$301,121,112	$117,504,339	0.20	1.64	12.34%
Total REIT		$183,616,773	$0	$183,616,773		$36,168,336	$264,952,776	$301,121,112	$117,504,339	0.20	1.64	12.34%
Timber												
Forest Separate Account	1992	$124,231,969	$0	$124,231,969	$0	$242,367,376	[redacted]			1.95	[redacted]	4.32%
Total Timber		$124,231,969	$0	$124,231,969	$0	$242,367,376				1.95		4.32%
Value Add												
Blue Moon Senior Housing II Sidecar L.P.	2019	$50,000,000	$50,000,000	$0	NM	$0	NM	NM	NM	NM	NM	NM
Blue Moon Senior Housing II, L.P.	2019	$50,000,000	$50,000,000	$0	NM	$0	NM	NM	NM	NM	NM	NM
BPG Investment Partnership IX, L.P.	2012	$25,000,000	$696,591	$24,303,409	[redacted]	$35,343,863	[redacted]					
BPG Investment Partnership V, L.P.	1999	$24,136,964	$0	$24,136,964		$43,926,194						
BPG Investment Partnership VI, L.P.	2002	$24,543,712	$0	$24,543,712		$41,584,267						
BPG Investment Partnership VII, L.P.	2005	$25,000,000	$0	$25,000,000		$12,588,893						
BPG Investment Partnership VIII, L.P.	2007	$15,588,238	$676,220	$14,912,018		$19,916,719						
Lubert-Adler Real Estate Fund VII, L.P.	2014	$25,000,000	$2,179,554	$22,820,446	$0	$7,410,076	$21,422,456	$28,832,532	$6,012,086	0.32	1.26	7.32%
Mesirow Financial Real Estate Value Fund III, L.P.	2018	$25,145,833	$13,744,059	$11,401,774	NM	$253,922	NM	NM	NM	NM	NM	NM
Oak Street Real Estate Capital Fund IV, L.P.	2017	$100,000,000	$67,474,336	$32,525,664	NM	$2,385,099	NM	[redacted]				
Senior Housing Partners VI, L.P.	2019	$100,000,000	$100,000,000	$0	[redacted]	$0	NM	NM	NM		[redacted]	
Westbrook Real Estate Fund V, L.P.	2004	$25,000,000	$0	$25,000,000	$2,200,785	$44,485,779	$6,398,065	$50,883,844	$23,683,059	1.64	1.87	43.59%
Westbrook Real Estate Fund VI, L.P.	2006	$35,000,000	$0	$35,000,000	$3,550,099	$37,571,397	$1,416,505	$38,987,902	$437,803	0.97	1.01	0.24%
Westbrook Real Estate Fund VII, L.P.	2007	$50,000,000	$0	$50,000,000	$6,006,377	$52,787,877	$13,993,211	$66,781,088	$10,774,711	0.94	1.19	2.98%
Westbrook Real Estate Fund VIII, L.P.	2009	$50,000,000	$0	$50,000,000	$4,080,480	$63,418,319	$10,211,546	$73,629,865	$19,549,385	1.17	1.36	11.50%
Total Value Add		$624,414,747	$284,770,760	$339,643,988	[redacted]	$361,672,405	[redacted]					

Data as of June 30, 2019.

PERFORMANCE BY STRATEGY (CONTINUED)

Investments		Commitments		Contributions & Distributions			Valuations			Performance		
Investment Name	Vintage Year	Commitment	Unfunded Commitment	Paid In Capital	Additional Fees	Cumulative Distributions	Valuation	Total Value	Net Benefit	DPI	TVPI	IRR
Opportunistic												
AG Asia Realty Fund, L.P.	2007	$25,000,000	$1,500,000	$23,500,000	[redacted]	$25,187,500	$2,153,910	$27,341,410	$3,841,410	1.07	[redacted]	[redacted]
Apollo Real Estate Investment Fund III, L.P.	1998	$50,000,000	$0	$50,000,000	[redacted]	$74,963,869	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Blackstone Real Estate Partners IV, L.P.	2003	$25,000,000	$0	$25,000,000	$0	$39,658,595	$864,075	$40,522,670	$15,522,670	1.59	1.62	11.83%
Blackstone Real Estate Partners V, L.P.	2006	$50,000,000	$2,087,026	$47,912,974	$0	$95,150,783	$4,191,872	$99,342,655	$51,429,681	1.99	2.07	10.71%
Blackstone Real Estate Partners VI, L.P.	2007	$75,000,000	$3,680,925	$71,319,075	$281,339	$146,966,874	$7,632,508	$154,599,382	$82,998,968	2.05	2.16	12.77%
Blackstone Real Estate Partners VII, L.P.	2011	$75,000,000	$10,496,700	$64,503,300	$1,592,492	$80,900,158	$46,218,449	$127,118,607	$61,022,815	1.22	1.92	16.67%
C-III Recovery Fund III, L.P.	2017	$100,000,000	$56,316,190	$43,683,810	[redacted]	$0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Clerestory Small Cap Real Estate Fund I - TE, L.P.	2010	$18,000,000	$2,771,044	$15,228,956	[redacted]	$14,848,913	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Colony Investors VIII, L.P.	2007	$22,500,000	$844,200	$21,655,800	[redacted]	$7,962,017	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
LEM Real Estate High-Yield Debt & Preferred Equity Fund III, L.P.	2013	$25,000,000	$21,992,807	$3,007,193	$0	$22,077,013	[redacted]	[redacted]	[redacted]	7.34	[redacted]	23.67%
PLA Residential Fund III, L.P.	2008	$29,654,968	$4,946,219	$24,708,749	[redacted]	$13,444,991	$734,735	$14,179,726	-$10,529,023	0.54	[redacted]	[redacted]
PLA Retail Fund I, L.P.	2006	$2,271,117	$0	$2,271,117	[redacted]	$8,162,626	$450,673	$8,613,299	$6,342,182	3.59	[redacted]	[redacted]
Rockpoint Finance Fund I, L.P.	2007	$2,527,500	$0	$2,527,500	[redacted]	$2,106,094	[redacted]	[redacted]	[redacted]	0.48	[redacted]	[redacted]
Rockpoint Real Estate Fund II, L.P.	2005	$34,138,784	$0	$34,138,784	[redacted]	$30,679,156	[redacted]	[redacted]	[redacted]	0.82	[redacted]	[redacted]
Rockpoint Real Estate Fund III, L.P.	2007	$50,632,887	$4,241,165	$46,391,722	[redacted]	$66,888,445	[redacted]	[redacted]	[redacted]	1.32	[redacted]	[redacted]
Rockpoint Real Estate Fund V, L.P.	2015	$50,000,000	$13,062,181	$36,937,819	[redacted]	$5,062,127	[redacted]	[redacted]	[redacted]	0.13	[redacted]	[redacted]
Scout Fund I-A, L.P.	2009	$75,000,000	$0	$75,000,000	$0	$116,533,142	$1,061,688	$117,594,830	$42,594,830	1.55	1.57	15.31%
Scout Fund II-A, L.P.	2016	$30,000,000	$2,369,921	$27,630,079	$0	$391,698	$31,159,142	$31,550,840	$3,920,762	0.01	1.14	6.88%
Senior Housing Partners IV, L.P.	2011	$22,089,297	$1,289,781	$20,799,516	[redacted]	$17,562,020	$20,749,753	$38,311,774	$17,512,257	0.84	[redacted]	[redacted]
Senior Housing Partners V, L.P.	2015	$50,000,000	$11,015,513	$38,984,487	[redacted]	$2,667,222	$46,709,511	$49,376,732	$10,392,246	0.07	[redacted]	[redacted]
SRE Opportunity Fund III Select, L.P.	2018	$50,000,000	$50,000,000	$0	[redacted]	$0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SRE Opportunity Fund III, L.P.	2018	$50,000,000	$41,000,000	$9,000,000	[redacted]	$0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Starwood Global Opportunity Fund VII-A, L.P.	2006	$35,000,000	$0	$35,000,000	[redacted]	$25,486,147	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Starwood Global Opportunity Fund VIII, L.P.	2009	$50,000,000	$4,643,719	$45,356,281	[redacted]	$68,465,826	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Starwood Opportunity Fund VI, L.P.	2001	$50,000,000	$0	$50,000,000	[redacted]	$51,782,742	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
ValStone Opportunity Fund V, LLC	2014	$14,663,402	$0	$14,663,402	$375	$3,209,834	$16,526,990	$19,736,824	$5,073,047	0.22	1.35	8.41%
Total Opportunistic		$1,061,477,955	$232,257,390	$829,220,565	[redacted]	$920,157,793	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total		$5,637,215,770	$1,008,328,715	$4,628,887,055	[redacted]	$5,066,402,125	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

NEPC

Data as of June 30, 2019.

APPENDIX 2:
DISCLAIMERS & DISCLOSURES

DISCLAIMER

- Past performance is no guarantee of future results.
- The opinions presented herein represent the good faith views of NEPC as of the date of this report and are subject to change at any time.
- Information used to prepare this report was obtained directly from the investment managers or custodians, and market index data was provided by other external sources. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.
- This report may contain confidential or proprietary information and may not be copied or redistributed to any party not legally entitled to receive it.

ALTERNATIVE INVESTMENT DISCLOSURES

In addition, it is important that investors understand the following characteristics of non-traditional investment strategies including hedge funds, real estate and private equity:

1. Performance can be volatile and investors could lose all or a substantial portion of their investment
2. Leverage and other speculative practices may increase the risk of loss
3. Past performance may be revised due to the revaluation of investments
4. These investments can be illiquid, and investors may be subject to lock-ups or lengthy redemption terms
5. A secondary market may not be available for all funds, and any sales that occur may take place at a discount to value
6. These funds are not subject to the same regulatory requirements as registered investment vehicles
7. Managers may not be required to provide periodic pricing or valuation information to investors
8. These funds may have complex tax structures and delays in distributing important tax information
9. These funds often charge high fees
10. Investment agreements often give the manager authority to trade in securities, markets or currencies that are not within the manager's realm of expertise or contemplated investment strategy

ATTACHMENT E

SERS' Defined Benefit Plan Investment Policy Statement

Commonwealth of Pennsylvania
State Employees' Retirement System

Adopted by SERS' Board on December 4, 2019

pennsylvania
STATE EMPLOYEES' RETIREMENT SYSTEM

Table of Contents

1. Introduction

The State Employees' Retirement Fund ("Fund") was established in 1923 by an act of the Pennsylvania legislature. The purpose of the Fund is the accumulation of funds exclusively for the benefit of the members and beneficiaries of members of the State Employees' Retirement System ("SERS" or the "System") for the payment of withdrawal, retirement, disability, and death benefits as provided in Pennsylvania Consolidated Statutes Title 71, Part XXV ("Retirement for State Employees and Officers"). The Fund is under the exclusive control and management of an eleven-member Board of Trustees ("Board"). For the purposes of this document, the term Board shall include the full Board and/or committees established by the Board.

In addition to administering a multiple-employer, cost-sharing defined benefit plan, SERS also administers a defined contribution plan, and a voluntary deferred compensation plan. This Investment Policy Statement primarily focuses on the defined benefit plan investments.

SERS' defined benefit plan is funded from investment earnings, employer contributions and employee contributions. It is the responsibility of SERS' investment professional staff, on behalf of the Board, to safeguard and invest the assets in a fiduciary capacity, solely in the interest of the members of the system.

2. Purpose

This Investment Policy Statement ("IPS" or "Policy") specifically outlines the investment philosophy and practices of SERS and has been developed to serve as the governing policy for the management of the System's defined benefit assets. The purpose of this Policy is to formalize the Board's investment objectives and policies, and to define the duties and responsibilities of the various individuals and entities involved in the investment process.

This is an official investment policy document of SERS. Deviation from this document is not permitted without explicit written permission, in advance, from the Board.

This Policy may be amended by a majority vote of the Board.

3. Authority

The Board's investment authority is governed by the "prudent expert" standard as set forth in Title 71, Pennsylvania Consolidated Statutes, Section 5931(a):

> **Control and management of fund.** The members of the board shall be the trustees of the fund. Regardless of any other provision of law governing the investments of funds under the control of an administrative board of the State government, the trustees shall have exclusive control and management of the said fund and full power to invest the same in accordance with the provisions of this section, subject, however, to the exercise of that degree of judgment, skill and care under the circumstances then prevailing which persons of prudence, discretion and intelligence, who are familiar with such matters, exercise in the management of their own affairs not in regard to speculation, but in regard to the permanent disposition of the funds, considering the probable income to be derived therefrom as well as the probable safety of their capital. The trustees shall have the power

to hold, purchase, sell, lend, assign, transfer or dispose of any of the securities and investments in which any of the moneys in the fund shall have been invested as well as of the proceeds of said investments, including any directed commissions which have accrued to the benefit of the fund as a consequence of the investments, and of any moneys belonging to said fund, subject in every case to meeting the standard of prudence set forth in this subsection.

No provision of this Policy shall be construed in contravention of the Board's statutory investment authority found in Title 71, Pennsylvania Consolidated Statutes, Section 5931.

4. Fiduciary Responsibility of the Board, Employees and Agents

In exercising this fiduciary responsibility, the members of the Board, employees of the Fund, and agents of the Fund are governed by the "prudent expert" standard and the exclusive benefit standard. The exclusive benefit standard requires these parties to act solely within the interests of SERS' participants and beneficiaries, and for the exclusive purpose of providing benefits to participants and beneficiaries.

Title 71, Pennsylvania Consolidated Statutes, Section 5931(e) provides, in part, as follows:

> **Fiduciary status of the board.** The members of the board, employees of the board and agents thereof shall stand in a fiduciary relationship to the members of the system regarding the investments and disbursements of any of the moneys of the fund and shall not profit either directly or indirectly with respect thereto.
>
> **[In reference to Pennsylvania-based investments]** The board may, when possible and consistent with its fiduciary duties imposed by this subsection or other law, including its obligation to invest and manage the fund for the exclusive benefit of the members of the system, consider whether an investment in any project or business enhances and promotes the general welfare of this Commonwealth and its citizens, including, but not limited to, investments that increase and enhance the employment of Commonwealth residents, encourage the construction and retention of adequate housing and stimulate further investment and economic activity in this Commonwealth.

5. Roles and Responsibilities

A. Board

The members of the Board are responsible as trustees for the proper management of the assets of the Fund.

In carrying out these duties, the Board is responsible for:

1. Approving the IPS that serves as the governing policy for the management of the System's assets.

2. Approving a long-term target asset allocation with asset class objectives and benchmarks as defined in the IPS.

3. Approving the engagement and termination of investment managers/funds and investment consultants. With regard to engagement and termination of investment managers/funds, the Board seeks recommendations from Investment Office Staff and consultants in a joint or separate recommendation memo/analysis.

4. Approving the Comprehensive Annual Financial Report.

5. Approving the annual actuarial report, assumptions, and funding level. Approving an actuarial experience study that is to be conducted no less than every five years.

6. Approving proxy voting guidelines.

7. Reviewing the investment performance and risk characteristics of the Fund.

8. Reviewing the results of an asset/liability study on a periodic basis, but not less than every five years.

9. Oversight and monitoring of staff including, but not limited to the hiring of the Chief Investment Officer, the Executive Director, the Director of Internal Audit, and the Chief Compliance Officer.

Act 5 of 2017 established additional duties for the Board. Specifically, Title 71, Pennsylvania Consolidated Statutes, Section 5902(q)(2) provides, in part, as follows:

> **Limitation on fees charged to the board.** In order to strive towards actuarial savings of $1,500,000,000 over 30 years from the effective date of this subsection while achieving the assumed annual rate of return at the least cost and maximum return on the system assets, the board shall:
>
> Consider the findings and recommendations of the Public Pension Management and Asset Investment Review Commission. The board shall, at its discretion, adopt guidelines and procedures to implement any recommendations of the Public Pension Management and Asset Investment Review Commission that the board believes will ensure the highest return on investment at the lowest responsible cost.
>
> Review, identify and implement any investment fee reduction and cost avoidance strategies identified to be prudent by the board, to reduce expenditures for investment.

B. Executive Director (Secretary)

Title 71, Pennsylvania Consolidated Statutes, Section 5902(a.1) provides, in part, as follows:

> **Secretary.** The secretary shall act as chief administrative officer for the board with respect to both the system and the plan. In addition to other powers and duties conferred upon and delegated to the secretary by the board, the secretary shall:
>
> 1. Serve as the administrative agent of the board.
> 2. Serve as liaison between the board and applicable legislative committees, the Treasury Department, the Department of the Auditor General, and between the board and the investment counsel and the mortgage supervisor in arranging for investments to secure maximum returns to the fund.
> 3. Review and analyze proposed legislation and legislative developments affecting the system or the plan and present findings to the board, legislative committees, and other interested groups or individuals.
> 4. Direct the maintenance of files and records and preparation of periodic reports required for actuarial evaluation studies.
> 5. Receive inquiries and requests for information concerning the system or the plan from the press, Commonwealth officials, State employees, the general public, research organizations, and officials and organizations from other states, and provide information as authorized by the board.
> 6. Supervise a staff of administrative, technical, and clerical employees engaged in record-keeping and clerical processing activities for both the system and the plan in maintaining files of members and participants, accounting for contributions, processing payments to annuitants and terminated participants, preparing required reports, and retirement counseling.

C. Investment Office Staff

The Chief Investment Officer is charged with the coordination of all investment-related matters within the System and supervision of Investment Office Staff. The Chief Investment Officer is responsible for the day-to-day administration of investment-related matters in accordance with Board policies. In general, the Chief Investment Officer is responsible for the following day-to-day investment-related activities:

1. Authorize receipt or payment for the acquisition or disposition of investments.
2. Act as liaison on behalf of the Board with all investment-related contractors.
3. Review investment transactions for conformity to certain applicable laws, regulations, each manager's investment strategy statement, and this Policy.

4. Review investment proposals presented by investment managers, and where appropriate, summarize and recommend the same for Board consideration.

5. Review and summarize for the Board pertinent information from relevant publications, discussions, meetings, and research on current investment related topics.

6. Respond to inquiries from the Board and Pennsylvania Legislature, the membership, the press, other governmental representatives, and the public concerning the investments of the Fund.

7. Provide an annual update to the Board summarizing what was accomplished over the past year and what the Fund will be doing in the next year in order to implement Policy Target Asset Allocation.

8. Update the IPS on an annual basis for Board review and approval.

9. Update investment-related policies and processes, and as appropriate, present to the Board for approval.

10. Perform such other duties as may be required to implement this Policy.

D. Internal Audit

The Director of Internal Audit reports functionally to the Audit, Risk, and Compliance Committee and administratively to the Executive Director. The internal audit department is independent of the System's operational activity and is responsible for providing objective audit and review services for the entire System, including the Investment Office. Internal audit's services emphasize the promotion of adequate and effective internal controls at a reasonable cost and result in suggested improvements that will lead to economies and efficiencies in the Systems' operations.

E. Chief Compliance Officer

The Chief Compliance Officer reports functionally to the Audit, Risk, and Compliance Committee and administratively to the Chief Counsel. The Chief Compliance Officer is responsible for, among other duties, monitoring the compliance activities of the Investment Office, with tasks including:

1. identifying potential areas of compliance vulnerability and risk;
2. assisting with the development, and implementation of risk management, and mitigation for resolution of problematic issues, and
3. providing guidance on how to avoid or address similar situations in the future.

F. Investment Consultants

The general and specialty consultants should be free of conflicts of interest or, where they potentially exist, make complete and total disclosure to the Board and obtain pre-clearance from the Board. The Board shall determine their specific responsibilities, which shall be set forth in their respective contracts with the Board.

General Investment Consultant

The general investment consultant makes recommendations to the Board on asset allocation, investment structure, policies, the investment managers' implementation of policy and strategy, and the appropriate investment horizon for the Fund given its actuarial characteristics, and provide such other research as may be needed from time to time. The general investment consultant also assists with investment manager searches, performance measurement and performance monitoring. The general investment consultant provides other services as contractually agreed upon with the Board and Investment Office Staff.

Specialty Investment Consultants

The Board may retain other investment consultants as required for specialized needs, such as for particular asset classes or unique investment projects. These specialty consultants will report to the Board on emerging trends and issues that are germane to their respective assignments and that are of concern to public pension funds generally and to the Fund in particular. Within the scope of their assignments, the specialty consultants will also analyze and make recommendations with respect to this Policy, the investment managers' implementation of policy and strategy, and provide such other research as may be needed from time to time. Specialty investment consultants provide other services as contractually agreed upon with the Board and Investment Office Staff.

G. Investment Managers

All external investment managers shall be retained pursuant to written contracts. Investment managers shall construct and manage investment portfolios consistent with the investment philosophy and disciplines for which the Board retained them and their specific investment guidelines, all of which shall be set forth in their investment objectives and guidelines. The guidelines shall be subject to periodic amendment at the discretion of the Board.

It is the Board's policy to limit the allocation of Fund investments such that no more than 15% of the total market value of Fund assets should be invested in any one investment product offered by an investment manager, except where management of such investments is of a passive nature (e.g., index funds).

Each manager's benchmark will reflect that manager's particular style or strategic role in SERS' investment process. Each benchmark will be clearly specified, measurable, and replicable (when possible). Benchmarks do not have to be published or widely recognized; they may be "customized" for a particular investment style or styles. The benchmark shall be determined in advance of funding by mutual agreement between the manager, Investment Office Staff, and consultant (general and/or specialty consultant, as appropriate). In the event of a change in management style, agreed upon change in a manager's strategy, availability of a better benchmark construction methodology, or changes to or additions in indices, a manager's benchmark may be modified by mutual consent between the manager, Investment Office Staff, and consultant (general and/or specialty consultant, as appropriate).

The Board further requires those public markets investment managers selected and working on its behalf to perform the following activities:

1. Execute investment decisions that are consistent within the scope of the approved investment guidelines expressed in the respective management agreement and other relevant documents.

2. Execute investment transactions on behalf of the Board in a manner that maximizes the investment value of each transaction from the viewpoint of the Fund, utilizing such brokers and dealers as they deem appropriate to obtain best execution and/or valuable information with respect to the economy and the affairs of corporations at the lowest total cost to the Fund.

3. Report to the Board at least quarterly through the Investment Office, with the exact frequency and format of reporting to be determined by the Investment Office, on the composition and relative performance of the investments in their designated portfolios; the economic and investment outlook for the near and long term; significant changes in the portfolio during the preceding period; and the reasons for any significant differences between the performance of their portfolios and the appropriate market indices or metrics.

4. Make themselves available as needed for meetings with the Board, Investment Office Staff, or agents of the Board regarding investment matters.

5. Comply at all times with all laws, regulations, contractual investment guidelines, and reporting requirements as determined by Investment Office Staff.

6. Perform such additional activities as detailed in each manager's investment management agreement with SERS.

H. State Treasurer

The State Treasurer serves as the custodian of the Fund, pursuant to Title 71, Pennsylvania Consolidated Statutes, Section 5931(c). In this capacity, the State Treasurer is responsible for the safe physical custody of investment instruments and the safe custody of any book-entry investment instruments that are held in depositories on behalf of the Commonwealth. As custodian, the State Treasurer is also responsible for preparing and delivering securities for settlement as authorized by the Board, attending to corporate actions, maintaining a book of record for these securities, facilitating an annual examination of these securities and books, and for preparing payment for securities transactions upon presentation of warrants properly signed and authorized. The State Treasurer may enter into a contract with a sub-custodian bank to assist in the execution of these responsibilities.

The State Treasurer is responsible for the temporary investment of cash balances until funds are required to meet disbursements or to acquire investments.

I. Actuarial Consultant

Pursuant to Title 71, Pennsylvania Consolidated Statutes, Section 5902(j), the Board engages an actuary to perform a valuation of the various accounts of SERS on an annual basis within six months of the close of each calendar year. In every fifth year, the Board shall have the actuary conduct an actuarial investigation and evaluation of the system based on data including the mortality, service, and compensation experience provided by the Board annually during the preceding five years concerning the members and beneficiaries.

6. Investment Objectives

The objectives of the Fund are to provide benefit payments to participants and beneficiaries at the lowest cost to the Commonwealth and to fund the program through a carefully planned and executed investment program.

The Fund seeks to produce the highest return on investment that is consistent with acceptable investment risks while providing sufficient liquidity that will permit the Fund to meet the System's benefit obligations.

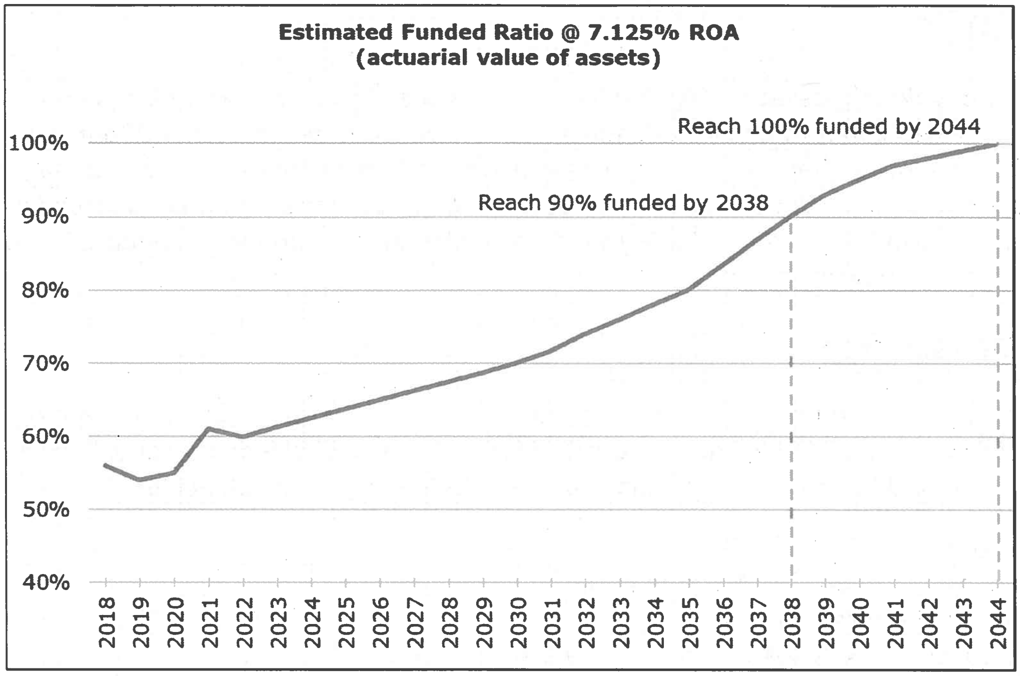
7. Investment Performance Objectives

SERS' Investment Performance Objectives:

- Achieve SERS' target rate of return over the long-term, net of fees.

- Achieve a SERS' total fund policy benchmark return over 10-year periods, net of fees. The fund policy benchmark index will be based on the asset allocation set forth in the IPS approved by the Board.

SERS' investment process requires a thorough analysis of the plan liabilities, liquidity requirements, and market opportunities. The Board, in collaboration with the Chief Investment Officer, actuarial consultant, and general investment consultant, establishes a target rate of return. Achieving, or exceeding this target rate of return is the primary investment performance objective of SERS' investment office to help meet the desired funded status. SERS' projected funded ratio is highlighted in the following chart.



Source: Korn Ferry

8. Asset Allocation Process

The Board accepts asset allocation as the primary determinant of the System's long-term contributor to investment return and risk. Asset allocation is substantially more influential than individual mandates deployed within asset classes, managers selected to implement the mandates, or tactical asset allocation decisions.

Among the factors that the Board considers in developing the policy target asset allocation are the following:

- Achieve SERS' investment return assumption over the long-term, net of fees, within risk and investment management fee levels deemed prudent by the Board.
- Maintain a level of liquid assets with a low correlation to the U.S. equity markets to pay retirement benefits and covenants during prolonged periods of market decline and potential state budgetary constraints.

In addition, SERS' asset allocation structure was developed by considering the Fund's liabilities, benefits policy, funding policy, and each asset class' expected return, volatility, and correlation with other asset classes. Investment Office Staff, in consultation with the Board and general investment consultant, combines asset classes in the most optimal structure to provide the highest expected return for a given level of risk, subject to implementation, liquidity, diversification, and cost constraints.

9. Liquidity

In addition to developing asset mixes to deliver on the Board's return and risk requirements, consideration is also given to ensure adequate liquidity which is sensitive to the duration of the plan liabilities, the ratio of active vs. retired members, and other factors. While maintaining a relatively large cash cushion has appeal, the Board is mindful of the potential drag on total portfolio returns over the long term, and as such, maintains a structure to provide adequate liquidity, while preserving earnings power.

10. Rebalancing

The Board recognizes the importance of rebalancing among liquid asset classes to maintain the risk-and-return characteristics of the Fund consistent with that of the policy target asset allocation and ranges approved by the Board. Liquid asset classes subject to rebalancing include:

- U.S. Equity
- International Developed Markets Equity
- Emerging Markets Equity
- Fixed Income (excludes Opportunistic Fixed Income)
- Inflation Protection (TIPS)
- Cash

The Board delegates the authority to rebalance liquid asset classes to the Chief Investment Officer. The Chief Investment Officer may use index portfolios and cash to rebalance within 90 business days after any liquid asset class breaches its policy range. The Chief Investment Officer shall assess liquid asset class market values relative to policy ranges using the monthly asset allocation report developed by SERS' Office of Finance & Administration. This rebalancing must move market values for these liquid asset classes within their policy allocation ranges. The Chief Investment Officer shall consult with the Investment Committee Chair and Board Chair prior to executing any rebalancing actions.

The Chief Investment Officer shall report all rebalancing actions at the next scheduled Board meeting.

11. Emergency Situations

The Board delegates authority to the Chief Investment Officer to make investment decisions on behalf of the Board in emergency situations. Emergency situations are defined as those that are unforeseeable and in the absence of action taken, the Fund may be adversely impacted. The Chief Investment Officer shall consult with the Investment Committee Chair and Board Chair prior to executing any emergency actions. In the event such action is taken, the Board will be apprised as soon as practical, but no later than the next scheduled Board meeting.

12. Prohibited Transactions

Investment managers are prohibited from entering into any transactions on behalf of the Fund that are not expressly authorized by this Policy or by specific investment manager guidelines including all applicable laws and regulations. All managers and consultants shall disclose any and all economic positions that may conflict with SERS' investment objectives and guidelines.

13. Investment Manager Recommendation Process

Investment Committee Interviews Investment Manager: Two weeks prior to the Investment Committee meeting, SERS' Investment Office and Investment Consultants provide the Investment Committee with an executive summary, a comprehensive investment memorandum, and a presentation from the investment manager. The Investment Committee interviews the investment manager and makes the decision to recommend the investment to the full Board for approval.

Full Board Approval: The Investment Committee Chair or a designee of the Chair presents the investment motions to the full Board to vote on approving the investment opportunity.

Ultimately, the decision to commit to an investment opportunity is one for the Board to make. In making its decision, the Board will take into consideration the action, if any, taken by the Investment Committee, but it is for the Board to make the decision on whether to proceed with the investment.

14. Investment Manager Evaluations

The Board endeavors not to make adverse retention decisions about investment managers based upon performance absent at least three years of performance data, recognizing that investment strategies are best assessed over full market cycles.

The Board's time horizon to review performance trends shall normally be over full market cycles, although the trend in investment experience over other time periods may be judged important. Any extreme or unusual events or trends will be considered when evaluating intermediate and short-term investment results. The *Investment Manager Monitoring Policy* has been developed in order to assist Investment Office Staff in applying consistent criteria to evaluate investment managers.

Notwithstanding the above, Investment Office Staff will review manager performance, portfolio positioning, and transactions at least annually.

15. Corporate Governance Standards

Good corporate governance promotes responsible business practices that serve as an integral component to a corporation's long-term value creation process and is an indispensable element of an effective corporate risk management program.

SERS is committed to improve corporate governance practices of the companies within the SERS portfolio. SERS' involvement includes: the development and periodic updating of the Board approved proxy voting policy, voting proxies, active participation in groups working to improve and enhance corporate governance practices, and ad hoc responses to important issues that affect the value of the portfolio, such as letters responding to regulatory and legislative proposals.

Updates to the proxy voting policies shall be prepared by the Investment Office and submitted to the Board for approval. In the update of the policies, the Investment Office shall seek to develop best practices. Best practices shall be developed through relationships with groups working to improve and enhance corporate governance practices and input that focuses on improving corporate governance practices from other prominent plan sponsors.

In addition, SERS monitors and, where appropriate, incorporates best corporate governance practice recommendations from organizations into the proxy voting guidelines. As good corporate governance practices are not static, the annual proxy voting modifications are designed to reflect the current trends in the marketplace.

Stock proxies are voted in accordance with guidelines and procedures contractually agreed upon with the Board and Investment Office Staff.

Corporate Actions

The custodian bank has standing instructions to forward notices of all corporate actions received, such as dividends, stock splits, mergers, acquisitions, spin–offs, or class action suits to SERS and/or its investment managers.

16. Trading and Brokerage Practices

The Board delegates the responsibility for the selection of brokerage firms to its investment managers, provided the investment managers select and utilize brokers. Notwithstanding this practice, the Board reserves the right to enter into brokerage commission recapture programs, and to establish goals for directed commissions provided the managers' investment processes are not being affected so as to adversely impact the Fund or place the Fund in a disadvantageous position relative to the managers' other accounts. As such, managers may be requested to direct a percentage of their brokerage activity on behalf of SERS. The Board will select the brokerage firms that are designated to receive such directed commissions and will communicate this information to the managers.

The Board also seeks to have managers direct a portion of trades through minority owned firms and reserves the right to establish proposed trading targets. However, the responsibility for the selection and use of minority brokerage firms is delegated to the investment managers.

Finally, all things being equal, the Board seeks to have investment managers trade through Pennsylvania-based brokers.

Efforts to monitor and control trading costs will be ongoing and may include the periodic use of formal trading cost analyses.

17. Transparency

SERS continues to work on enhancing its transparency efforts, while complying with the legal restrictions of its contracts. SERS requires general partners of new investment opportunities approved by the Board in private markets to provide SERS with the information found within the Institutional Limited Partners Association's (ILPA) Reporting Template through customized reporting or completion of the ILPA Reporting Template. SERS will continue to publish its quarterly performance reports and its private markets specialty consultants' semi-annual performance report, unredacted to the greatest extent possible. SERS will use commercially reasonable efforts to publish net-of-fee and gross-of-fee returns on a prospective basis when reporting quarterly investment performance to the Board, effective with the 1st Quarter 2020 performance report. SERS will post summary board materials on SERS' public website, which includes a summary manager presentation, summary staff memo, and summary consultant memo for all new investment opportunities presented to the Board. SERS will publicly disseminate an annual report of all investment fees and expenses reported by its managers beginning with calendar year 2020.

Public Access to Records

Records of investment transactions are maintained by the System at its office located at 30 North Third Street, Harrisburg, PA 17101. Requests for public inspection or copies of documents that are a matter of public record will be honored in a manner consistent with the Pennsylvania Right-to-Know Law (RTKL), 65 P.S. §§ 101 - 3104, and SERS' Right-To-Know Law Policy regarding the dissemination of public information. Inquiries should be directed to SERS' Right-to-Know Law Open-Records Officer.

18. Diversity and Inclusion

The Board defines "diverse investment manager" as an investment management firm owned and/or controlled by a majority of persons who are women and/or minorities.

The Board encourages the use of diverse investment managers in managing the Fund's assets, encompassing all asset classes, within the bounds of financial and fiduciary prudence, and to take affirmative steps to remove any barriers to the full participation in investment opportunities afforded by the Fund.[1] SERS believes that professionals and decision-makers who come from diverse backgrounds contribute different points of view that enhance organizational quality and economic performance.

If a prospective manager meets the requirements of being a diverse investment manager, it will be noted in the presentation materials Investment Office staff provides to the Board.

SERS currently reports on Minority/Woman-Owned Managers and Brokers in the annual Budget Book, which shows the firms that classify themselves as minority and/or woman owned firms, as well as their AUM/Committed Capital/Commissions.

SERS' Master DDQ, which is sent out to prospective managers, has a Diversity and Inclusion section that requests information from the manager on related policies. It also encourages the completion of the ILPA Team Diversity Template. This template has the manager provide a breakdown of both gender and racial/ethnic composition by position for the firm.

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[1] Language incorporated from Final Report and Recommendations: Public Pension Management and Asset Investment Review Commission (pg. 49) and Fiduciary Guide to Investing with Diverse Asset Managers and Firms (pg. 47).

19. SERS' Emerging Investment Manager Program

Objective

Consistent with the Board's fiduciary responsibilities, the Board established the SERS' Emerging Investment Manager Program ("SERS EIM Program") to:

- Identify and gain early access to talented investment managers in their early stages to generate above benchmark returns (net of fees); and

- Provide an evaluation platform of potential investment managers who have demonstrated superior risk-adjusted returns for consideration into the Fund.

Scope

The SERS EIM Program shall apply to emerging investment managers who manage long-only public equity assets.

Structure and Standards

The SERS EIM Program will be comprised of manager-of-managers selected in accordance with SERS' Hiring Investment Manager Process. The manager-of-managers will have the discretion and authority to select and invest with emerging investment managers based on the objectives and guidelines established by the Board and SERS' Investment Office. The manager-of-managers' fees shall be disclosed to the Board for evaluation.

Emerging Investment Manager Criteria

Investment managers selected by the manager-of-managers to participate in the SERS EIM Program must meet the following criteria:

- Registered under the Investment Advisors Act of 1940 or has an exemption from registration (and will maintain such registration or exemption);

- Total firm assets under management of less than $5 billion and/or an investment strategy of less than $1 billion at the time of the manager-of-managers' initial evaluation;

- A quantifiable track record for the investment product under consideration (or for a product with a similar investment philosophy and process as the product under consideration);

- Portfolio manager(s) with a minimum two-year track record (directly or indirectly attributable to that portfolio manager(s)) in an investment style and process similar to that which is under consideration;

- Historical performance must be GIPS compliant; and

- Disclosure of position and transaction level transparency (at least monthly).

As indicated in Section 4 of this Policy, "the Board may, when possible and consistent with its fiduciary duties imposed by law, including its obligation to invest and manage the Fund for the exclusive benefit of the members of the System, consider whether an investment in any project or business enhances and promotes the general welfare of the Commonwealth and its citizens. Where investment characteristics are equivalent, the Board's policy will favor investments that will have a positive impact on the economy of Pennsylvania."

Therefore, when making their selections, manager-of-managers may favor emerging investment managers who meet the SERS EIM Program objectives and criteria noted above, plus having one or more of the following characteristics:

- Pennsylvania investment management firms headquartered or incorporated within the Commonwealth; and/or

- Investment management firms owned and/or controlled by a majority of persons who are women and/or minorities.

Administration

The Investment Office shall be responsible for the oversight of the SERS EIM Program by recommending program policies and manager-of-managers for the Board's consideration.

Source of Funding

Funding for the SERS EIM Program may come from assets within public equity assets or cash at the Board's sole discretion, depending on the current equity allocation relative to the target allocation.

20. Asset Class Objectives, Structure, and Guidelines

Private Equity

Objective

The objective of Private Equity is to achieve a return in excess of its public equity benchmark (75% Russell 3000 Index / 25% MSCI World ex U.S. Index plus a 300 basis point premium) over 10-year periods (annualized, net of fees).

Structure

Private Equity investments are non-traditional investments made in the form of closed-end limited partnership structures organized to make domestic and international private investments such as buyouts, special situations, and growth equity.

Strategy	Description
Buyouts	A specialized form of private equity characterized chiefly by investments in established privately held firms that are undergoing a fundamental change in operations or strategy.
Special Situations	Investments in funds which acquire distressed companies or companies in need of restructuring and funds from the secondary market.
Growth Equity	Investments in specialized forms of private equity, characterized chiefly by investments in late stage venture, minority growth equity, and small buyout strategies.

Guidelines

a. Permitted Investment Vehicles

SERS may invest in fund-of-funds, separately managed accounts, or other non-closed-end vehicles, if by doing so SERS achieves access to investment opportunities and/or information that might not otherwise be attainable through closed-end funds.

b. Diversification

Achieved by investing in funds with differing vintage years, industry/sector, geographic area, and private equity focuses (e.g. buyouts, distressed, secondaries, late stage venture, minority growth equity, small buyout strategies, etc.).

c. Investment Size

The Fund's investment/commitment in a single Private Equity commingled closed-end fund may not exceed five percent (5%) of the net market value of the Private Equity portfolio at the time of initial investment.

The Fund's investment/commitment in a single Private Equity commingled closed-end fund may not exceed twenty percent (20%) of the commingled closed-end fund's total fund size.

These criteria exclude separately managed accounts where SERS is the sole investor.

d. Minimum Criteria:

Investment Strategy
There must be a sufficient universe of potential investments to accommodate institutional investing. The investment strategy must be set forth in sufficient detail to permit substantive and meaningful review of the opportunity, verification of investment concept, and comprehensive analysis of risk factors. The investment strategy shall also outline the Firm's corporate governance policies and procedures with respect to management of the Firm and its underlying investments. Finally, there must be sound evidence that the investment will provide reasonable probability of achieving the return and risk objectives of SERS.

Investment Process
The Firm shall demonstrate a sound process for sourcing, performing due diligence, selecting, monitoring, and exiting investments. This investment process shall describe the Firm's internal investment and management controls and should provide for regular monitoring and valuing of existing investments, as well as a strategy and procedure for exiting investments. The Fund shall have carefully documented its investment processes, including those related to hiring managers to manage the Fund's investments.

Management
The Manager must have expertise and experience in sourcing, pricing, selection, structuring and negotiating private equity investments. It is preferable that the Firm's key investment personnel have direct experience investing for institutional investors, a history of working together, a successful track record of implementing the strategy proposed for the particular investment and are managing portfolios of capital similar in size to the amount currently being sought. Depending on the strategy, operational experience in target industries is desirable.

Terms and Conditions
Each partnership agreement shall be negotiated such that SERS receives competitive terms and conditions.

e. Due Diligence:

Before any investment is recommended to the Board and an investment is made, Investment Office Staff and its Private Equity consultant will rigorously review the investment opportunity. Best efforts shall be made to complete a due diligence review by Investment Office Staff and Private Equity consultant prior to uploading to BoardDocs of the materials pertaining to the investment opportunity for Investment Committee and Board consideration. If the due diligence results are favorable, the Investment Office staff and Private Equity consultant shall recommend to the Board in writing the investment opportunity. The Investment Committee and Board shall be made fully aware of any due diligence matters that are outstanding, which must be satisfied prior to successful completion of contract negotiations. The due diligence materials shall include without limitation, meetings with the investment principals, reviews of pertinent offering documents and supporting materials, the Manager's completion of a due diligence questionnaire, and reference checks. Such reviews allow SERS to more effectively evaluate the soundness of the investment opportunity, and its adherence to SERS' investment guidelines as to investment strategy, process, management, and terms and conditions.

f. Monitoring and Reporting:

Each manager will provide SERS' Investment Office with quarterly unaudited reports (or semi-annual reports if customarily produced by the manager) and annual audited reports in sufficient detail to allow Investment Office Staff to assess the performance of each Private Equity investment. Each manager is expected to timely report on all material developments including, but not limited to, personnel changes, contractual problems or amendments, distribution issues, and any other items required for appropriate monitoring by Investment Office Staff. Each manager, as part of its investment report to SERS, is expected to provide information concerning its Pennsylvania portfolio activity (if any), including employment statistics.

Semiannually, the Private Equity consultant will submit to the Board a Private Equity performance report which includes Private Credit investments. Performance measurement will utilize an Internal Rate of Return metric ("IRR"). The IRR is based on inflows and outflows of partnership capital, giving consideration to the residual value of investment holdings, and calculated net of management fees, expenses, and the manager's share of carried interest. The IRR calculation is an annualized-since-inception measure, updated quarterly, and along with cash–on–cash return multiples, serves as the primary objective measurement of a manager's performance. The performance of each investment will be compared against Burgiss' relevant Vintage Year Median Returns (or other relevant relative return data made available by SERS' Private Equity consultant).

Investment performance for private market investments must be viewed over a longer time horizon than the assessment period used for publicly traded securities. Although the final performance of a Private Equity investment cannot be known until its termination, it is recognized that the performance of a more mature investment (7–10 years) provides a more accurate indication thereof.

For Investment Office Staff to more actively monitor a manager's investments for compliance with the terms and conditions of the limited partnership agreement as well as SERS' expectations, SERS often seeks a seat on the fund's advisory board or valuation committee. In such capacity, Investment Office Staff will generally participate in the review and/or approval of: (i) the Manager's valuation policy, (ii) underlying investments remaining in the portfolio, (iii) the Manager's valuation of such underlying investments, and (iv) whether potential conflicts of interest exist. As the size of SERS' commitments decrease, so does the likelihood that it will be offered opportunities to serve on their advisory boards and valuation committees.

Private Credit

Objective

The objective of Private Credit is to achieve a return in excess of the S&P/LSTA Leveraged Loan Index plus 100 basis points over 10-year periods (annualized, net of fees).

Structure

Private Credit investments are non-traditional investments made in the form of closed-end limited partnership structures organized to invest in a diverse set of strategies including direct lending, diversified credit, and distressed debt.

Direct lending funds will lend money to privately held firms, often as part of a private equity leveraged buyout transaction. These loans will be predominantly medium-duration, floating rate, and senior in the capital structure.

Diversified credit funds may invest in various credit strategies including specialty lending, niche credit opportunities, mezzanine and other debt securities, credit derivatives, structured credit and structured equity.

Distressed debt funds will invest in the credit securities of distressed companies or companies in need of restructuring. Private Credit funds are less liquid than public fixed income with investment horizons of five years or more.

Guidelines

a. Permitted Investment Vehicles

In general, SERS' investments in Private Credit will be through closed-end funds. SERS will seek Board approval if investments require the use of other investment vehicles.

b. Diversification

Achieved by investing in funds with differing vintage years, seniority in the capital structure, industry/sector, and geographic focuses.

c. Investment Size

The Fund's investment/commitment in a single Private Credit commingled closed-end fund may not exceed $200 million.

The Fund's investment/commitment in a single Private Credit commingled closed-end fund may not exceed twenty percent (20%) of the commingled closed-end fund's total fund size.

These criteria exclude separately managed accounts where SERS is the sole investor.

d. Minimum Criteria:

Investment Strategy
There must be a sufficient universe of potential investments to accommodate institutional investing. The investment strategy must be set forth in sufficient detail to permit substantive and meaningful review of the opportunity, verification of investment concept, and comprehensive analysis of risk factors. The investment strategy shall also outline the Firm's corporate governance policies and procedures with respect to management of the Firm and its underlying investments. Finally, there must be sound evidence that the investment will provide reasonable probability of achieving the return and risk objectives of SERS.

Investment Process
The Firm shall demonstrate a sound process for sourcing, performing due diligence, selecting, monitoring, and exiting investments. This investment process shall describe the Firm's internal investment and management controls and should provide for regular monitoring and valuing of existing investments, as well as a strategy and procedure for exiting investments. The Fund shall have carefully documented its investment processes, including those related to hiring managers to manage the Fund's investments.

Management
The Manager must have expertise and experience in sourcing, pricing, selection, structuring and negotiating private credit investments. It is preferable that the Firm's key investment personnel have direct experience investing for institutional investors, a history of working together, a successful track record of implementing the strategy proposed for the particular investment and are managing portfolios of capital similar in size to the amount currently being sought. Depending on the strategy, operational experience in target industries is desirable.

Terms and Conditions
Each partnership agreement shall be negotiated such that SERS receives competitive terms and conditions.

e. Due Diligence:

Before any investment is recommended to the Board and an investment is made, Investment Office Staff and its Private Equity consultant will rigorously review the investment opportunity. Best efforts shall be made to complete a due diligence review by Investment Office Staff and Private Equity consultant prior to uploading to BoardDocs of the materials pertaining to the investment opportunity for Investment Committee and Board consideration. If the due diligence results are favorable, the Investment Office staff and Private Equity consultant shall recommend to the Board in writing the investment opportunity. The Investment Committee and Board shall be made fully aware of any due diligence matters that are outstanding, which must be satisfied prior to successful completion of contract negotiations. The due diligence materials shall include without limitation, meetings with the investment principals, reviews of pertinent offering documents and supporting materials, the Manager's completion of a due diligence questionnaire, and reference checks. Such reviews allow SERS to more effectively evaluate the soundness of the investment opportunity, and its adherence to SERS' investment guidelines as to investment strategy, process, management, and terms and conditions.

f. Monitoring and Reporting:

Each manager will provide SERS' Investment Office with quarterly unaudited reports (or semi-annual reports if customarily produced by the manager) and annual audited reports in sufficient detail to allow Investment Office Staff to assess the performance of each Private Credit investment. Each manager is expected to timely report on all material developments including, but not limited to, personnel changes, contractual problems or amendments, distribution issues, and any other items required for appropriate monitoring by Investment Office Staff. Each manager, as part of its investment report to SERS, is expected to provide information concerning its Pennsylvania portfolio activity (if any), including employment statistics.

Semiannually, the Private Equity consultant will submit to the Board a Private Equity performance report which includes Private Credit investments. Performance measurement will utilize an Internal Rate of Return metric ("IRR"). The IRR is based on inflows and outflows of partnership capital, giving consideration to the residual value of investment holdings, and calculated net of management fees, expenses, and the manager's share of carried interest. The IRR calculation is an annualized-since-inception measure, updated quarterly, and along with cash–on–cash return multiples, serves as the primary objective measurement of a manager's performance. The performance of each investment will be compared against Burgiss' relevant Vintage Year Median Returns (or other relevant relative return data made available by SERS' Private Equity consultant).

Investment performance for private market investments must be viewed over a longer time horizon than the assessment period used for publicly traded securities. Although the final performance of a Private Credit investment cannot be known until its termination, it is recognized that the performance of a more mature investment (7–10 years) provides a more accurate indication thereof.

For Investment Office Staff to more actively monitor a manager's investments for compliance with the terms and conditions of the limited partnership agreement as well as SERS' expectations, SERS often seeks a seat on the fund's advisory board or valuation committee. In such capacity, Investment Office Staff will generally participate in the review and/or approval of: (i) the Manager's valuation policy, (ii) underlying investments remaining in the portfolio, (iii) the Manager's valuation of such underlying investments, and (iv) whether potential conflicts of interest exist. As the size of SERS' commitments decrease, so does the likelihood that it will be offered opportunities to serve on their advisory boards and valuation committees.

Real Estate

Objective

The objective of Real Estate is to generate returns through capital appreciation and current income to achieve a return in excess of its benchmark (90% NCREIF Fund Index – Open End Diversified Core Equity ("NFI-ODCE") / 10% FTSE NAREIT U.S. Real Estate Index) over 5-year periods (annualized, net of fees). Real Estate investments may also lower overall fund volatility and provide a moderate hedge against inflation.

Structure

Real Estate investments are non-traditional investments made in the form of individually managed accounts and pooled investment vehicles organized to invest in private market equity and debt investments in real estate and real estate related companies and public market investments in real estate investment trusts (REITs) and real estate operating companies.

Strategy	Description
Core/Core Plus	Core and Core Plus investments are long-term investments in high-quality real estate that generate returns primarily from stable income producing properties.
Value-Add and Opportunistic	Value-Add and Opportunistic investments have higher risk/return expectations than Core/Core Plus investments. Value-Add and Opportunistic strategies utilize greater leverage and active real estate strategies including leasing, repositioning, renovation and/or rehabilitation in addition to development, thereby taking higher risks but demanding higher returns. Returns are primarily generated from capital appreciation from opportunistic investments.
Real Estate Securities	Investments in publicly-traded securities of companies whose primary business is to own real estate. Real Estate Securities provide SERS with direct exposure to U.S. and non-U.S. real estate markets and offer high dividend yield and liquidity.

Guidelines

a. Permitted Investment Vehicles

SERS' investments in Real Estate will be through vehicles that maximize the Fund's control, including the ability to exit an investment are preferred, but the Fund acknowledges that it may use vehicles with limited control in order to achieve certain goals, such as diversification, access to specialized investments, or manager expertise.

The Fund may purchase assets on a wholly owned basis through Individually Managed Account structures. The Individually Managed Account structure is the preferred investment vehicle due to its low-cost structure and control features provided to SERS, except when pooled investment vehicles offer an identifiable advantage for accessing a particular investment opportunity.

Investment opportunities may be accessed through the ownership of units or shares of a Pooled Investment Vehicle. Any legally organized vehicle is allowed, including, but not limited to, joint ventures, limited partnerships, public and private real estate investment trusts, insurance company separate accounts, and limited liability corporations. Preference will be given to those Pooled Investment Vehicles that offer greater investment and reporting transparency.

b. Individually Managed Accounts

The Individually Managed Account manager may consider joint venture or co–investment ownership within Individually Managed Account structures.

Individually Managed Accounts are actively managed programs with managers buying and selling investments as market conditions and opportunities dictate. All investments are made within the scope of approved investment guidelines in each manager's respective investment management agreement, as well as this IPS. The size of each individually managed account will be determined with reference to the overall allocation to real estate and the level of purchase and sale activity in any given manager's portfolio.

It is the intent that over the long-term each individually managed account be self-funded; i.e., that new acquisitions be funded out of portfolio cash flows and sales proceeds. However, it is recognized that the timing of cash flows in these portfolios is difficult to forecast given the uncertainties and lead time involved with the purchase and sale of commercial real estate investments. In addition, it is understood that commercial real estate investments are stand-alone business entities that may require periodic investment of new cash, some of which may be unanticipated and time sensitive, in order to enhance the value of any given investment and honor legal, health and safety, or other obligations, to which the owner (a SERS controlled entity) is bound. At no time will the total amount funded to any individually managed account exceed the commitment amount plus total capital returned as monitored and reported by the Real Estate consultant to the Board.

The Investment Office and Real Estate consultant will monitor cash flow projections provided by the managers to ensure that the total real estate portfolio remains near the target allocation provided within this Policy. At no time, however, will an Individually Managed Account manager be required to liquidate investments at inopportune times for the purposes of rebalancing.

c. Diversification

Strategy

SERS anticipates that approximately 35% of its real estate program will be targeted to Core investments, 55% targeted to Non-Core investments (value-add and opportunistic) and 10% to REITs.

Manager

No single investment manager shall manage more than 30% of the total real estate allocation determined by the Board. However, there may be instances when the "denominator effect," special situations such as portfolio take-overs and value appreciation of investments, can suddenly cause an "out of balance" situation with regard to any given manager. When this type of situation occurs the Investment Office and Real Estate consultant will work with the affected manager to bring the portfolio back into balance within a reasonable timeframe.

Property Type and Property Location

Diversification by property type and location will be monitored and prudently managed, but the Fund recognizes that its diversification relative to benchmark may vary due to current opportunities available in the market and expectations for optimal risk-adjusted returns going forward. Diversification by geography includes international investments.

Vintage Year Diversification

SERS' Investment Office shall prudently monitor and manage the vintage year exposure of the total real estate portfolio, but the Fund recognizes that vintage year exposures will vary due to current opportunities and the expectations for optimal risk-adjusted returns available in the market.

International Investing

Targeted international investments totaling up to 20% of the total real estate portfolio shall be permitted as approved by the Board. Incidental non-domestic real estate exposure may exist from Pooled Investment Vehicle investments.

d. Investment Size

At no time shall the net investment amount in a single property within an Individually Managed Account exceed five percent (5%) of the net market value of the total Fund's real estate portfolio at the time of initial investment.

The Fund's investment in a single closed-end Pooled Investment Vehicle may not exceed five percent (5%) of the net market value of the real estate portfolio at the time of initial investment.

The Fund's investment/commitment in a single closed-end Pooled Investment Vehicle may not exceed twenty percent (20%) of the closed-end fund's total fund size.

The Fund's investment in a single open-end pooled fund may not exceed 15% of the net market value of the real estate portfolio at the time of initial investment.

e. Leverage

The Fund shall seek to constrain overall leverage within the real estate program to a loan-to-value ratio ("LTV") of 50% at the time the debt is placed. The LTV ratio in the separate account portfolios shall not exceed 60% at the time that debt is placed. It is understood that market value fluctuations may cause the LTV of all or a component of the program to exceed the limits expressed herein; in such an event, SERS shall not be required to sell investments or pay down debt in order to meet LTV limits expressed herein. The preference is to provide the managers the discretion to use leverage within contractual guidelines, when accretive to returns, without significantly increasing risk; however, debt that is recourse to a separate account will not be permitted unless approved by SERS' Investment Office.

f. Valuation

All investments in an Individually Managed Account will be independently valued not less than once every three years by a qualified Member Appraisal Institute (MAI) designated appraiser approved by SERS' Investment Office. During interim periods, the Investment Manager responsible for the investments will perform the valuations. Investments held in Pooled Investment Vehicles shall be valued using the methodology approved with the selection of the Pooled Investment Vehicle.

g. Selection Criteria for Individually Managed Accounts:

Manager Selection Process

Investment managers (both Individually Managed Account and Pooled Investment Vehicle managers) must have significant and direct experience investing and managing money for institutional investors. The manager must have expertise and experience in pricing, selection, structuring, and negotiating real estate investments. It is preferable that key investment personnel have a successful track record of implementing the strategy proposed for this investment and managing portfolios of capital similar in size to the amount currently sought. Investment Office Staff and Consultant shall establish specific qualification criteria, desired levels of competency, and respective evaluation factors consistent with the purpose of each search for an Individually Managed Account manager.

Investment Office Staff and Real Estate consultant shall meet with, review, and evaluate preferred candidates based upon the established criteria.

Investment Office Staff and Real Estate consultant shall recommend to the Board in writing the manager to be interviewed and selected by the Board.

Control and Monitoring

Preliminary Investment Summary

Individually Managed Account managers shall have full discretion over the acquisition, management, and sale of individual investments. Prior to closing an investment, the manager shall provide a Preliminary Investment Summary to Investment Office Staff. The preliminary package shall include an analysis of the merits, projected return, and exit strategy for the proposed investment, together with sufficient information for SERS' Investment Office to confirm the proposed investment's consistency with this IPS and the investment manager's guidelines and strategy under its investment management agreement.

Reporting

Individually Managed Account managers shall adhere to the most recent version of the Real Estate Information Standards established jointly by the National Council of Real Estate Investment Fiduciaries, the Pension Real Estate Association, and the National Association of Real Estate Investment Managers, as well as, generally accepted accounting principles (GAAP). Managers will submit on an annual basis a third–party audited financial statement of the account managed by the Individually Managed Account manager.

Responsible Contracting

Managers of the Fund's wholly-owned assets in Individually Managed Accounts shall support and encourage the engagement of responsible contractors to provide building construction and maintenance services for such assets, subject to adherence to the Fund's fiduciary principles of loyalty, care, skill, prudence, and diligence. In all respects, such managers shall recognize and adhere to the principle that only the involved contractor has control over (1) the means and manner by which the contracted services are provided, and (2) the contractor's labor relation policies.

A responsible contractor is a contractor who, among other things: (1) has the appropriate experience, reputation, employee relations, responsiveness, fees, and dependability to perform required work; and (2) provides workers a fair wage and fair benefits for the required work, based on local market conditions. The utilization of such contractors may add value to the Funds' investments by ensuring that essential building and construction services are provided by adequately trained, experienced, and motivated workers.

The Board recognizes the right, as provided by law, of eligible employees to organize into a union or to not organize into a union, as the employees choose, and encourages contractors providing building construction and management services for the Fund's wholly-owned assets in Individually Managed Accounts to recognize and not impermissibly interfere with the lawful exercise of those rights and, upon a proper request, to bargain in good faith with any such lawfully recognized union.

Managers of the Fund's wholly-owned assets in Individually Managed Accounts and contractors providing building construction and maintenance services for such assets shall comply with applicable federal, state, and local laws, regulations and ordinances, including (but not limited to) those related to insurance, tax withholdings, minimum wage, health and safety, labor, and environmental matters.

With respect to those assets that the Fund does not wholly-own, it is desirable that the entity owning such assets comply with the foregoing policy statement.

Budget and Management Plan

Not more than 90 days after the end of the calendar year, Investment Office Staff and Real Estate consultant shall meet with the manager of personnel directly responsible for an Individually Managed Account portfolio and asset management for a review and evaluation of the Manager's Budget and Management Plan, which shall include a summary of the prior year's financial performance, budgeted projections for the ensuing year, and the Manager's current hold/sell recommendation for each property.

h. Selection Criteria for Pooled Investment Vehicles:

Selection Process

Investment Office Staff and Real Estate consultant will conduct screenings of the universe of available investment offerings that may be identified through Real Estate consultant's real estate databases, meetings with fund sponsors and their agents, and established SERS' relationships. The initial screen will focus on the identification of high-quality candidates that clearly meet SERS' real estate investment guidelines and strategy, and which conform to the diversification and other risk management policies set forth in this Policy.

After identifying potential candidates, Investment Office Staff and Real Estate consultant will conduct due diligence to ascertain which will provide optimal investment opportunities for SERS. The candidates will be assessed across a variety of criteria, including but not limited to:

- investment track record;

- quality, stability, depth and experience of investment professionals;
- clearly defined investment strategy that complements or is otherwise accretive to SERS' current or projected real estate portfolio construction;
- alignment of general partner's interests with limited partners' interests;
- adequacy of operational, accounting, legal compliance and reporting systems and personnel;
- terms and conditions of the fund, including but not limited to fees, promoted interests, key person provisions and removal and/or replacement of the general partner by the limited partners;
- client base and references; and
- unique advantages to the investment that benefit SERS, such as negotiation of preferred fees by Investment Office Staff and/or Real Estate consultant.

Best efforts shall be made by Investment Office Staff and the Real Estate consultant to complete due diligence prior to uploading to BoardDocs of the materials pertaining to the investment opportunity for Investment Committee and Board consideration. If due diligence results are favorable, the Investment Office staff and Real Estate consultant shall recommend to the Investment Committee and the Board in writing the investment opportunity to be interviewed and selected by the Board. The Investment Committee and Board shall be made fully aware of any due diligence matters that are outstanding, which must be satisfied prior to successful completion of contract negotiations.

Closing Process

Completion of due diligence requires Fund counsel's review of the Pooled Investment Vehicle's formation and associated legal documents.

i. Discretionary Authority:

The Board provides complete investment discretion within contractual guidelines to its managers regarding the acquisition, management, and disposition of real estate holdings.

j. Performance Measurement Report

Real Estate consultant shall provide performance measurement reports on a semi-annual basis. The report shall also include attributes for both the investment managers and the total portfolio including: income, appreciation, gross and net returns, cash flow, diversification, and comparisons with relevant industry performance indices.

U.S. Equity

Objective

The objective of U.S. Equity is to generate returns through capital appreciation and income from dividend payments that meet or exceed the Russell 3000 Index over 5-year periods (annualized, net of fees).

Structure

U.S. Equity investments are traditional equity investments made in the form of separate accounts and commingled funds. U.S. Equity contributes to a higher expected long-term return to the fund and is also a material contributor to volatility.

Guidelines

a. Maintain an allocation to U.S. Equity within +/- 5% of its target allocation as stated in this Policy.

b. Maintain an overweight to U.S. small cap equity (20% allocation to U.S. small cap within the U.S. public equity allocation).

c. Contain tracking error and maintain cost control by investing in passive strategies in more efficient areas of the U.S. equity market.

International Developed Markets Equity

Objective

The objective of International Developed Markets Equity is to generate returns through capital appreciation and income from dividend payments that meet or exceed the MSCI World ex U.S. Index over 5-year periods (annualized, net of fees).

Structure

International Developed Markets Equity investments are traditional equity investments made in the form of separate accounts and commingled funds. International Developed Markets Equity contributes to a higher expected long-term return to the fund and is also a material contributor to volatility.

Guidelines

a. Maintain an allocation to International Developed Markets Equity within +/- 5% of its target allocation as stated in this Policy.

b. Contain tracking error and maintain cost control by investing in passive strategies in more efficient areas of the International Developed Markets Equity.

Emerging Markets Equity

Objective

The objective of Emerging Markets Equity is to generate returns through capital appreciation and income from dividend payments that exceed the MSCI Emerging Markets Index over 5-year periods (annualized, net of fees).

Structure

Emerging Markets Equity investments are traditional equity investments made in the form of commingled funds since there are legal challenges for SERS to use separate accounts to open sub-custodial trading accounts in certain emerging market countries. Emerging Markets Equity contributes to a higher expected long-term return to the fund and is also a material contributor to volatility.

Emerging markets are generally regarded as less efficient than developed markets and historically have been more volatile than developed markets. Returns have been influenced by capital flows into and out of these markets; however, longer term, emerging markets can be attractive to those investors seeking to access the financial returns derived from rapidly expanding economies. Due to the high return volatility associated with emerging markets, the SERS Fund takes a diversified approach using a variety of investment strategies. The SERS Fund employs a structure diversified by investment advisor, style, and type.

Guidelines

a. Maintain an allocation to Emerging Markets Equity within +/- 4% of its target allocation as stated in this Policy.

b. Contain tracking error, maintain cost control, and the ability to efficiently rebalance to the Emerging Markets Equity asset class by keeping a passive strategy.

c. The percentage allocation to the actively managed segment, which could make up the majority of the Emerging Markets Equity asset class, will be determined by conviction in and the availability of actively managed investment strategies.

Fixed Income

Objective

The objective of Fixed Income is to provide liquidity to minimize capital impairment risk, reduce volatility of the total fund, and contribute total return to the fund that meet or exceed its benchmark (Bloomberg Barclays U.S. Aggregate Bond Index) over 5-year periods (annualized, net of fees). Fixed Income should also provide diversification and low correlation with equity markets.

Structure

Fixed Income investments are traditional investments made in the form of separate accounts and commingled funds. They include investments in publicly-traded debt obligations of sovereign, quasi-sovereign and corporate entities. The asset class generates current income and the repayment of principal at maturity.

Strategy	Description
Opportunistic Fixed Income	Investments in sovereign debt, commercial and residential non-agency mortgage-backed securities, asset-backed securities, credit strategies, and high yield debt, which seek to provide excess return when performance conditions are favorable, and offer varying potential return with a corresponding variance in expected risk.
Core Fixed Income	Investments in intermediate duration investment grade bonds of various types (e.g. agency government bonds, corporate bonds, agency-mortgage backed securities), which provide capital loss protection in difficult market conditions, and offer risk mitigation due to low correlation with equity.
Nominal U.S. Treasuries	Investments in securities matching the risk and return profile of 10-year U.S. Treasury Notes.

Guidelines

a. Maintain an allocation to Fixed Income within +/- 5% of its target allocation as stated in this Policy.

b. Maintain cost control and the ability to rebalance to Fixed Income by keeping a passive strategy.

c. The active segment, which is mainly comprised of Opportunistic Fixed Income strategies, will be determined by risk budgeting and conviction in the investment strategies.

Inflation Protection (TIPS)

Objective

The objective of Inflation Protection is to protect against both expected and unexpected higher inflation, provide liquidity to minimize capital impairment risk, reduce volatility of the total fund, and contribute total return to the fund that meet or exceed its benchmark (Bloomberg Barclays U.S. TIPS Index) over 5-year periods (annualized, net of fees).

Structure

Treasury Inflation-Protected Securities (TIPS) are traditional investments made in the form of separate accounts and commingled funds. The primary advantage of TIPS is that their return offers protection against both expected and unexpected higher inflation, as the securities' coupon payments are directly tied to the rate of inflation. TIPS, therefore, maintain the purchasing power of the investor. The coupon payments of TIPS have two components: a real coupon rate that is established at the issuance of the bond, and an accrual equal to the rate of inflation which adds to the principal balance of the security. TIPS are also useful for hedging liabilities which are affected by inflation and for hedging a cash flow stream against the need to liquidate equities and conventional bonds at depressed prices, in order to meet pension obligations during periods of unexpected inflation.

Guidelines

a. Maintain an allocation to TIPS within +/- 3% of its target allocation as stated in this Policy.

b. Maintain cost control and the ability to rebalance to Inflation Protection by keeping a passive strategy or a low-cost active strategy alternative approved by the Board.

Cash

Objective

The objective of Cash is to serve as the primary source of liquidity and generate returns that meet or exceed its benchmark (ICE BofAML U.S. 3-Month Treasury Bill Index) over a three-year period.

Structure

Cash investments emphasize the use of higher credit quality debt instruments that are liquid and have short maturities and durations, or have floating rates and have historically been invested in the Pennsylvania Treasury Group Investment Fund, a short-term investment fund.

Guidelines

a. Maintain a maximum allocation to Cash of 7% as stated in this Policy.

21. Benchmarks

Asset Class Benchmarks

Asset Class	Asset Class Benchmarks
Private Equity	75% Russell 3000 Index / 25% MSCI World ex U.S. Index plus 300 basis points
Private Credit	S&P/LSTA Leveraged Loan Index plus 100 basis points
Real Estate	90% NCREIF Fund Index – Open End Diversified Core Equity ("NFI-ODCE") / 10% FTSE NAREIT U.S. Real Estate Index
U.S. Equity	Russell 3000 Index
International Developed Markets Equity	MSCI World ex U.S. Index
Emerging Markets Equity	MSCI Emerging Markets Index
Fixed Income	Bloomberg Barclays U.S. Aggregate Bond Index
Inflation Protection (TIPS)	Bloomberg Barclays U.S. TIPS Index
Cash	ICE BofAML U.S. 3-Month Treasury Bill Index

Total Fund Benchmark

The total fund benchmark is calculated monthly using asset class benchmark returns and policy target asset allocation weights, respectively (as shown in the table below).

Asset Class	Asset Class Benchmarks	Policy Target Asset Allocation %
Private Equity	75% Russell 3000 Index / 25% MSCI World ex U.S. Index plus 300 basis points	14.0%
Private Credit	S&P/LSTA Leveraged Loan Index plus 100 basis points	4.0%
Real Estate	90% NCREIF Fund Index – Open End Diversified Core Equity ("NFI-ODCE") / 10% FTSE NAREIT U.S. Real Estate Index	8.0%
U.S. Equity	Russell 3000 Index	25.0%
International Developed Markets Equity	MSCI World ex U.S. Index	13.0%
Emerging Markets Equity	MSCI Emerging Markets Index	4.0%
Fixed Income	Bloomberg Barclays U.S. Aggregate Bond Index	26.0%[2]
Inflation Protection (TIPS)	Bloomberg Barclays U.S. TIPS Index	4.0%
Cash	ICE BofAML U.S. 3-Month Treasury Bill Index	2.0%

[2] 22% target to Core Fixed Income, 4% target to Opportunistic Fixed Income

22. 2020 Investment Initiatives for SERS' Investment Office

1. Provide the Board with a report defining the operational risks, costs, resource requirements, and benefits associated with internally managing passive equity and fixed income securities.

2. Provide the Board with a report defining the operational risks, costs, resource requirements, and benefits associated with internally managing private market co-investments.

3. Implement Board approved Public Pension Management and Asset Investment Review Commission investment-related recommendations to enhance transparency of fees and performance.

4. Update investment-related policies and processes.

23. SERS' Policy Target Asset Allocations

Based on input from Board members, the following key themes were factored into the development of the SERS' policy target asset allocations.

The policy target asset allocations are projected to:

1. Achieve SERS' investment return assumption of 7.125%
2. Target a lower annual investment management fee structure
3. Target a higher allocation to liquid assets with low correlation to the U.S. equity markets
4. Target a lower allocation to less liquid assets

SERS' Policy Target Asset Allocations

	Current Exposure 7/31/2019	2018-2019 Current Target	Policy Target AA Refined Target 7.00%	Policy Ranges
Private Equity	13.7%	16.0%	14.0%	n/a
Multi-Strategy	5.1%	10.0%	n/a	n/a
Private Credit	0.7%	0.0%	4.0%	n/a
Real Estate	6.8%	12.0%	8.0%	n/a
Global Equity	3.5%	48.0%	n/a	n/a
U.S. Equity	26.6%	0.0%	25.0%	+/- 5%
International Developed Markets Equity	18.7%	0.0%	13.0%	+/- 5%
Emerging Markets Equity	6.2%	0.0%	4.0%	+/- 4%
Fixed Income	14.5%	11.0%	26%[1]	+/- 5%
Inflation Protection (TIPS)	0.0%	0.0%	4.0%	+/- 3%
Cash	4.2%	3.0%	2.0%	7% max

Estimated Return (Geometric)	n/a	7.397%	7.000%
Estimated Risk (Standard Deviation)	n/a	16.34%	13.66%

1. 22% target to Core FI, 4% target to Opportunistic FI

24. Projected Liquidity of Refined Target 7.00% Asset Mix

	Capital Preservation Assets			Return Seeking Assets						
	Cash	Inflation Protection (TIPS)	Fixed Income (US Agg)	US Equity	Int. Dev. Mkts Equity	Emerging Mkts Equity	Real Estate	Opp. FI	Private Credit	Private Equity
Policy Target Asset Allocation	2%	4%	22%	25%	13%	4%	8%	4%	4%	14%
Expected Return (Geometric)	2.50%	3.75%	3.75%	7.15%	7.00%	7.25%	7.85%	5.25%	6.50%	8.50%
Expected Volatility	0.90%	5.05%	3.75%	17.95%	19.75%	27.45%	19.55%	7.70%	12.50%	29.30%
Liquidity	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM	LOW	LOW	LOW	LOW
Correlation to US Equity	-0.04	-0.05	-0.11	1.00	0.81	0.87	0.74	0.72	0.85	0.92
Months of Benefit Payments	1.9	3.8	21.0							
Months of Benefit Payments (inlcudes EE & ER contributions)	6.6	13.2	72.3							
Cumulative Months of Benefit Payments (includes EE & ER contributions)	92.1									

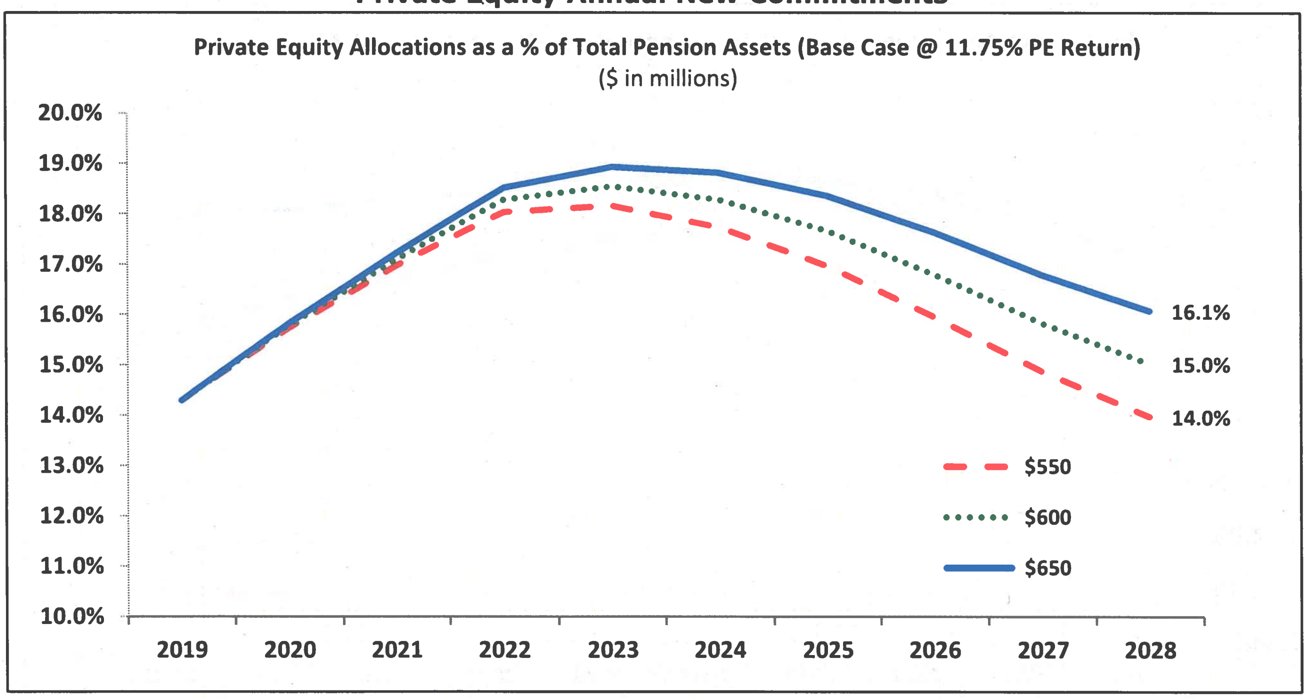
Source of Data: Callan A/L Study 10/16/19

Assumptions:

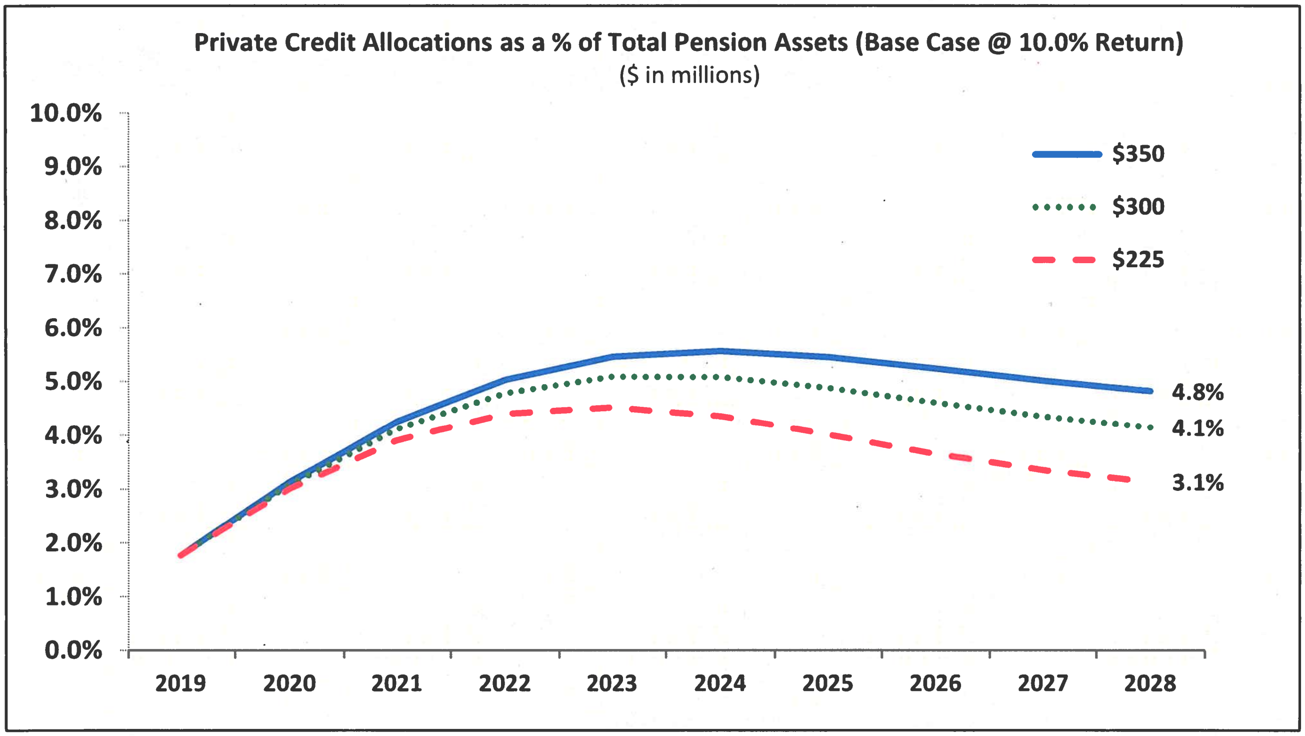
- Total fund assets as of 7/31/19 at $29.6 billion
- Monthly benefit payments at $310 million
- Monthly benefit payments net of contributions at $90 million

25. Private Markets Annual Pacing

Private Equity Annual New Commitments



Private Credit Annual New Commitments



Real Estate Annual New Commitments