#### Kentucky Retirement Systems Special Called Investment Committee Meeting January 18, 2024 at 10:00 a.m. ET (9:00 a.m. CT) Via Video Teleconference and Facebook Live

#### AGENDA

1.	Call to Order	Prewitt Lane
2.	Opening Legal Statement	Legal Services
3.	Roll Call	Sherry Rankin
4.	Public Comment	Sherry Rankin
5.	Asset Allocation Analysis*	Wilshire
6.	Real Return Investment Recommendation*	KPPA Investment Staff
7.	Adjourn*	Prewitt Lane

\* Committee Action May be Taken



# Kentucky Retirement Systems (KRS)

Kentucky Employees Retirement System (KERS) State Police Retirement System (SPRS)

Asset Allocation Analysis

December 2023



### Contents

Background & Overview

Observations & Recommendation

Asset Allocation Approach

Asset Allocation Inputs

Asset Liability Projections

Appendix



# Background & Overview



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# Background & Overview

- The asset allocation decision is the most important decision an investor can make
  - The asset allocation decision drives 90% of return variability among portfolios
- Wilshire recommends revisiting the asset allocation decision every three to five years, or sooner, as market conditions warrant
  - KRS (pre-separation) last reviewed asset allocation in February of 2022; the last full asset-liability study was conducted in November 2020
  - In order to meet the discount rates, and given the capital markets assumptions at the time, increased exposure to public equities was approved while core fixed income and real return were reduced
- The market environment in 2023 is much different than that of 2020, largely driven by a regime change that resulted in significantly higher interest rates allowing fixed income to once again play a prominent role in client portfolios
- What have we done to date regarding the study?
  - Worked with the IC Chair and Staff based on comments from Board to identify risk-appetite of the Plans and appropriate policies to model as a component of a mean-variance analysis
  - Collected most recent KERS and SPRS actuarial data



# Opportunity

KRS has the opportunity to reduce risk while maintaining expected returns

- Fixed income assets provide utility again
- Forward-looking returns on equities are subdued due to high valuations and recent strong returns
- Assumed rates of return are more easily achieved than what was possible during previous AA and AL studies

#### Focus of the 2023 Asset Liability Study

- Consider alternative strategic asset allocation policies that reduce risk, as measured by expected volatility, but also in the context of economic factor exposure
- Consider allocations that provide an efficient and/or improved risk-return tradeoff given current market conditions

# **Observations & Recommendation**

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# **Observations & Recommendation**

# Wilshire recommends that the Board adopt one of the lower risk policies based on the Board's desired risk profile

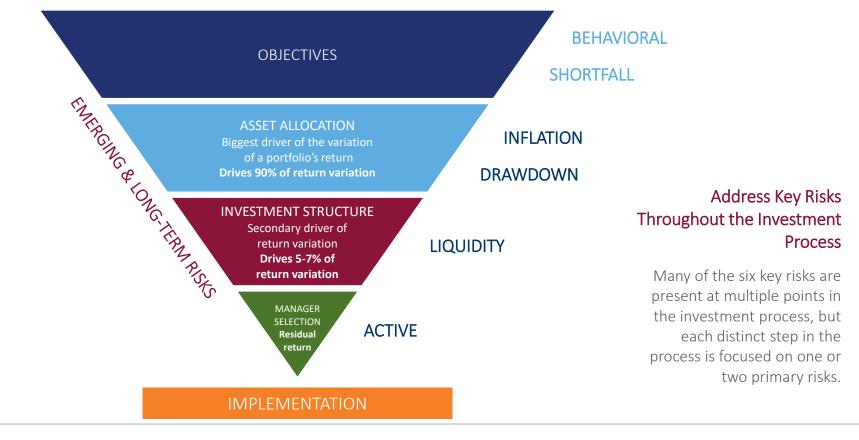
- All of the lower risk portfolio options have the following merits compared to the current asset allocation policy targets:
  - Expected returns in excess of the assumed rate while cutting risk
  - Reduced growth factor exposure (improves sensitivity to economic downturns)
  - Improved liquidity in normal and stressed market environments
  - Improved Sharpe ratio
- The lower risk portfolios sacrifice some upside potential in the optimistic scenarios (top 25% of modelled observations (see pages 44 and 54) and have modestly lower inflation factor scores



# Asset Allocation Approach

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## Focus on Decisions That are Most Impactful



# Risk Assessment Framework

Wilshire's multi-dimensional view of risk integrates organizational and investment considerations into a comprehensive framework for evaluating strategic decisions.

Shortfall: Support distributions and long-term growth

Behavioral: Instill strong governance

Drawdown: Limit portfolio losses

Inflation: Preserve long-term purchasing power

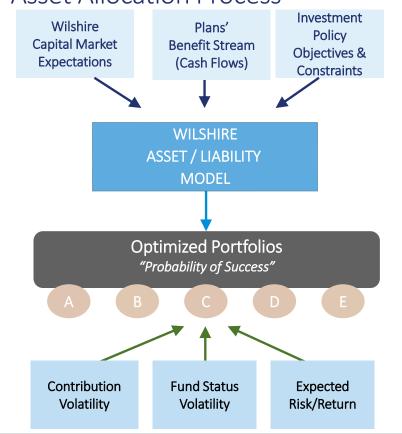
Liquidity: Balance near-term needs, long-term opportunities

Active: Ensure unique exposures

**Emerging & Long-Term**: Environmental, Social & Governance risks, such as externalities, intangibles and reputation may be linked to various risk lenses



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### Asset Allocation Process

- The mission of a defined benefit plan is to fund benefits promised to participants
- The role of asset allocation is to manage risk in order to fulfill that core mission
  - Maximize safety of promised benefits
  - Minimize cost of funding these benefits
- Wilshire's Asset Liability Model provides methodology for selecting a target portfolio that considers both goals
- Rigorously developed capital market assumptions for risk and return (see appendix)
- Given that short-term volatility is also important, we identify the impact of the asset allocation decision on funded ratios, annual contribution requirements, and other metrics
- Strategic asset allocation is not a guide to outperforming in every market ... but it should provide a roadmap for success over a market cycle



# Asset Allocation Inputs



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# KERS NON-HAZARDOUS RETIREMENT PLAN

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## Plan Status

	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	16,577.0	15,858.0
2. Market Value of Assets (MVA)	3,013.8	3,522.0
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	13,563.2	12,336.0
4. AAL MVA Funded Ratio (2. / 1.)	<u>18.2%</u>	<u>22.2%</u>
5. Actuarial Value of Assets (AVA)	3,065.0	3,577.6
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	13,512.0	12,280.4
7. AAL AVA Funded Ratio (5. / 1.)	<u>18.5%</u>	<u>22.6%</u>
Economic Assumptions		
Discount Rate	5.25%	5.25%

• June 30, 2022, data was provided in the actuarial valuation report by the plan actuary.

• June 30, 2023, data was projected by Wilshire using data from the report and additional metrics provided by the actuary.

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#### **Projected Cashflow** Contributions Benefit Payments Difference Difference as % of Assets \$1,200.0 2.75% \$1,000.0 2.25% \$800.0 1.75% \$600.0 1.25% (\$u<sup>\$</sup>100.0 0.75% \$200.0 0.25% \$0.0 -0.25% 202 202 202 203 202 202 202 203 203 203 -\$200.0 -0.75% Benefit payments and contributions (both employer and member) were provided by plan actuary. ٠ Difference as a % of Assets is based on projected median asset values with the Current Target policy ٠



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# KERS HAZARDOUS RETIREMENT PLAN

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## Plan Status

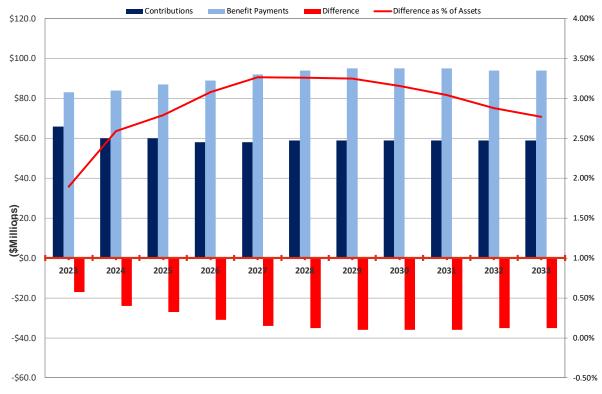
	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	1,317.0	1,321.0
2. Market Value of Assets (MVA)	811.0	898.8
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	506.0	422.2
4. AAL MVA Funded Ratio (2. / 1.)	<u>61.6%</u>	<u>68.0%</u>
5. Actuarial Value of Assets (AVA)	832.0	878.9
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	485.0	442.1
7. AAL AVA Funded Ratio (5. / 1.)	<u>63.2%</u>	<u>66.5%</u>
Economic Assumptions		
Discount Rate	6.25%	6.25%

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# **Projected Cashflow**



Benefit payments and contributions (both employer and member) were provided by plan actuary.
Difference as a % of Assets is based on projected median asset values with the Current Target policy.

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### Plan Status

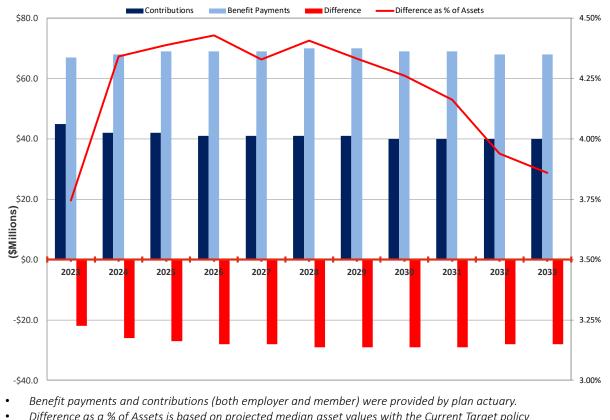
	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	1,067.0	1,039.0
2. Market Value of Assets (MVA)	551.7	587.5
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	515.3	451.5
4. AAL MVA Funded Ratio (2. / 1.)	<u>51.7%</u>	<u>56.5%</u>
5. Actuarial Value of Assets (AVA)	560.0	576.5
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	507.0	462.5
7. AAL AVA Funded Ratio (5. / 1.)	<u>52.5%</u>	<u>55.5%</u>
Economic Assumptions		
Discount Rate	5.25%	5.25%

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# **Projected Cashflow**



Difference as a % of Assets is based on projected median asset values with the Current Target policy



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# KERS NON-HAZARDOUS INSURANCE PLAN

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## Plan Status

	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	1,782.0	1,721.0
2. Market Value of Assets (MVA)	1,364.4	1,452.3
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	417.6	268.7
4. AAL MVA Funded Ratio (2. / 1.)	<u>76.6%</u>	<u>84.4%</u>
5. Actuarial Value of Assets (AVA)	1,410.0	1,523.4
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	372.0	197.6
7. AAL AVA Funded Ratio (5. / 1.)	<u>79.1%</u>	<u>88.5%</u>
Economic Assumptions		
Discount Rate	6.25%	6.50%

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#### **Projected Cashflow** Benefit Payments Difference Difference as % of Assets Contributions \$200.0 7.00% \$150.0 6.00% \$100.0 5.00% \$50.0 4.00% (\$0.0 \$0.0 3.00% 2024 202 202 202 202 202 203 203 2032 203 -\$50.0 2.00% -\$100.0 1.00% -\$150.0 0.00%

Benefit payments and contributions (both employer and member) were provided by plan actuary.
Difference as a % of Assets is based on projected median asset values with the Current Target policy

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# KERS HAZARDOUS INSURANCE PLAN

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## Plan Status

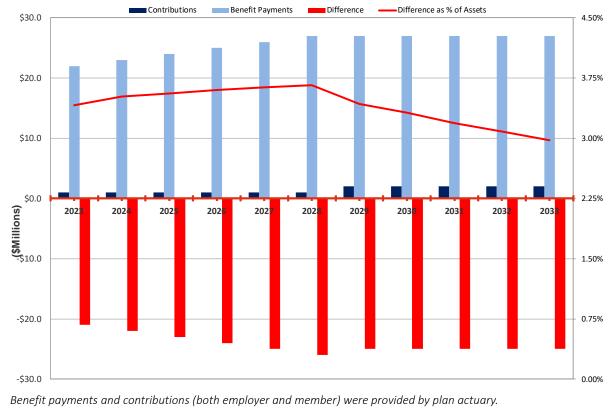
	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	347.0	340.0
2. Market Value of Assets (MVA)	588.2	616.0
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	(241.2)	(276.0)
4. AAL MVA Funded Ratio (2. / 1.)	<u>169.5%</u>	<u>181.2%</u>
5. Actuarial Value of Assets (AVA)	598.0	616.8
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	(251.0)	(276.8)
7. AAL AVA Funded Ratio (5. / 1.)	<u>172.3%</u>	<u>181.4%</u>
Economic Assumptions		
Discount Rate	6.25%	6.50%

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# **Projected Cashflow**

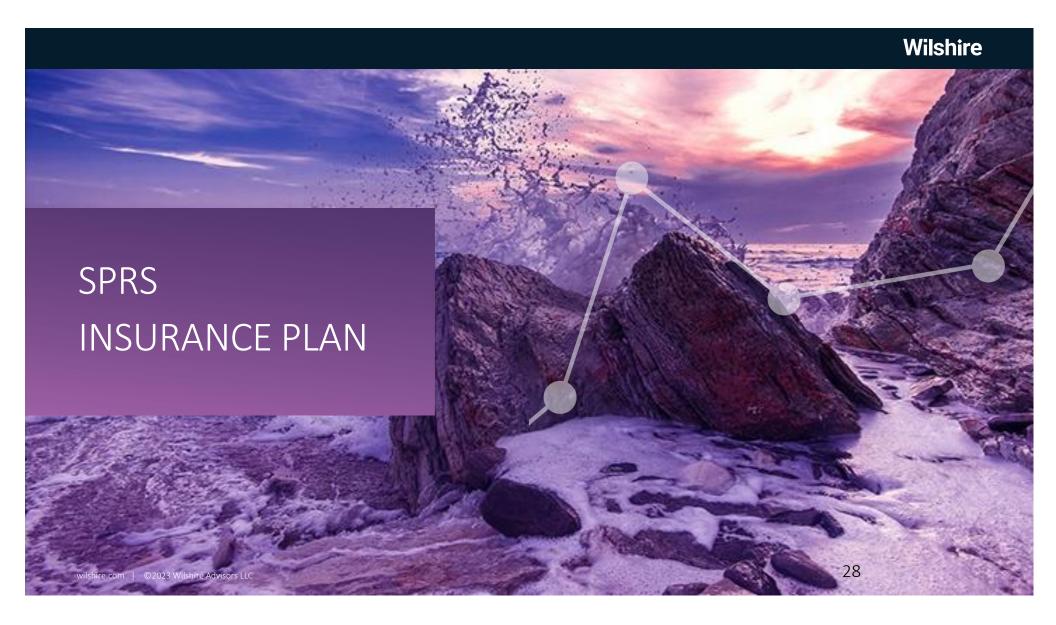


Difference as a % of Assets is based on projected median asset values with the Current Target policy

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## Plan Status

	June 30, 2022	June 30, 2023
Asset and Liability Data (\$ - Millions)		
1. Actuarial Accrued Liability (AAL)	233.0	230.0
2. Market Value of Assets (MVA)	231.2	245.8
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	1.8	(15.8)
4. AAL MVA Funded Ratio (2. / 1.)	<u>99.2%</u>	<u>106.9%</u>
5. Actuarial Value of Assets (AVA)	234.0	239.2
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	(1.0)	(9.2)
7. AAL AVA Funded Ratio (5. / 1.)	<u>100.4%</u>	<u>104.0%</u>
Economic Assumptions		
Discount Rate	6.25%	6.50%

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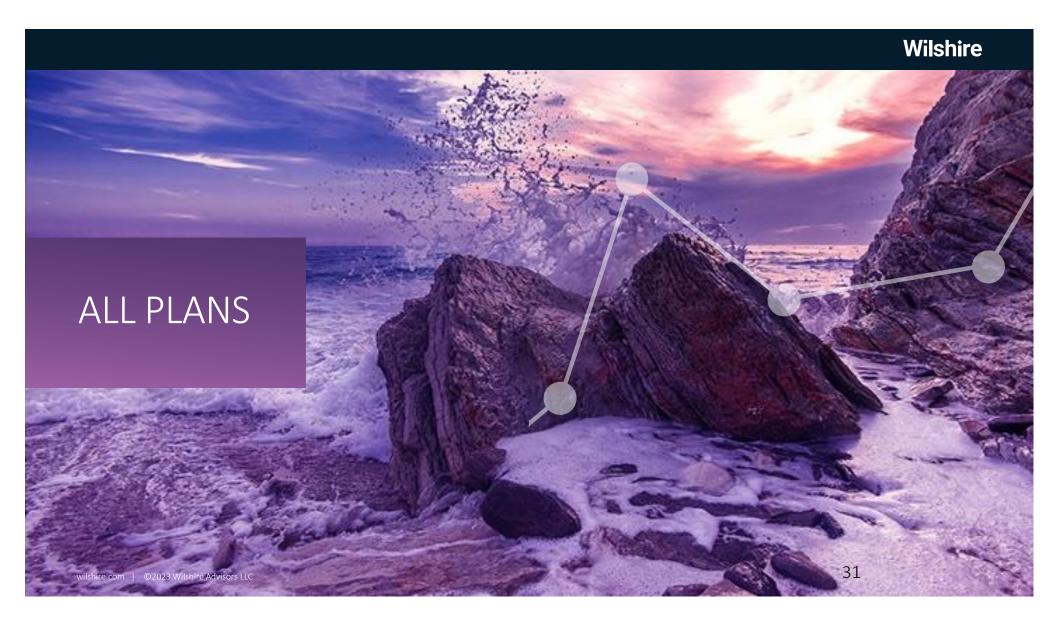
# **Projected Cashflow**



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# Plan Status – As of June 30, 2023

	KERS Non-Hazardous Pension	KERS Hazardous Pension	SPRS Pension	KERS Non-Hazardous Insurance	KERS Hazardous Insurance	SPRS Insurance
Asset and Liability Data (\$ - Millions)						
1. Actuarial Accrued Liability (AAL)	15,858.0	1,321.0	1,039.0	1,721.0	340.0	230.0
2. Market Value of Assets (MVA)	3,522.0	898.8	587.5	1,452.3	616.0	245.8
3. AAL MVA Funded Status (Unfunded Liability) (1 2.)	12,336.0	422.2	451.5	268.7	(276.0)	(15.8)
4. AAL MVA Funded Ratio (2. / 1.)	<u>22.2%</u>	<u>68.0%</u>	<u>56.5%</u>	<u>84.4%</u>	<u>181.2%</u>	<u>106.9%</u>
5. Actuarial Value of Assets (AVA)	3,577.6	878.9	576.5	1,523.4	616.8	239.2
6. AAL AVA Funded Status (Unfunded Liability) (1 5.)	12,280.4	442.1	462.5	197.6	(276.8)	(9.2)
7. AAL AVA Funded Ratio (5. / 1.)	<u>22.6%</u>	<u>66.5%</u>	<u>55.5%</u>	<u>88.5%</u>	<u>181.4%</u>	<u>104.0%</u>
Economic Assumptions						
Discount Rate	5.25%	6.25%	5.25%	6.50%	6.50%	6.50%

• June 30, 2023, data was projected by Wilshire using data from the report and additional metrics provided by the actuary.

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# Capital Market Assumptions – KPPA Bucketing

#### Wilshire's Capital Market Assumptions as of June 30, 2023

Wilshire's asset class return, risk and correlation assumptions are developed on multi-year forward looking expected rates of return and historical risk and correlation, adjusted to incorporate recent trends

Public market return expectations represent a passive investment in the asset class (beta). They do not reflect value added from active management (alpha).

Asset Classes	Expected Return 10 Years	Expected Return 30 Years	Risk	Cash Yield	Factor Exposure Growth	Factor Exposure Inflation	Liquidity Market Level	Liquidity Stressed Metric
Public Equity	6.15	7.15	17.10	2.05	8.00	-1.30	90	0
Private Equity	9.15	9.95	27.80	0.00	13.35	-3.80	0	0
Core Fixed Income	4.85	4.80	4.70	4.95	-0.95	-2.50	100	85
Specialty Credit	7.40	7.40	9.05	9.70	3.50	-0.50	30	0
Cash	3.85	3.55	0.75	3.85	0.00	0.00	100	100
Real Estate	6.00	6.95	13.95	2.30	3.70	1.00	0	0
Real Return	6.85	7.35	10.65	3.60	2.15	5.80	0	0

# Capital Market Assumptions – Wilshire Bucketing

#### Wilshire's Capital Market Assumptions as of June 30, 2023

Wilshire's asset class return, risk and correlation assumptions are developed on multi-year forward looking expected rates of return and historical risk and correlation, adjusted to incorporate recent trends

Public market return expectations represent a passive investment in the asset class (beta). They do not reflect value added from active management (alpha).

Asset Classes	Expected Return 10 Years	Expected Return 30 Years	Risk	Cash Yield	Factor Exposure Growth	Factor Exposure Inflation	Liquidity Market Level	Liquidity Stressed Metric
Public Equity	6.15	7.15	17.10	2.05	8.00	-1.30	90	0
Private Equity	9.15	9.95	27.80	0.00	13.35	-3.80	0	0
Specialty Credit	7.40	7.40	9.05	9.70	3.50	-0.50	30	0
Core Fixed Income	4.85	4.80	4.70	4.95	-0.95	-2.50	100	85
Cash	3.85	3.55	0.75	3.85	0.00	0.00	100	100
Real Estate	6.00	6.95	13.95	2.30	3.70	1.00	0	0
Real Return	6.85	7.35	10.65	3.60	2.15	5.80	0	0

Growth – Assets with significant growth factor exposure, high expected returns and high risk

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Defensive Growth – Assets with positive growth factor exposure with moderate risk

Defensive/Rate Sensitive – Assets whose value/return is sensitive to changes in interest rates

Real Assets/Inflation Sensitive – Assets whose value/return is sensitive to inflation



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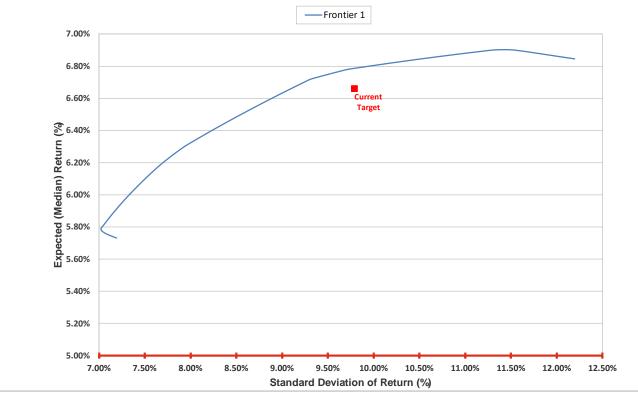
# KERS NON-HAZARDOUS RETIREMENT PLAN SPRS RETIREMENT PLAN 5.25% DISCOUNT RATE

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## Asset Only Efficient Frontier

### Given the asset classes and constraints, opportunities to enhance portfolio efficiency do exist



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## Portfolios Modeled – KPPA Bucketing

	Current	Optimization	Lower	Lower	Lower
Asset Class	Target	Constraints	Risk X	Risk Y	Risk Z
Public Equity	32.50%	30% - 80%	30.00%	30.00%	30.00%
Private Equity	<u>7.00%</u>	0% - 7% <sup>1</sup>	<u>6.00%</u>	<u>3.00%</u>	<u>0.00%</u>
Total Equity	39.50%		36.00%	33.00%	30.00%
Core Fixed Income	20.50%	10% - 50%	27.00%	30.00%	40.00%
Specialty Credit	15.00%	0% - 20% <sup>1</sup>	20.00%	20.00%	15.00%
Cash	<u>5.00%</u>	2% - 5%	<u>2.00%</u>	2.00%	<u>5.00%</u>
Total Fixed Income	40.50%		49.00%	52.00%	60.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	5.00%	5.00%	5.00%
Real Return	<u>10.00%</u>	5% - 10% <sup>1</sup>	<u>10.00%</u>	<u>10.00%</u>	<u>5.00%</u>
Total Inflation Protected	20.00%		15.00%	15.00%	10.00%
Total Assets	100.0%		100.0%	100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	29.50%	0% - 35%	26.00%	23.00%	15.00%
Expected Return - 10 Years (%)	6.66		6.66	6.48	6.04
Expected Return - 30 Years (%)	7.16		7.08	6.88	6.38
Standard Deviation of Return (%)	9.79		9.10	8.50	7.40
+/(-) in Expected Return - 10 Years (bps)			0	(18)	(62)
+/(-) in Expected Return - 30 Years (bps)			(8)	(28)	(78)
+/(-) in SD of Return (bps)			(69)	(129)	(239)
Sharpe Ratio	0.29		0.31	0.31	0.30

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

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## Portfolios Modeled – KPPA Bucketing

Asset Class	Current Target	Lower Risk X	Lower Risk Y	Lower Risk Z
Total Equity	39.50%	36.00%	33.00%	30.00%
Total Fixed Income	40.50%	49.00%	52.00%	60.00%
Total Inflation Protected	<u>20.00%</u>	<u>15.00%</u>	<u>15.00%</u>	<u>10.00%</u>
Total Assets	100.0%	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.66	6.66	6.48	6.04
Expected Return - 30 Years (%)	7.16	7.08	6.88	6.38
Standard Deviation of Return (%)	9.79	9.10	8.50	7.40
Contribution to Asset Volatility (%):				
Equity	69.9	67.7	64.0	64.7
Fixed Income	12.9	19.4	22.1	24.6
Inflation Protected	17.2	12.9	13.9	10.7
Cash Yield	3.9	4.4	4.6	4.5
Growth Factor	4.4	4.0	3.6	2.8
Inflation Factor	-0.6	-0.8	-0.7	-1.1
Liquidity				
Market	59.3	62.0	65.0	76.5
Stressed	22.4	25.0	27.5	39.0

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## Portfolios Modeled – Wilshire Bucketing

Asset Class	Current Target	Optimization Constraints	Lower Risk X	Lower Risk Y	Lower Risk Z
Public Equity	32.50%	30% - 80%	30.00%	30.00%	30.00%
Private Equity	7.00%	<b>0%</b> - <b>7%</b> <sup>1</sup>	6.00%	3.00%	0.00%
Total Growth Assets	39.50%		36.00%	33.00%	30.00%
Specialty Credit	<u>15.00%</u>	0% - 20% <sup>1</sup>	<u>20.00%</u>	20.00%	<u>15.00%</u>
Total Defensive Growth Assets	15.00%		20.00%	20.00%	15.00%
Core Fixed Income	20.50%	10% - 50%	27.00%	30.00%	40.00%
Cash	<u>5.00%</u>	2% - 5%	<u>2.00%</u>	2.00%	5.00%
Total Defensive / Rate Sensitive Assets	25.50%		29.00%	32.00%	45.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	5.00%	5.00%	5.00%
Real Return	<u>10.00%</u>	5% - 10% <sup>1</sup>	<u>10.00%</u>	<u>10.00%</u>	<u>5.00%</u>
Total RA / Inflation Sensitive Assets	20.00%		15.00%	15.00%	10.00%
Total Assets	100.0%		100.0%	100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	29.50%	0% - 35%	26.00%	23.00%	15.00%
Expected Return - 10 Years (%)	6.66		6.66	6.48	6.04
Expected Return - 30 Years (%)	7.16		7.08	6.88	6.38
Standard Deviation of Return (%)	9.79		9.10	8.50	7.40
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Sharpe Ratio	0.29		0.31	0.31	0.30

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

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## Portfolios Modeled – Wilshire Bucketing

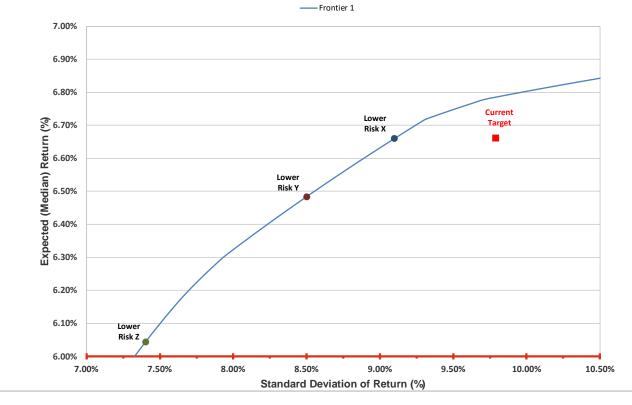
Asset Class	Current Target	Lower Risk X	Lower Risk Y	Lower Risk Z
Total Growth Assets	39.50%	36.00%	33.00%	30.00%
Total Defensive Growth Assets	15.00%	20.00%	20.00%	15.00%
Total Defensive / Rate Sensitive Assets	25.50%	29.00%	32.00%	45.00%
Total RA / Inflation Sensitive Assets	20.00%	<u>15.00%</u>	<u>15.00%</u>	<u>10.00%</u>
Total Assets	100.0%	100.0%	100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	29.50%	26.00%	23.00%	15.00%
Expected Return - 10 Years (%)	6.66	6.66	6.48	6.04
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Standard Deviation of Return (%)	9.79	9.10	8.50	7.40
Contribution to Asset Volatility (%):				
Growth	69.9	67.7	64.0	64.7
Defensive Growth	9.6	14.2	15.7	13.2
Defensive/Rate Sensitive	3.3	5.2	6.4	11.4
RA/Inflation Sensitve	17.2	12.9	13.9	10.7
Cash Yield	3.9	4.4	4.6	4.5
Growth Factor	4.4	4.0	3.6	2.8
Inflation Factor	-0.6	-0.8	-0.7	-1.1
Liquidity				
Market	59.3	62.0	65.0	76.5
Stressed	22.4	25.0	27.5	39.0

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## Asset Only Efficient Frontier

### Given the asset classes and constraints, opportunities to enhance portfolio efficiency do exist

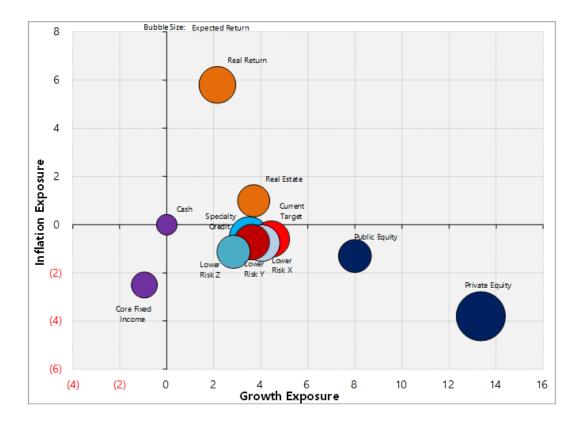


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## **Economic Factor Exposure**

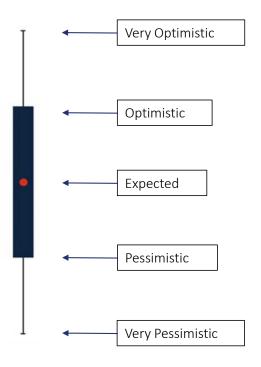
Concentrated factor tilts can represent portfolio vulnerability (e.g., reliance on growth markets)

To the extent possible, a portfolio with factor neutrality is desirable for weathering unexpected future market environments



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## Box and Whisker Graphs



In each year of the simulation, there are 5,000 independent economic trial results.

**Expected:** 50% of the potential scenarios result in higher than this value and 50% results in lower

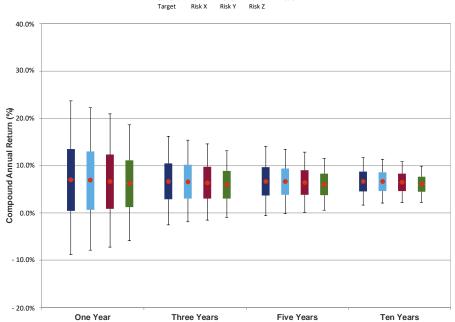
**Very optimistic:** Only 5% of the scenarios result in higher than this value and 95% result in lower

**Optimistic:** Only 25% of the scenarios result in higher than this value and 75% result in lower

**Pessimistic:** 75% of the scenarios results in higher than this value and 25% result in lower

**Very pessimistic:** 95% of the scenarios result in higher than this value and 5% result in lower

## Distribution of Returns\*



Current Lower Lower Median

60	One Year					Three	Years			Five Y	/ears		Ten Years			
(%)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Optimistic	23.66	22.23	20.98	18.61	16.15	15.39	14.61	13.15	14.09	13.43	12.84	11.59	11.69	11.31	10.86	9.87
Optimistic	13.53	12.98	12.38	11.16	10.49	10.18	9.74	8.86	9.68	9.42	9.03	8.28	8.77	8.61	8.30	7.63
Median (Expected)	6.99	6.90	6.67	6.26	6.68	6.56	6.33	5.91	6.67	6.63	6.43	6.02	6.66	6.66	6.48	6.04
Pessimistic	0.45	0.67	0.83	1.20	2.87	3.00	3.03	3.06	3.68	3.82	3.81	3.75	4.52	4.65	4.62	4.44
Very Pessimistic	-8.85	-7.89	-7.21	-5.87	-2.50	-1.92	-1.52	-0.97	-0.55	-0.13	0.16	0.60	1.66	2.06	2.15	2.25

\*For periods longer than one year, returns are compound annual.

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# ALL OTHER PLANS:

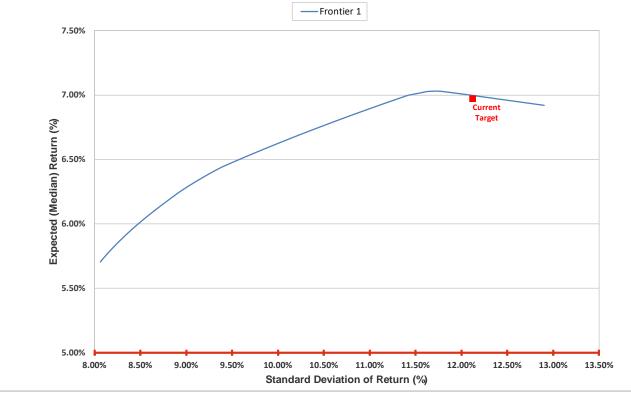
- KERS NON-HAZ INS
- KERS HAZ RET/INS
- SPRS INS

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## Asset Only Efficient Frontier

### Given the asset classes and constraints, opportunities to enhance portfolio efficiency do exist



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## Portfolios Modeled – KPPA Bucketing

Asset Class	Current	Optimization	Lower	Lower
Asset Class	Target	Constraints	Risk A	Risk B
Public Equity	43.50%	40% - 80%	40.00%	40.00%
Private Equity	<u>10.00%</u>	0% - 10% <sup>1</sup>	<u>8.00%</u>	<u>7.50%</u>
Total Equity	53.50%		48.00%	47.50%
Core Fixed Income	10.00%	10% - 50%	10.00%	15.50%
Specialty Credit	15.00%	0% - 20% <sup>1</sup>	25.00%	20.00%
Cash	<u>1.50%</u>	2% - 5%	<u>2.00%</u>	<u>2.00%</u>
Total Fixed Income	26.50%		37.00%	37.50%
Real Estate	10.00%	5% - 10% <sup>1</sup>	7.00%	5.00%
Real Return	<u>10.00%</u>	0% - 10% <sup>1</sup>	<u>8.00%</u>	<u>10.00%</u>
Total Inflation Protected	20.00%		15.00%	15.00%
Total Assets	100.0%		100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	32.50%	0% - 35%	31.50%	27.50%
Expected Return - 10 Years (%)	6.97		6.99	6.86
Expected Return - 30 Years (%)	7.62		7.55	7.40
Standard Deviation of Return (%)	12.12		11.29	10.88
+/(-) in Expected Return - 10 Years (bps)			2	(11)
+/(-) in Expected Return - 30 Years (bps)			(7)	(22)
+/(-) in SD of Return (bps)			(83)	(124)
Sharpe Ratio	0.26		0.28	0.28

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

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## Portfolios Modeled – KPPA Bucketing

Asset Class	Current Target	Lower Risk A	Lower Risk B
Total Equity	53.50%	48.00%	47.50%
Total Fixed Income	26.50%	37.00%	37.50%
Total Inflation Protected	<u>20.00%</u>	<u>15.00%</u>	<u>15.00%</u>
Total Assets	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.97	6.99	6.86
Expected Return - 30 Years (%)	7.62	7.55	7.40
Standard Deviation of Return (%)	12.12	11.29	10.88
Contribution to Asset Volatility (%):			
Equity	78.1	73.9	76.0
Fixed Income	8.5	15.4	13.5
Inflation Protected	13.4	10.7	10.5
Cash Yield	3.5	4.3	4.1
Growth Factor	5.8	5.5	5.2
Inflation Factor	-0.6	-0.7	-0.7
Liquidity			
Market	55.2	55.5	59.5
Stressed	10.0	10.5	15.2

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## Portfolios Modeled – Wilshire Bucketing

Asset Class	Current Target	Optimization Constraints	Lower Risk A	Lower Risk B
Public Equity	43.50%	40% - 80%	40.00%	40.00%
Private Equity	<u>10.00%</u>	<b>0%</b> - <b>10%</b> <sup>1</sup>	<u>8.00%</u>	7.50%
Total Growth Assets	53.50%		48.00%	47.50%
Specialty Credit	<u>15.00%</u>	0% - 20% <sup>1</sup>	<u>25.00%</u>	<u>20.00%</u>
Total Defensive Growth Assets	15.00%		25.00%	20.00%
Core Fixed Income	10.00%	10% - 50%	10.00%	15.50%
Cash	<u>1.50%</u>	2% - 5%	2.00%	2.00%
Total Defensive / Rate Sensitive Assets	11.50%		12.00%	17.50%
Real Estate	10.00%	5% - 10% <sup>1</sup>	7.00%	5.00%
Real Return	<u>10.00%</u>	<b>0%</b> - <b>10%</b> <sup>1</sup>	<u>8.00%</u>	<u>10.00%</u>
Total RA / Inflation Sensitive Assets	20.00%		15.00%	15.00%
Total Assets	100.0%		100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	32.50%	0% - 35%	31.50%	27.50%
Expected Return - 10 Years (%)	6.97		6.99	6.86
Expected Return - 30 Years (%)	7.62		7.55	7.40
Standard Deviation of Return (%)	12.12		11.29	10.88
+/(-) in Expected Return - 10 Years (bps)			2	(11)
+/(-) in Expected Return - 30 Years (bps)			(7)	(22)
+/(-) in SD of Return (bps)			(83)	(124)
Sharpe Ratio	0.26		0.28	0.28
1				

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

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## Portfolios Modeled – Wilshire Bucketing

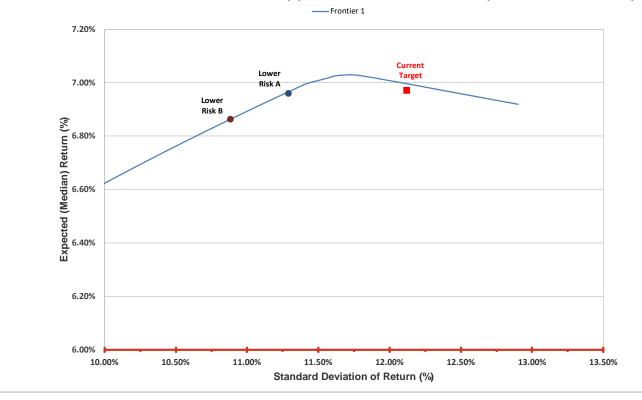
Asset Class	Current Target	Lower Risk A	Lower Risk B
Total Growth Assets	53.50%	48.00%	47.50%
Total Defensive Growth Assets	15.00%	25.00%	20.00%
Total Defensive / Rate Sensitive Assets	11.50%	12.00%	17.50%
Total RA / Inflation Sensitive Assets	<u>20.00%</u>	<u>15.00%</u>	<u>15.00%</u>
Total Assets	100.0%	100.0%	100.0%
Total Illiquid Assets <sup>1</sup>	32.50%	31.50%	27.50%
Expected Return - 10 Years (%)	6.97	6.99	6.86
Expected Return - 30 Years (%)	7.62	7.55	7.40
Standard Deviation of Return (%)	12.12	11.29	10.88
Contribution to Asset Volatility (%):			
Growth	78.1	73.9	76.0
Defensive Growth	7.4	14.2	11.5
Defensive/Rate Sensitive	1.1	1.2	2.0
RA/Inflation Sensitve	13.4	10.7	10.5
Cash Yield	3.5	4.3	4.1
Growth Factor	5.8	5.5	5.2
Inflation Factor	-0.6	-0.7	-0.7
Liquidity			
Market	55.2	55.5	59.5
Stressed	10.0	10.5	15.2

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## Asset Only Efficient Frontier

### Given the asset classes and constraints, opportunities to enhance portfolio efficiency do exist

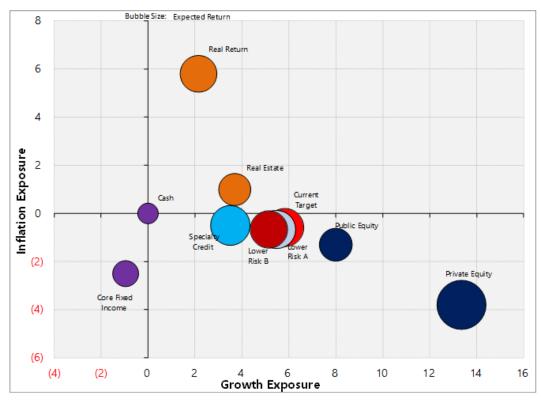


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## **Economic Factor Exposure**

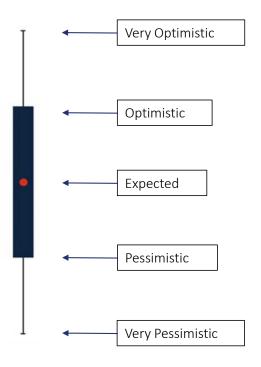
Concentrated factor tilts can represent portfolio vulnerability (e.g., reliance on growth markets)

To the extent possible, a portfolio with factor neutrality is desirable for weathering unexpected future market environments



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## Box and Whisker Graphs



In each year of the simulation, there are 5,000 independent economic trial results.

**Expected:** 50% of the potential scenarios result in higher than this value and 50% results in lower

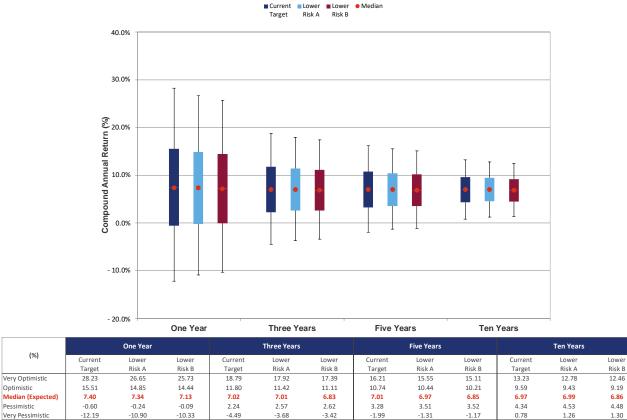
**Very optimistic:** Only 5% of the scenarios result in higher than this value and 95% result in lower

**Optimistic:** Only 25% of the scenarios result in higher than this value and 75% result in lower

**Pessimistic:** 75% of the scenarios results in higher than this value and 25% result in lower

**Very pessimistic:** 95% of the scenarios result in higher than this value and 5% result in lower

## Distribution of Returns\*



\*For periods longer than one year, returns are compound annual

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Optimistic

Pessimistic

(%)

54

6.86

4.48

1.30



# Asset Liability Projections

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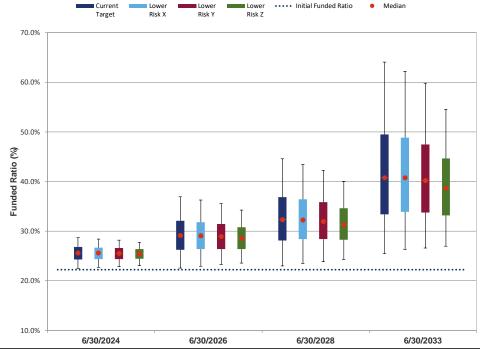


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# KERS NON-HAZARDOUS RETIREMENT PLAN

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## AAL MVA Funded Ratio



### Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

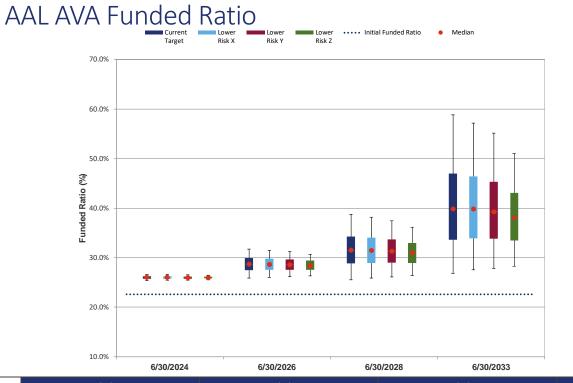
The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 22.2%

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -0.90%.

			6/3	30/2024	6/30/2026			6/30/2	2028	6/30/2033							
		6/30/	2024		6/30/2026					6/30/	/2028		6/30/2033				
(%)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	
/ery Optimistic	28.71	28.44	28.21	27.77	36.93	36.25	35.57	34.28	44.58	43.46	42.30	40.07	64.14	62.24	59.87	54.60	
Optimistic	26.81	26.71	26.59	26.36	32.08	31.81	31.47	30.78	36.87	36.42	35.83	34.65	49.53	48.87	47.48	44.66	
Median (Expected)	25.57	25.55	25.51	25.43	29.11	29.03	28.88	28.56	32.28	32.22	31.95	31.33	40.78	40.78	40.15	38.64	
Pessimistic	24.32	24.36	24.39	24.46	26.27	26.37	26.37	26.39	28.15	28.38	28.39	28.28	33.42	33.87	33.77	33.20	
Very Pessimistic	22.50	22.69	22.83	23.09	22.53	22.91	23.24	23.58	23.00	23.51	23.84	24.26	25.46	26.30	26.58	26.95	

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Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 22.6%

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -0.90%.

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			6	5/30/2024		6/30/202	26	6/3	0/2028		6/30/2033					
		6/30/	2024		6/30/2026			6/30/2028				6/30/2033				
(%)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Optimistic	26.62	26.57	26.52	26.43	31.70	31.45	31.19	30.67	38.71	38.14	37.44	36.17	58.85	57.13	55.17	51.03
Optimistic	26.24	26.22	26.20	26.15	29.90	29.80	29.66	29.38	34.27	34.02	33.65	32.97	46.98	46.42	45.31	43.08
Median (Expected)	25.99	25.99	25.98	25.97	28.66	28.62	28.57	28.43	31.54	31.47	31.28	30.92	39.79	39.80	39.27	38.03
Pessimistic	25.74	25.75	25.76	25.77	27.48	27.51	27.52	27.53	28.87	28.94	28.98	28.91	33.61	33.92	33.82	33.46
Very Pessimistic	25.38	25.42	25.44	25.50	25.86	26.04	26.15	26.30	25.53	25.86	26.06	26.35	26.80	27.51	27.86	28.23

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#### **Employer Contributions** Current Lower Lower Lower • Median Risk X Risk Y Risk Z Target \$1,500.0 \$1,400.0 ٠ ٠ ٠ . \$1,300.0 \$1,200.0 (\$ \$1,100.0 \$ \$1,000.0 \$ \$1,000.0 • **•** -\$900.0 • \$800.0 \$700.0 \$600.0 6/30/2023 6/30/2025 6/30/2027 6/30/2032

#### Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

#### Drawdown Risk:

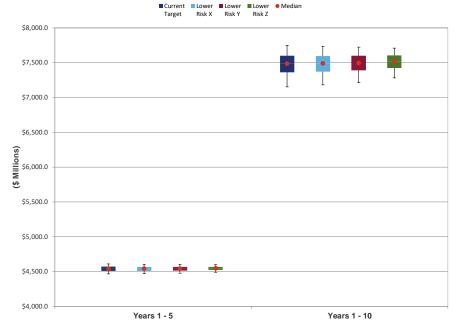
The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

(4	6/30/2023			6/30/2023 6/30/2025						6/30	/2027		6/30/2032			
(\$ Millions)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Pessimistic	1,319.8	1,319.8	1,319.8	1,319.8	988.0	987.1	986.2	985.0	908.9	907.1	906.0	903.8	924.9	920.8	918.6	916.5
Pessimistic	1,319.8	1,319.8	1,319.8	1,319.8	978.4	978.1	978.0	977.8	888.5	888.2	887.9	888.1	886.7	885.4	885.4	887.5
Median (Expected)	1,319.8	1,319.8	1,319.8	1,319.8	971.4	971.6	971.9	972.5	872.9	873.3	874.3	876.3	853.2	853.4	856.3	862.5
Optimistic	1,319.8	1,319.8	1,319.8	1,319.8	964.3	964.9	965.7	967.2	856.7	858.0	860.2	864.0	814.8	817.9	823.8	835.7
Very Optimistic	1,319.8	1,319.8	1,319.8	1,319.8	954.2	955.5	956.9	959.6	831.2	834.8	838.8	845.9	754.0	762.5	772.8	793.1

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## Present Value of Contributions



### Shortfall Risk:

The potential for the current allocation to have higher median present value of contributions than the alternative policies.

#### Drawdown Risk:

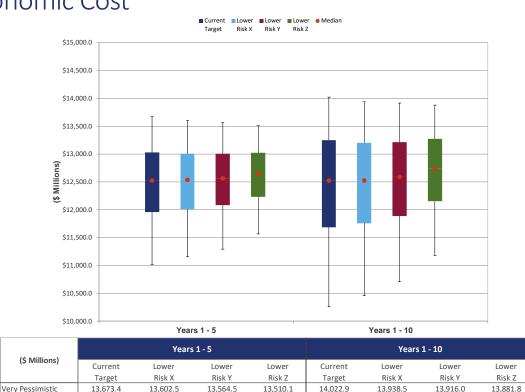
The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

#### EROA = 5.25%

(\$ Millions)		Years	1-5		Years 1 - 10						
	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower			
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z			
Very Pessimistic	4,608.0	4,604.2	4,601.7	4,597.1	7,744.3	7,730.7	7,722.1	7,709.7			
Pessimistic	4,568.2	4,567.1	4,566.9	4,566.7	7,599.5	7,595.4	7,596.8	7,601.8			
Median (Expected)	4,538.4	4,539.6	4,541.1	4,544.5	7,484.9	7,487.3	7,496.2	7,514.2			
Optimistic	4,507.6	4,510.0	4,513.5	4,521.1	7,359.7	7,370.0	7,387.8	7,422.7			
Very Optimistic	4,462.9	4,469.6	4,475.9	4,488.9	7,150.2	7,179.8	7,213.6	7,278.7			

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# MVA Economic Cost



13.019.6

12,639.4

12,229.8

11,564.6

13,246.2

12,521.9

11,681.0

10,255.9

#### Shortfall Risk:

Wilshire

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 5.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

Pessimistic

Optimistic

Very Optimistic

Median (Expected)

13.029.2

12,523.2

11,958.4

11,016.3

13.004.2

12,531.8

12,008.6

11,155.0

13.001.8

12,566.5

12,082.3

11,289.4

62

13.200.1

12,524.4

11,751.7

10,454.9

13.212.4

12,586.7

11,887.1

10,703.9

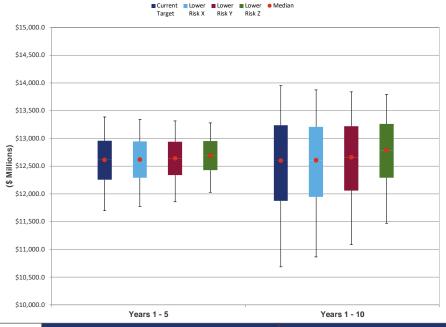
13.270.4

12,741.6

12,155.4

11,178.1

## AVA Economic Cost



#### Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 5.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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		Years 1 -	· 5		Year						
(\$ Millions)		Years	; 1 - 5		Years 1 - 10						
	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower			
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z			
Very Pessimistic	13,385.8	13,341.8	13,316.2	13,276.9	13,949.0	13,871.2	13,837.2	13,791.3			
Pessimistic	12,954.3	12,943.1	12,941.4	12,950.3	13,239.3	13,209.3	13,221.6	13,259.2			
Median (Expected)	12,611.9	12,619.4	12,642.5	12,690.0	12,601.6	12,606.6	12,660.3	12,783.8			
Optimistic	12,256.0	12,289.9	12,339.6	12,428.7	11,875.9	11,945.5	12,056.8	12,290.7			
Very Optimistic	11,693.2	11,773.5	11,858.3	12,025.4	10,685.0	10,862.9	11,080.0	11,469.3			

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### Wilshire

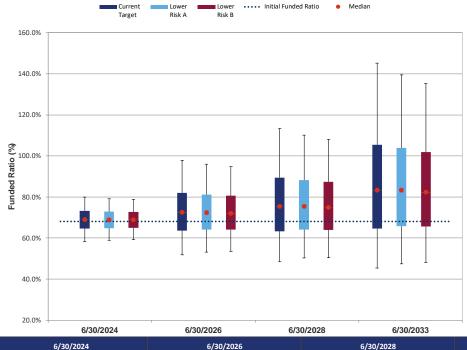


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# KERS HAZARDOUS RETIREMENT PLAN

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## AAL MVA Funded Ratio



Lower

Risk A

96.04

81.22

72.39

64.11

53.15

Lower

Risk B

94.74

80.63

72.10

64.12

53.56

Current

Target

113.42

89.49

75.39

63.23

48.53

Lower

Risk A

110.24

88.25

75.40

64.08

50.25

Lower

Risk B

108.21

87.34

74.89

63.92

50.49

Current

Target

145.16

105.40

83.42

64.69

45.39

### Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 68.0%

6/30/2033

Lower

Risk A

139.49

103.96

83.37

65.80

47.37

Lower

Risk B

135.27

101.87

82.34

65.64

48.09

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.14%.

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Current

Target

80.03

73.30

68.95

64.61

58.21

Lower

Risk A

79.20

72.95

68.92

64.81

58.93

Lower

Risk B

78.72

72.73

68.81

64.89

59.24

Current

Target

97.92

82.06

72.54

63.59

51.90

(%)

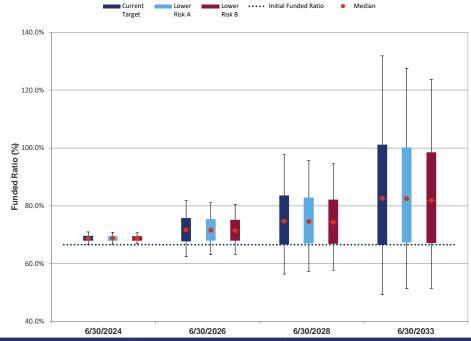
Very Optimistic

Median (Expected)

Optimistic

Pessimistic Very Pessimisti

## AAL AVA Funded Ratio



6/30/2026

Lower

Risk A

80.98

75.37

71.52

67.88

63.04

Current

Target

81.75

75.70

71.63

67.67

62.36

Lower

Risk B

70.67

69.48

68.69

67.91

66.78

### Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 66.5%

6/30/2033

Lower

Risk A

127.49

100.13

82.50

67.32

51.24

Lower

Risk B

123.65

98.49

81.83

67.08

51.42

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.14%.

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Current

Target

70.94

69.59

**68.72** 

67.85

66.57

(%)

Very Optimistic

Median (Expected)

Optimistic

Pessimistic Very Pessimistic 6/30/2024

Lower

Risk A

70.77

69.52

68.71

67.89

66.72

65

6/30/2028

Lower

Risk A

95.64

82.79

74.59

66.94

57.31

Lower

Risk B

94.56

82.12

74.24

66.86

57.68

Current

Target

131.87

101.09

82.65

66.43

49.29

Current

Target

97.66

83.56

74.65

66.53

56.30

Lower

Risk B

80.45

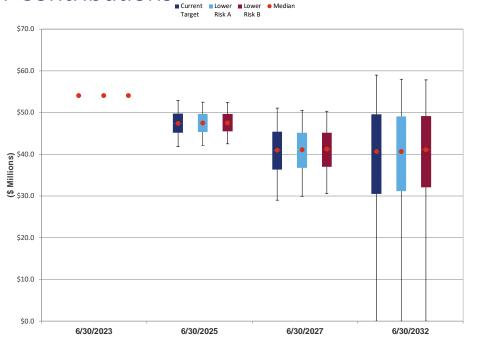
75.13

71.42

67.90

63.20

## **Employer Contributions**



#### Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

#### Drawdown Risk:

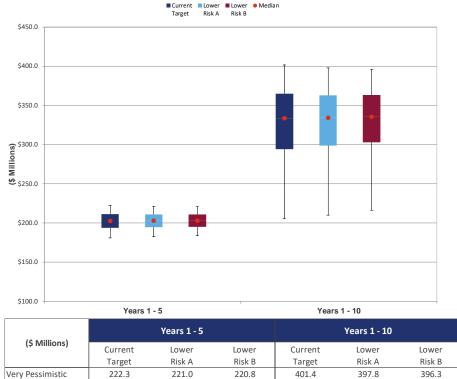
The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

			0/00/2020	00012020			0/00/2021						
	6/30/2023			6/30/2025				6/30/2027		6/30/2032			
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower	
	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B	
Very Pessimistic	54.1	54.1	54.1	52.9	52.5	52.4	51.1	50.5	50.3	59.0	58.0	57.8	
Pessimistic	54.1	54.1	54.1	49.7	49.7	49.6	45.4	45.1	45.1	49.6	49.1	49.1	
Median (Expected)	54.1	54.1	54.1	47.4	47.5	47.5	41.0	41.0	41.2	40.6	40.6	41.1	
Optimistic	54.1	54.1	54.1	45.2	45.3	45.5	36.3	36.7	37.0	30.5	31.1	32.0	
Very Optimistic	54.1	54.1	54.1	41.8	42.1	42.4	29.0	29.9	30.6	0.0	0.0	0.0	

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## Present Value of Contributions



210.6

202.9

195.0

183.7

364.7

333.6

294.1

205.1

#### Shortfall Risk:

The potential for the current allocation to have higher median present value of contributions than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

EROA = 6.25%

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Pessimistic

Optimistic

Very Optimistic

Median (Expected)

211.0

202.6

193.7

180.8

210.6

202.7

194.5

182.4

362.8

334.0

298.6

209.7

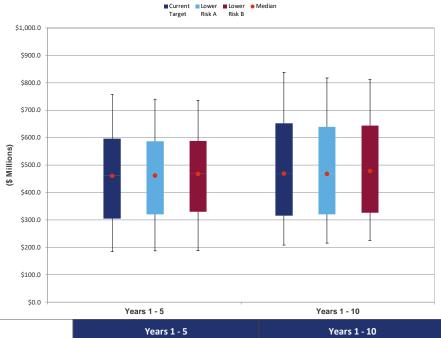
363.1

335.4

302.6

216.3

## MVA Economic Cost



(\$ Millions)		Years 1 - 5		Years 1 - 10					
	Current	Lower	Lower	Current	Lower	Lower			
	Target	Risk A	Risk B	Target	Risk A	Risk B			
Very Pessimistic	758.4	739.8	735.1	837.5	817.2	813.3			
Pessimistic	596.0	586.8	588.2	651.9	639.5	643.5			
Median (Expected)	460.9	461.6	467.2	468.3	467.7	478.0			
Optimistic	304.9	320.3	329.5	315.4	319.6	326.0			
Very Optimistic	184.0	186.0	187.6	208.1	214.7	224.8			

### Shortfall Risk:

Wilshire

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

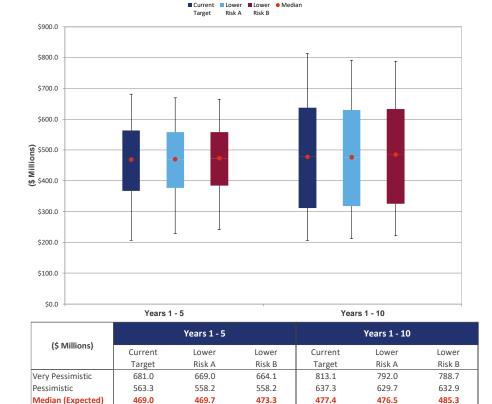
The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

#### EROA = 6.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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## AVA Economic Cost



384.2

242.2

Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 6.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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Optimistic

Very Optimistic

367.6

206.0

376.7

228.7

#### 69

Wilshire

311.4

206.6

318.1

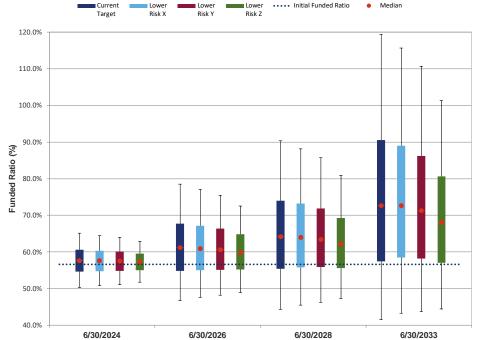
211.5

325.8

221.1



## AAL MVA Funded Ratio



### Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

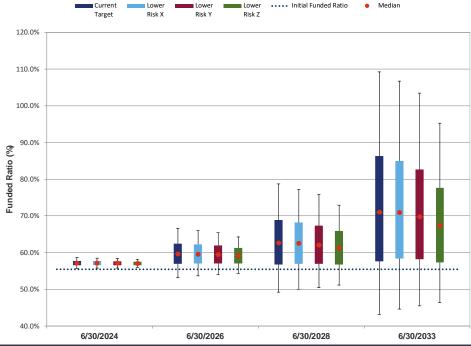
#### Initial Funded Ratio = 56.5%

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -0.93%.

	6/30/2024			6/30/2026 6/30/2				2028 6/30/2033								
	6/30/2024			6/30/2026			6/30/2028				6/30/2033					
(%)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Optimistic	65.12	64.48	63.93	62.87	78.53	77.04	75.42	72.52	90.40	88.11	85.70	80.91	119.48	115.68	110.66	101.37
Optimistic	60.58	60.33	60.06	59.51	67.75	67.11	66.35	64.87	74.01	73.19	71.83	69.22	90.53	89.06	86.22	80.67
Median (Expected)	57.62	57.58	57.48	57.29	61.14	60.92	60.55	59.86	64.13	64.01	63.42	62.15	72.62	72.62	71.26	68.15
Pessimistic	54.63	54.73	54.80	54.97	54.80	55.03	55.10	55.16	55.40	55.81	55.83	55.58	57.41	58.44	58.16	56.98
Very Pessimistic	50.32	50.77	51.09	51.71	46.70	47.60	48.20	48.95	44.34	45.51	46.24	47.20	41.52	43.28	43.76	44.43

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# AAL AVA Funded Ratio



## Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 55.5%

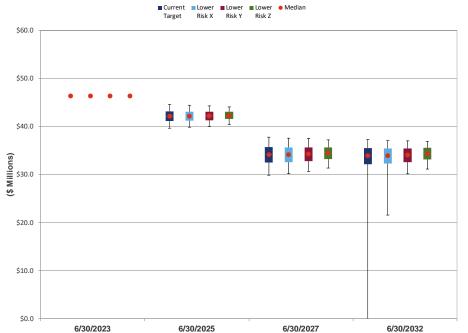
One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -0.93%.

72

					0/30/20	64	0/50	12020	,	0/00/2020		0/30/203	5					(6/30/2
	(		6/30/	/2024			6/30	/2026			6/30	/2028			6/30	/2033		8/31/
	(%)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Year to
		Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	
	Very Optimistic	58.62	58.49	58.38	58.17	66.52	66.02	65.39	64.26	78.70	77.30	75.79	72.89	109.25	106.76	103.43	95.29	) of
	Optimistic	57.71	57.66	57.61	57.50	62.47	62.25	61.91	61.30	68.87	68.20	67.35	65.84	86.33	84.96	82.65	77.67	
	Median (Expected)	57.12	57.11	57.09	57.05	59.63	59.53	59.41	59.12	62.64	62.47	62.07	61.31	70.96	70.90	69.77	67.30	
	Pessimistic	56.52	56.54	56.55	56.59	56.90	57.01	57.04	57.04	56.70	56.89	56.89	56.78	57.63	58.34	58.14	57.28	
_	Very Pessimistic	55.66	55.75	55.81	55.93	53.22	53.65	53.91	54.29	49.22	50.02	50.50	51.15	43.10	44.63	45.42	46.36	

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## **Employer Contributions**



#### Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

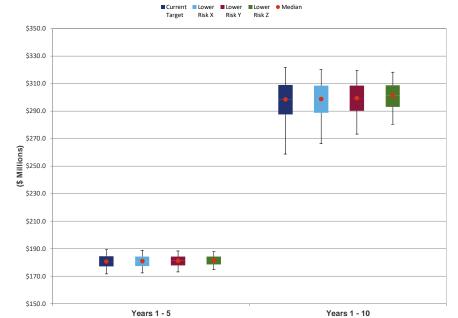
#### Drawdown Risk:

The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

		6/30	/2023		6/30/2025					6/30,	/2027		6/30/2032			
(\$ Millions)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Pessimistic	46.3	46.3	46.3	46.3	44.5	44.4	44.3	44.1	37.8	37.5	37.5	37.2	37.3	37.1	37.0	36.9
Pessimistic	46.3	46.3	46.3	46.3	43.1	43.1	43.1	43.0	35.7	35.6	35.6	35.6	35.5	35.4	35.4	35.5
Median (Expected)	46.3	46.3	46.3	46.3	42.1	42.1	42.2	42.3	34.1	34.2	34.3	34.4	33.9	33.9	34.0	34.3
Optimistic	46.3	46.3	46.3	46.3	41.1	41.2	41.3	41.5	32.4	32.6	32.8	33.2	32.2	32.3	32.5	33.1
Very Optimistic	46.3	46.3	46.3	46.3	39.6	39.8	40.0	40.4	29.8	30.2	30.6	31.3	0.0	21.5	30.1	31.1

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## Present Value of Contributions



#### Shortfall Risk:

The potential for the current allocation to have higher median present value of contributions than the alternative policies.

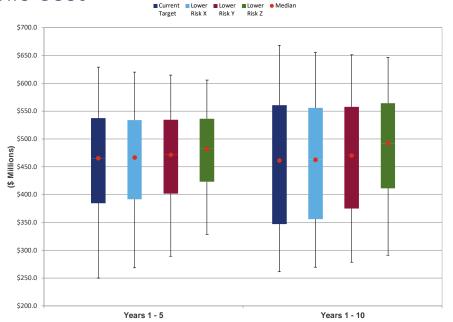
#### Drawdown Risk:

The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

		Years	s <b>1</b> - 5			Years	1 - 10		
(\$ Millions)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower	
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z	
Very Pessimistic	189.2	188.7	188.4	187.8	321.5	320.2	319.6	318.3	
Pessimistic	184.3	184.2	184.2	184.1	309.0	308.6	308.6	308.8	
Median (Expected)	180.7	180.8	181.0	181.4	298.6	298.8	299.5	301.2	
Optimistic	177.0	177.3	177.7	178.6	287.7	288.8	290.3	293.1	
Very Optimistic	171.6	172.4	173.1	174.6	258.7	266.4	273.3	280.5	

### EROA = 5.25%

# MVA Economic Cost



### Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

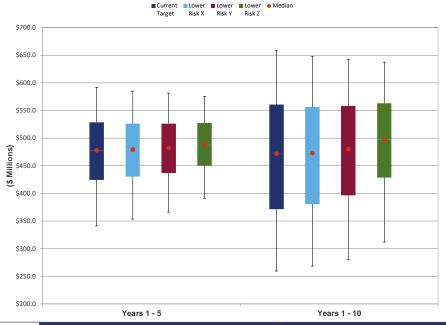
#### EROA = 5.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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(4 * **** )		Years	;1-5			Years	1 - 10	
(\$ Millions)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z
Very Pessimistic	629.3	620.4	614.9	605.6	668.1	655.3	651.1	646.2
Pessimistic	537.6	534.0	534.7	536.0	560.9	556.1	557.4	564.0
Median (Expected)	465.4	466.7	471.6	482.2	461.2	462.6	470.3	492.0
Optimistic	384.3	391.3	401.5	423.2	346.6	356.0	374.7	411.3
Very Optimistic	249.5	268.3	289.1	328.1	261.3	269.4	278.4	290.9

# AVA Economic Cost



## Shortfall Risk:

Wilshire

The potential for the current allocation to have a higher median economic cost than the alternative policies.

### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 5.25%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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		rears 1 - 5	)		rears	1 - 10				
(* * **** * *		Years	:1-5		Years 1 - 10					
(\$ Millions)	Current	Lower	Lower	Lower	Current	Lower	Lower	Lower		
	Target	Risk X	Risk Y	Risk Z	Target	Risk X	Risk Y	Risk Z		
Very Pessimistic	591.6	584.9	581.4	575.2	658.7	648.4	642.6	637.5		
Pessimistic	528.3	526.1	526.3	527.4	560.3	556.2	558.1	563.1		
Median (Expected)	477.6	479.0	482.2	489.0	471.9	472.9	480.3	496.8		
Optimistic	424.4	430.5	436.8	450.4	371.2	380.2	396.1	428.1		
Very Optimistic	341.0	353.4	366.0	390.8	259.3	268.5	279.7	311.8		

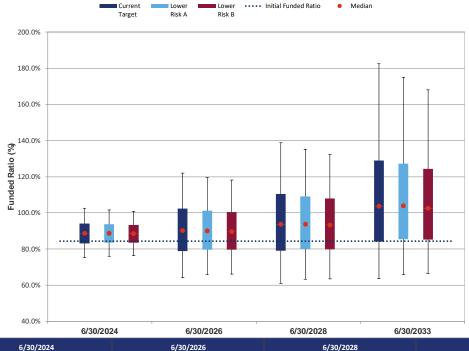


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# KERS NON-HAZARDOUS INSURANCE PLAN

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## AAL MVA Funded Ratio



Lower

Risk B

118.09

100.46

89.73

79.55

66.21

Current

Target

138.89

110.51

93.75

79.01

60.93

Lower

Risk A

135.16

109.03

93.80

80.09

63.26

Lower

Risk B

132.41

107.87

93.27

79.81

63.44

Current

Target

182.51

128.97

103.68

84.08

63.62

Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 84.4%

6/30/2033

Lower

Risk A

175.06

127.26

103.91

85.39

65.78

Lower

Risk B

168.13

124.38

102.60

85.17

66.31

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.31%.

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Current

Target

102.57

94.13

88.66

83.20

75.16

Lower

Risk A

101.53

93.69

88.62

83.45

76.06

Lower

Risk B

100.92

93.41

88.48

83.56

76.46

Current

Target

122.00

102.33

90.23

78.89

64.15

Lower

Risk A

119.59

101.21

90.11

79.55

65.71

(%)

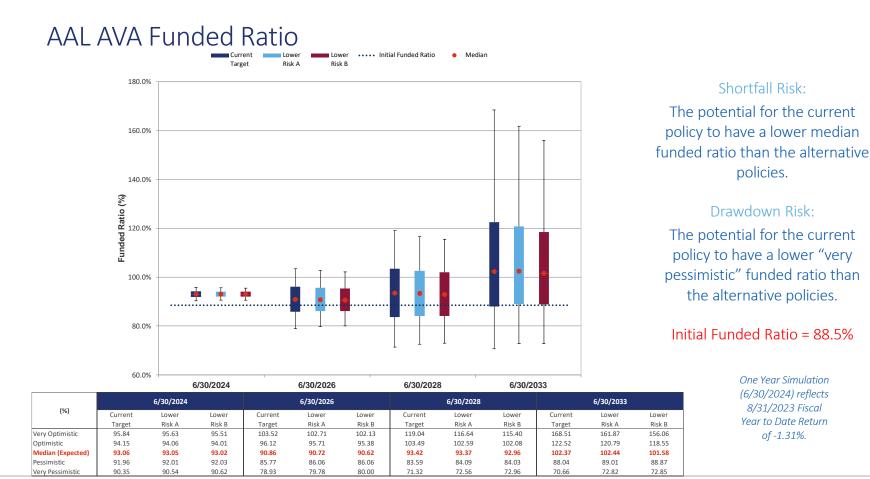
Very Optimistic

Very Pessimistic

Median (Expected)

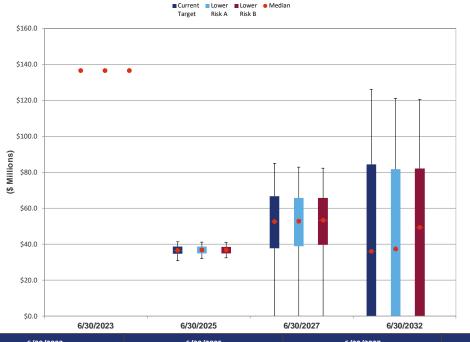
Optimistic

Pessimistic



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## **Employer Contributions**



### Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

#### Drawdown Risk:

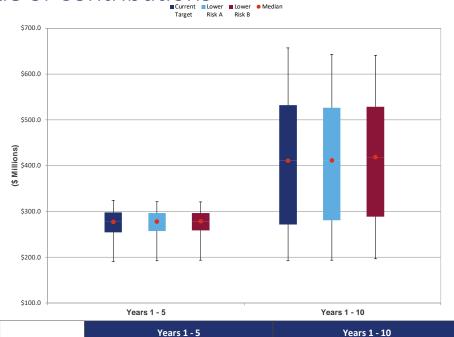
The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

		6/30/2023			6/30/2025		6/30/2027			6/30/2032		
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower
	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B
Very Pessimistic	136.6	136.6	136.6	41.4	41.0	40.9	84.8	82.8	82.3	126.1	121.1	120.5
Pessimistic	136.6	136.6	136.6	38.6	38.5	38.5	66.5	65.7	65.7	84.4	81.7	82.0
Median (Expected)	136.6	136.6	136.6	36.6	36.6	36.7	52.5	52.7	53.2	35.9	37.3	49.2
Optimistic	136.6	136.6	136.6	34.6	34.7	34.9	37.6	38.8	39.6	0.0	0.0	0.0
Very Optimistic	136.6	136.6	136.6	30.8	32.0	32.3	0.0	0.0	0.0	0.0	0.0	0.0

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# Present Value of Contributions



		Years 1 - 5			Years 1 - 10	
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower
	Target	Risk A	Risk B	Target	Risk A	Risk B
Very Pessimistic	324.2	321.1	320.5	656.7	642.8	640.6
Pessimistic	297.4	296.2	296.2	532.1	526.6	528.3
Median (Expected)	277.2	277.3	278.1	410.6	411.1	418.6
Optimistic	253.9	256.8	258.3	271.1	280.2	288.3
Very Optimistic	190.8	192.2	193.2	192.1	193.3	196.4

### Shortfall Risk:

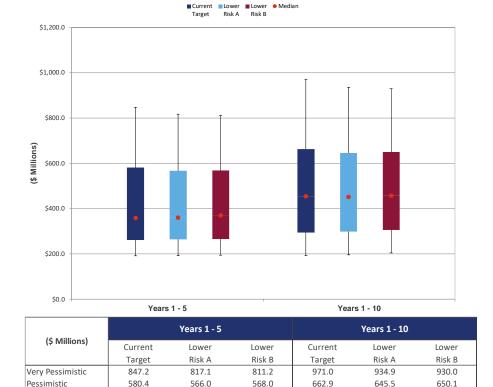
The potential for the current allocation to have higher median present value of contributions than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

## EROA = 6.50%

## **MVA Economic Cost**



369.1

265.2

193.9

## Shortfall Risk:

Wilshire

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

#### EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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Median (Expected)

Very Optimistic

Optimistic

358.2

261.2

191.5

360.3

263.2

192.5

#### 82

453.3

293.6

192.8

451.0

298.1

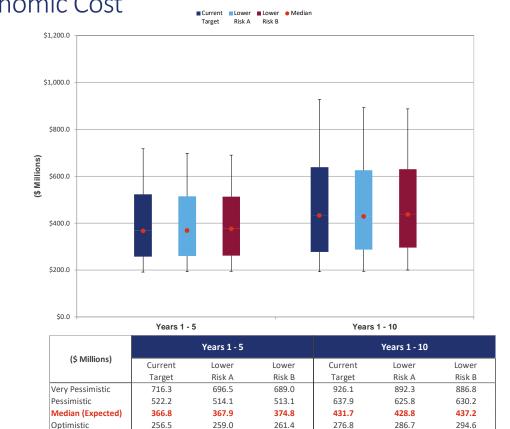
194.6

456.9

306.0

204.1

# AVA Economic Cost



## Shortfall Risk:

Wilshire

The potential for the current allocation to have a higher median economic cost than the alternative policies.

#### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

#### EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

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Very Optimistic

190.9

192.3

193.3

192.3

193.6

199.2



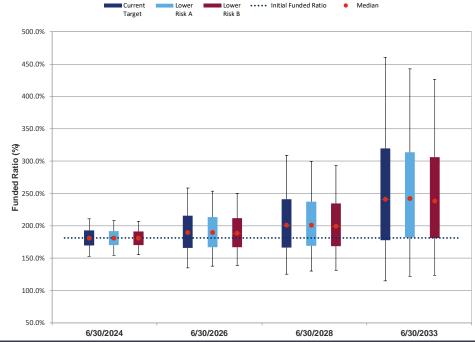
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# KERS HAZARDOUS INSURANCE PLAN

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# AAL MVA Funded Ratio



6/30/2026

Lower

Risk A

253.42

213.43

189.72

167.01

137.88

Lower

Risk B

250.23

211.87

188.71

167.11

138.94

Current

Target

308.85

241.14

201.13

166.62

125.40

## Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 181.2%

6/30/2033

Lower

Risk A

442.98

313.98

242.18

182.20

122.19

Lower

Risk B

426.55

305.96

238.53

180.99

123.51

**One Year Simulation** (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.09%.

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Current

Target

210.55

192.72

181.19

169.68

(%)

Median (Expected) Pessimistic

Very Optimistic

Very Pessimistic

Optimistic

6/30/2024

Lower

Risk A

208.36

191.80

181.10

170.21

154.64

Lower

Risk B

207.08

191.21

180.81

170.43

155.48

Current

Target

258.51

215.80

189.78

165.72

134.80

86

6/30/2028

Lower

Risk A

299.78

237.38

200.85

168.85

129.86

Lower

Risk B

293.68

234.76

199.39

168.61

131.25

Current

Target

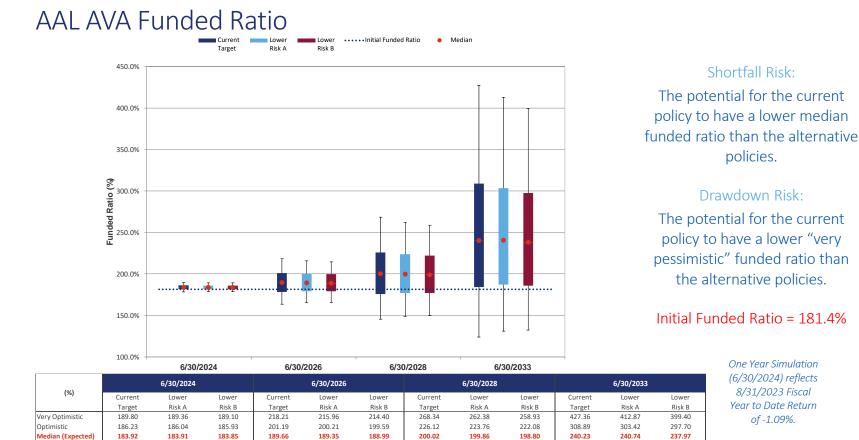
460.48

319.71

241.36

177.81

115.04



#### **One Year Simulation** (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return

of -1.09%.

181.62

178.23

181.73

178.61

181.77

178.78

178.48

163.49

179.06

165.08

179.09

165.75

175.67

145.31

176.91

148.70

176.88

149.69

184.25

123.95

187.24

131.09

186.02

132.24

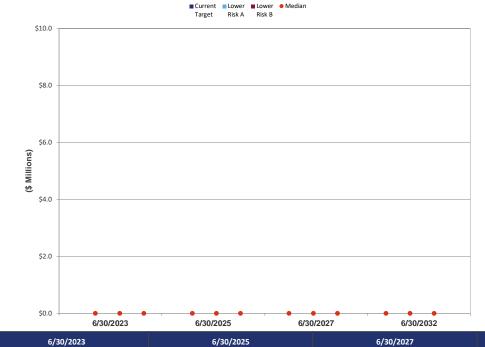
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Pessimistic

Very Pessimistic

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## **Employer Contributions**



## Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

#### Drawdown Risk:

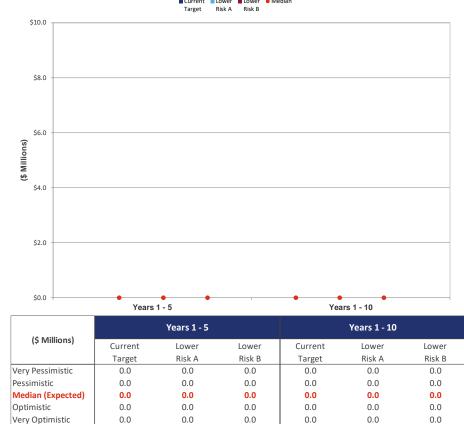
The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

			6/30/2023	6/3	30/2025	6/30	0/2027	6/30/2	032			
		6/30/2023			6/30/2025			6/30/2027			6/30/2032	
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower	Current	Lower	Lower
	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B	Target	Risk A	Risk B
Very Pessimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pessimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median (Expected)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Very Optimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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# Present Value of Contributions



Shortfall Risk:

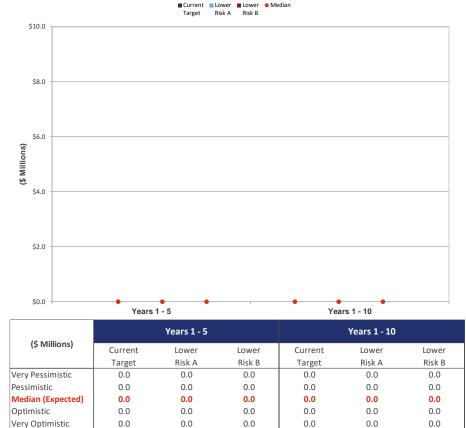
The potential for the current allocation to have higher median present value of contributions than the alternative policies.

Drawdown Risk:

The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

EROA = 6.50%

# MVA Economic Cost



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#### Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

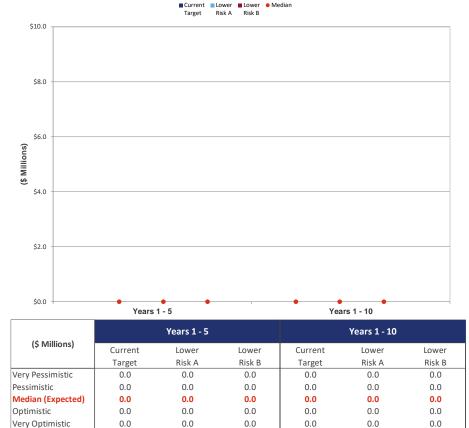
### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

## AVA Economic Cost



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#### Shortfall Risk:

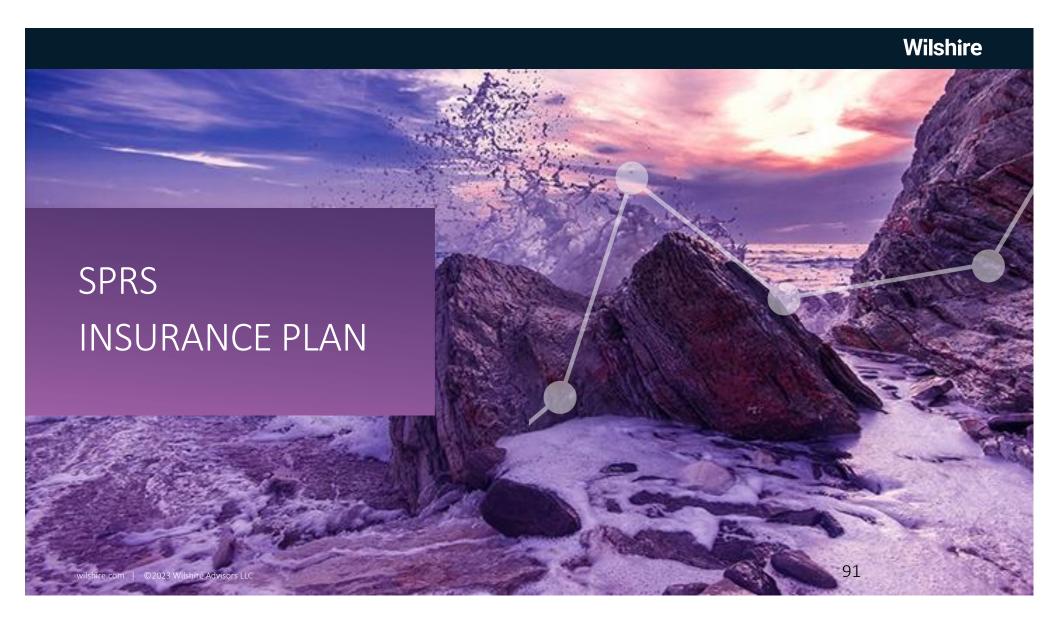
The potential for the current allocation to have a higher median economic cost than the alternative policies.

### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

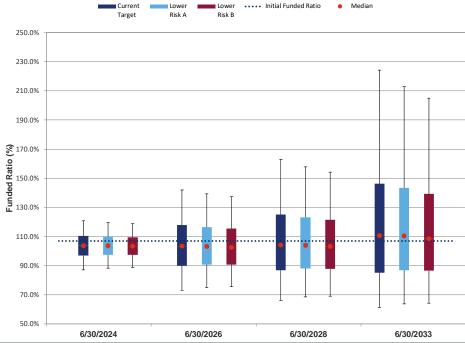
EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.



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# AAL MVA Funded Ratio



## Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

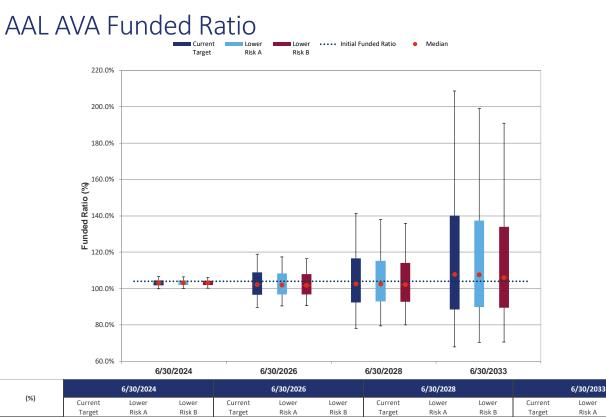
#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 106.9%

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.13%.

6/30/2033 6/30/2024 6/30/2026 6/30/2028 (%) Current Lower Lower Current Lower Lower Current Lower Lower Current Lower Lower Risk A Risk B Risk A Risk B Risk A Risk B Risk A Target Target Target Target Risk B Very Optimistic 119.53 118.78 142.05 139.33 137.39 162.95 157.94 154.25 224.41 213.11 205.05 120.81 115.54 143.42 Optimistic 110.40 109.87 109.52 117.81 116.41 125.08 123.16 121.53 146.34 139.24 103.68 103.46 103.30 103.12 102.50 104.13 103.97 103.24 110.70 110.34 108.48 Median (Expected) 103.63 Pessimistic 96.97 97.28 97.41 89.97 90.68 90.75 86.85 88.04 87.85 85.17 86.89 86.50 87.11 88.22 88.70 73.09 74.91 75.37 66.03 68.52 69.04 61.21 63.70 64.09 Very Pessimistic



## Shortfall Risk: The potential for the current policy to have a lower median funded ratio than the alternative policies.

#### Drawdown Risk:

The potential for the current policy to have a lower "very pessimistic" funded ratio than the alternative policies.

#### Initial Funded Ratio = 104.0%

Lower

Risk B

190.94

133.85

106.06

89.40

70.52

199.00

137.42

107.46

89.83

70.35

One Year Simulation (6/30/2024) reflects 8/31/2023 Fiscal Year to Date Return of -1.13%.

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106.58

104.50

103.15

101.81

99.84

106.32

104.39

103.14

101.87

100.06

106.17

104.32

103.11

101.90

100.16

118.82

108.80

102.11

96.60

89.54

117.43

108.24

101.95

96.81

90.36

116.48

107.86

101.70

96.78

90.63

141.17

116.55

102.62

92.29

77.96

137.96

115.22

102.48

92.84

79.44

208.74

140.07

107.73

88.48

67.75

135.81

114.10

102.14

92.71

79.92

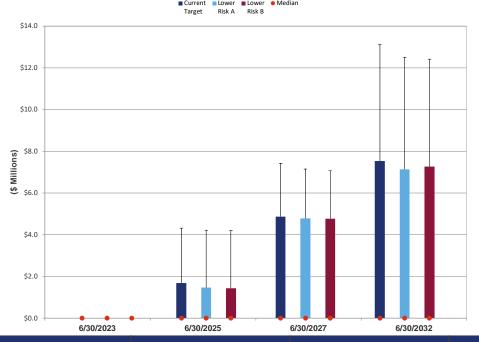
Very Optimistic

Median (Expected) Pessimistic

Very Pessimistic

Optimistic

# Employer Contributions



## Shortfall Risk:

The potential for the current policy to have higher median contributions than the alternative policies.

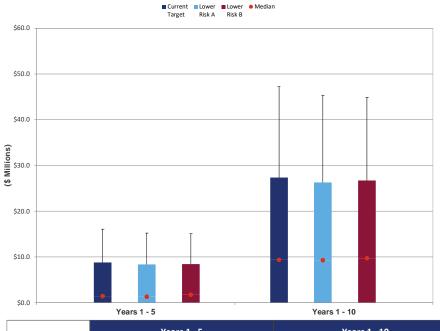
#### Drawdown Risk:

The potential for the current policy to have higher "very pessimistic" contributions than the alternative policies.

(4		6/30/2023			6/30/2025			6/30/2027			6/30/2032	
(\$ Millions)	Current	Lower	Lower									
	Target	Risk A	Risk B									
Very Pessimistic	0.0	0.0	0.0	4.3	4.2	4.2	7.4	7.1	7.1	13.1	12.5	12.4
Pessimistic	0.0	0.0	0.0	1.7	1.5	1.4	4.9	4.8	4.8	7.5	7.1	7.3
Median (Expected)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Optimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Very Optimistic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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# Present Value of Contributions



(4.8.6111)		Years 1 - 5			Years 1 - 10	
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower
	Target	Risk A	Risk B	Target	Risk A	Risk B
Very Pessimistic	16.0	15.2	15.1	47.2	45.4	44.9
Pessimistic	8.7	8.4	8.4	27.3	26.3	26.7
Median (Expected)	1.4	1.3	1.7	9.3	9.3	9.7
Optimistic	0.0	0.0	0.0	0.0	0.0	0.0
Very Optimistic	0.0	0.0	0.0	0.0	0.0	0.0

Shortfall Risk:

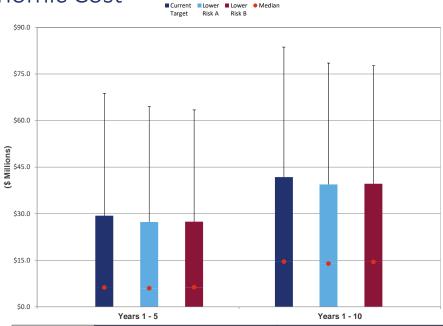
The potential for the current allocation to have higher median present value of contributions than the alternative policies.

Drawdown Risk:

The potential for the current allocation to have higher "very pessimistic" present value of contributions than the alternative policies.

EROA = 6.50%

# MVA Economic Cost



(6 a eru)		Years 1 - 5		Years 1 - 10				
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower		
	Target	Risk A	Risk B	Target	Risk A	Risk B		
Very Pessimistic	68.7	64.5	63.4	83.6	78.5	77.7		
Pessimistic	29.4	27.3	27.4	41.8	39.4	39.7		
Median (Expected)	6.2	6.0	6.3	14.6	13.9	14.4		
Optimistic	0.0	0.0	0.0	0.0	0.0	0.0		
Very Optimistic	0.0	0.0	0.0	0.0	0.0	0.0		

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### Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

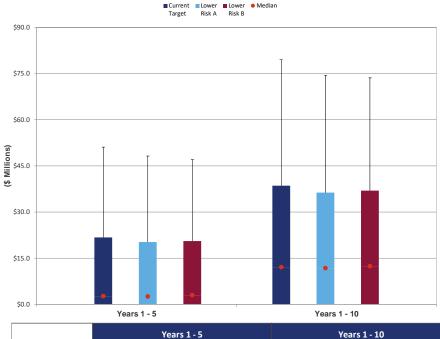
### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.

## AVA Economic Cost



(* * **********************************		Years 1 - 5		Years 1 - 10				
(\$ Millions)	Current	Lower	Lower	Current	Lower	Lower		
	Target	Risk A	Risk B	Target	Risk A	Risk B		
Very Pessimistic	51.1	48.2	47.1	79.5	74.4	73.6		
Pessimistic	21.7	20.2	20.5	38.6	36.3	36.9		
Median (Expected)	2.7	2.6	3.0	12.1	11.7	12.4		
Optimistic	0.0	0.0	0.0	0.0	0.0	0.0		
Very Optimistic	0.0	0.0	0.0	0.0	0.0	0.0		

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### Shortfall Risk:

The potential for the current allocation to have a higher median economic cost than the alternative policies.

### Drawdown Risk:

The potential for the current allocation to have a higher "very pessimistic" economic cost than the alternative policies.

EROA = 6.50%

Economic Cost is defined as the present value of contributions plus contributions necessary to fully fund the plan at the end of the projection period.



# Appendix – Correlation Matrix

# Capital Market Assumptions

- Wilshire's Capital Market Assumptions as of June 30, 2023
- Wilshire's asset class return, risk and correlation assumptions are developed on multi-year forward looking expected rates of return and historical risk and correlation, adjusted to incorporate recent trends
- Public market return expectations represent a passive investment in the asset class (beta). They do not reflect value added from active management (alpha).

	Public Equity	Private Equity	Specialty Credit	Core Fixed Income	Cash	Real Estate	Real Return
Return - 10-Year (%) Return - 30-Year (%) Risk (%)	6.15 7.15 17.10	9.15 9.95 27.80	7.40 7.40 9.05	4.85 4.80 4.70	3.85 3.55 0.75	6.00 6.95 13.95	6.85 7.35 10.65
Correlations							
Public Equity	1.00						
Private Equity	0.74	1.00					
Specialty Credit	0.57	0.31	1.00				
Core Fixed Income	0.20	0.31	0.15	1.00			
Cash	-0.06	0.00	-0.09	0.18	1.00		
Real Estate	0.54	0.52	0.63	0.19	-0.05	1.00	
Real Return	0.50	0.44	0.58	0.15	0.01	0.49	1.00

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# Appendix – Asset Allocation Ranges

# Allowable Asset Allocation Ranges

Wilshire's Asset Allocation Committee (WAAC) maintains standard asset allocation parameters which reflect generally observed market practices for institutional asset owners. While Wilshire expects most client portfolios will fall within these asset allocation ranges. Wilshire recognizes and occasionally recommends portfolio allocations that may diverge from these general ranges based on a client's particular circumstances, goals or needs.

Asset Segment	Corporate DB	E&F					
Total Equity (Public+Private)	0% - 80%						
Private Equity (Aggregate)	0% - 15%	0% - 20%	0% - 30%				
Fixed Income (Core/High-quality - Liquid IG)	10% - 100% 10% - 50%						
Other Fixed Income/Credit (Aggregate)		0% - 25%					
Private/Illiquid Credit (Aggregate)	0% - 15%						
High Yield	0% - 10%						
Other: EMD, Loans, Convertibles	0% - 7.5%						
Total Real Assets (Public + Private)	0% - 25%						
Total Real Estate (Public + Private)	0% - 25%						
RA Other: Commodities, Gold, Infra, GLI, MLPs, O&G, Timber	0% - 5%						
Marketable Alternatives (Aggregate)	0% - 12.5% 0% - 20%						
Cash	0% - 5%						
Leverage	0% - 20%						
Total Private/Illiquid	0% - 25%	0% - 50%					

These thresholds were informed by allocation information from Greenwich Associates, and Wilshire Advisors, LLC, universe data and will be reviewed for reasonableness from time to time. \*Last Updated 12/2021



# Appendix – Efficient Frontier



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# KERS NON-HAZARDOUS RETIREMENT PLAN SPRS RETIREMENT PLAN 5.25% DISCOUNT RATE

# Efficient Frontier Portfolios – KPPA Bucketing

Asset Class	Current Target	Optimization Constraints	Minimum Risk	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6	Portfolio 7	Portfolio 8	Portfolio 9	Maximum Risk
Public Equity	32.50%	30% - 80%	30.00%	30.00%	30.00%	30.00%	30.00%	32.00%	25 50%	39.50%	44.50%	51.00%
		30% - 80% 0% - 7% <sup>1</sup>	0.00%						35.50% 7.00%		7.00%	
Private Equity	7.00%	0% - 7%		0.00%	2.00%	4.50%	7.00%	7.00%		7.00%		7.00%
Total Equity	39.50%		30.00%	30.00%	32.00%	34.50%	37.00%	39.00%	42.50%	46.50%	51.50%	58.00%
Core Fixed Income	20.50%	10% - 50%	50.00%	36.50%	31.00%	28.50%	24.50%	19.00%	15.50%	11.50%	10.00%	10.00%
Specialty Credit	15.00%	0% - 20% <sup>1</sup>	0.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Cash	5.00%	2% - 5%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Total Fixed Income	40.50%		55.00%	58.50%	53.00%	50.50%	46.50%	41.00%	37.50%	33.50%	32.00%	32.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	10.00%	5.00%	5.00%	5.00%	6.50%	10.00%	10.00%	10.00%	6.50%	5.00%
Real Return	10.00%	5% - 10% <sup>1</sup>	5.00%	6.50%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	5.00%
Total Inflation Protected	20.00%		15.00%	11.50%	15.00%	15.00%	16.50%	20.00%	20.00%	20.00%	16.50%	10.00%
Total Assets	100.0%		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.66		5.73	6.23	6.42	6.59	6.74	6.80	6.84	6.88	6.90	6.84
Standard Deviation of Return (%)	9.79		7.19	7.76	8.30	8.84	9.44	9.98	10.52	11.08	11.56	12.20
+/(-) in Expected Return - 10 Years (bps)			(93)	(43)	(24)	(7)	8	14	18	22	24	18
+/(-) in SD of Return (bps)			(260)	(203)	(149)	(95)	(35)	19	73	129	177	241
Sharpe Ratio	0.29		0.26	0.31	0.31	0.31	0.31	0.30	0.28	0.27	0.26	0.25

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

# Efficient Frontier Portfolios – Wilshire Bucketing

	Current	Optimization	Minimum	Portfolio	Maximum							
Asset Class	Target	Constraints	Risk	2	3	4	5	6	7	8	9	Risk
'ublic Equity	32.50%	30% - 80%	30.00%	30.00%	30.00%	30.00%	30.00%	32.00%	35.50%	39.50%	44.50%	51.00%
Private Equity	7.00%	0% - 7% <sup>1</sup>	0.00%	0.00%	2.00%	4.50%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
<sup>r</sup> otal Growth Assets	39.50%		30.00%	30.00%	32.00%	34.50%	37.00%	39.00%	42.50%	46.50%	51.50%	58.00%
ipecialty Credit	<u>15.00%</u>	0% - 20% <sup>1</sup>	0.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
<sup>r</sup> otal Defensive Growth Assets	15.00%		0.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Core Fixed Income	20.50%	10% - 50%	50.00%	36.50%	31.00%	28.50%	24.50%	19.00%	15.50%	11.50%	10.00%	10.00%
lash 🛛	5.00%	2% - 5%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
<sup>r</sup> otal Defensive / Rate Sensitive Assets	25.50%		55.00%	38.50%	33.00%	30.50%	26.50%	21.00%	17.50%	13.50%	12.00%	12.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	10.00%	5.00%	5.00%	5.00%	6.50%	10.00%	10.00%	10.00%	6.50%	5.00%
Real Return	10.00%	5% - 10% <sup>1</sup>	5.00%	6.50%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	5.00%
<sup>r</sup> otal RA / Inflation Sensitive Assets	20.00%		15.00%	11.50%	15.00%	15.00%	16.50%	20.00%	20.00%	20.00%	16.50%	10.00%
Total Assets	100.0%		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.66		5.73	6.23	6.42	6.59	6.74	6.80	6.84	6.88	6.90	6.84
itandard Deviation of Return (%)	9.79		7.19	7.76	8.30	8.84	9.44	9.98	10.52	11.08	11.56	12.20
·/(-) in Expected Return - 10 Years (bps)			(93)	(43)	(24)	(7)	8	14	18	22	24	18
·/(-) in SD of Return (bps)			(260)	(203)	(149)	(95)	(35)	19	73	129	177	241
iharpe Ratio	0.29		0.26	0.31	0.31	0.31	0.31	0.30	0.28	0.27	0.26	0.25

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.



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# ALL OTHER PLANS:

- KERS NON-HAZ INS
- KERS HAZ RET/INS
- SPRS INS

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# Efficient Frontier Portfolios – KPPA Bucketing

Asset Class	Current Target	Optimization Constraints	Minimum Risk	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6	Portfolio 7	Portfolio 8	Portfolio 9	Maximum Risk
Public Equity	43.50%	40% - 80%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	42.00%	53.00%
Private Equity	10.00%	0% - 10% <sup>1</sup>	0.00%	0.00%	0.00%	1.50%	4.00%	7.00%	9.50%	10.00%	10.00%	10.00%
Total Equity	53.50%		40.00%	40.00%	40.00%	41.50%	44.00%	47.00%	49.50%	50.00%	52.00%	63.00%
Core Fixed Income	10.00%	10% - 50%	50.00%	35.50%	27.50%	21.50%	19.00%	16.00%	13.50%	10.50%	10.00%	10.00%
Specialty Credit	15.00%	0% - 20% <sup>1</sup>	0.00%	14.50%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Cash	1.50%	2% - 5%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Total Fixed Income	26.50%		55.00%	55.00%	49.50%	43.50%	41.00%	38.00%	35.50%	32.50%	32.00%	32.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	7.50%	6.00%	5.00%
Real Return	10.00%	0% - 10% <sup>1</sup>	0.00%	0.00%	5.50%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	0.00%
Total Inflation Protected	20.00%		5.00%	5.00%	10.50%	15.00%	15.00%	15.00%	15.00%	17.50%	16.00%	5.00%
Total Assets	100.0%		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.97		5.70	6.07	6.35	6.54	6.68	6.83	6.96	7.03	7.03	6.92
Standard Deviation of Return (%)	12.12		8.06	8.60	9.15	9.70	10.19	10.75	11.28	11.64	11.80	12.90
+/(-) in Expected Return - 10 Years (bps)			(127)	(90)	(62)	(43)	(29)	(14)	(1)	6	6	(5)
+/(-) in SD of Return (bps)			(406)	(352)	(297)	(242)	(193)	(137)	(84)	(48)	(32)	78
Sharpe Ratio	0.26		0.23	0.26	0.27	0.28	0.28	0.28	0.28	0.27	0.27	0.24

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.

# Efficient Frontier Portfolios – Wilshire Bucketing

	Current	Optimization	Minimum	Portfolio	Portfolio	Portfolio	Portfolio	Portfolio	Portfolio	Portfolio	Portfolio	Maximum
Asset Class	Target	Constraints	Risk	2	3	4	5	6	7	8	9	Risk
Public Equity	43.50%	40% - 80%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	42.00%	53.00%
Private Equity	10.00%	0% - 10% <sup>1</sup>	0.00%	0.00%	0.00%	1.50%	4.00%	7.00%	9.50%	10.00%	10.00%	10.00%
Total Growth Assets	53.50%		40.00%	40.00%	40.00%	41.50%	44.00%	47.00%	49.50%	50.00%	52.00%	63.00%
Specialty Credit	15.00%	0% - 20% <sup>1</sup>	0.00%	14.50%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Total Defensive Growth Assets	15.00%		0.00%	14.50%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Core Fixed Income	10.00%	10% - 50%	50.00%	35.50%	27.50%	21.50%	19.00%	16.00%	13.50%	10.50%	10.00%	10.00%
Cash	1.50%	2% - 5%	5.00%	5.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Total Defensive / Rate Sensitive Assets	11.50%		55.00%	40.50%	29.50%	23.50%	21.00%	18.00%	15.50%	12.50%	12.00%	12.00%
Real Estate	10.00%	5% - 10% <sup>1</sup>	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	7.50%	6.00%	5.00%
Real Return	<u>10.00%</u>	0% - 10% <sup>1</sup>	<u>0.00%</u>	0.00%	5.50%	<u>10.00%</u>	<u>10.00%</u>	<u>10.00%</u>	<u>10.00%</u>	<u>10.00%</u>	<u>10.00%</u>	0.00%
Total RA / Inflation Sensitive Assets	20.00%		5.00%	5.00%	10.50%	15.00%	15.00%	15.00%	15.00%	17.50%	16.00%	5.00%
Total Assets	100.0%		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Expected Return - 10 Years (%)	6.97		5.70	6.07	6.35	6.54	6.68	6.83	6.96	7.03	7.03	6.92
Standard Deviation of Return (%)	12.12		8.06	8.60	9.15	9.70	10.19	10.75	11.28	11.64	11.80	12.90
+/(-) in Expected Return - 10 Years (bps)			(127)	(90)	(62)	(43)	(29)	(14)	(1)	6	6	(5)
+/(-) in SD of Return (bps)			(406)	(352)	(297)	(242)	(193)	(137)	(84)	(48)	(32)	78
Sharpe Ratio	0.26		0.23	0.26	0.27	0.28	0.28	0.28	0.28	0.27	0.27	0.24

<sup>1</sup> Total Illiquid Assets are constrained to not exceed 35%. Illiquid Assets are defined as total of Private Equity, 50% of Speciality Credit, Real Estate and 50% of Real Return.



# Appendix – Regimes

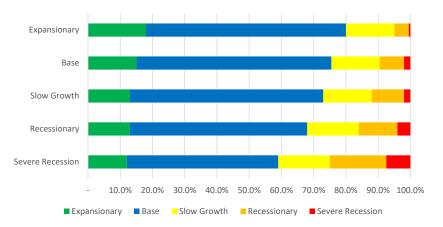
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## **Efficient Frontier Portfolios**

Managing drawdown risk – the "uncertainty around the uncertainty"

- Most simulation models assume returns are lognormally distributed
- Though reasonable in most years, left-tail events occur more frequently than predicted
- A regime switching model can help us preexperience uncomfortable return paths that fall outside a normal distribution's field of view

	ospatio	DIEN LESE	3101	NBOWER PES	SSIMIAL	Selection .
expansionary	18.0%	62.0%	15.0%	4.5%	0.5%	
base	15.0%	60.5%	15.0%	7.5%	2.0%	
slow growth	13.0%	60.0%	15.0%	10.0%	2.0%	
recessionary	13.0%	55.0%	16.0%	12.0%	4.0%	
severe recession	12.0%	47.0%	16.0%	17.5%	7.5%	



## Stress Testing: Regime Assumptions

- In below trend and worse environments, the portfolio's return expectations is materially lower and the volatility is materially higher
- Volatility in the below trend and worse environments are left-skewed, i.e. negative-skewed

US Stocks	Dev xUS Stocks	EM Stocks	Prvt Mkts	Cash	Core Bonds	LT Bonds	US TIPS	Н	US RES	Private RE	Commodities	Current Target *	Current Target **
10.50 12.00	11.50 13.00	11.75 21.00	16.50 22.15	4.10 0.75	4.35 5.20	4.30 10.85	3.55 6.50	8.20 8.00	10.75 13.50	11.00 10.90	9.10 16.00	9.69 7.43	10.81 9.05
5.50 17.00	6.50 18.00	6.75 26.00	9.00 29.65	3.85 0.75	4.85	4.80 9.85	4.05	6.20	5.75 17.50	6.00 13.90	6.10 16.00	6.66	6.97 12.12
17.00	10.00	20.00	23.00	0.10	4.70	3.00	0.00	10.00	17.50	10.00	10.00	5.15	
3.50	4.50	4.75	6.00	3.85	5.85	6.30	4.55	5.20	3.75	4.00	5.10	5.73	5.59 15.89
22.00	23.00	51.00	57.15	0.75	5.70	11.05	7.50	12.00	21.50	10.90	10.00	12.75	15.69
(4.50)	(3.50)	(3.25)	(6.00)	3.35	6.85	7.80	6.55	1.20	(4.25)	(4.00)	2.10	0.87	(0.64)
27.00	28.00	36.00	44.65	0.75	6.70	13.85	9.00	15.00	27.50	21.90	21.00	15.88	19.82
			(11.05)	0.0-		10.05	10 ==	(10.05)		(0.1.05)	(1.00)	(10.05)	
· · · ·	× /	· · · · · ·	× /					× /	· · · · · · · · · · · · · · · · · · ·	· · · · ·	· · · · · ·	· · · ·	<mark>(27.12)</mark> 29.57
	9 10.50 12.00 5.50 17.00 3.50 22.00 (4.50)	S         S           10.50         11.50           12.00         13.00           5.50         6.50           17.00         18.00           3.50         4.50           22.00         23.00           (4.50)         (3.50)           27.00         28.00           (44.50)         (43.50)	9         8         8           10.50         11.50         11.75           12.00         13.00         21.00           5.50         6.50         6.75           17.00         18.00         26.00           3.50         4.50         4.75           22.00         23.00         31.00           (4.50)         (3.50)         (3.25)           27.00         28.00         36.00           (44.50)         (43.50)         (43.25)			10.50         11.50         11.75         16.50         4.10         4.35           12.00         13.00         21.00         22.15         0.75         5.20           5.50         6.50         6.75         9.00         3.85         4.85           17.00         18.00         26.00         29.65         0.75         4.70           3.50         4.50         4.75         6.00         3.85         5.85           22.00         23.00         31.00         37.15         0.75         5.70           (4.50)         (3.50)         (3.25)         (6.00)         3.35         6.85           27.00         28.00         36.00         44.65         0.75         6.70           (44.50)         (43.50)         (43.25)         (41.00)         2.85         14.85	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	10.50         11.50         11.75         16.50         4.10         4.35         4.30         3.55           12.00         13.00         21.00         22.15         0.75         5.20         10.85         6.50           5.50         6.50         6.75         9.00         3.85         4.85         4.80         4.05           17.00         18.00         26.00         29.65         0.75         4.70         9.85         6.00           3.50         4.50         4.75         6.00         3.85         5.85         6.30         4.55           22.00         23.00         31.00         37.15         0.75         5.70         11.85         7.50           (4.50)         (3.50)         (3.25)         (6.00)         3.35         6.85         7.80         6.55           27.00         28.00         36.00         44.65         0.75         6.70         13.85         9.00           (44.50)         (43.50)         (43.25)         (41.00)         2.85         14.85         19.80         16.55	10.50       11.50       11.75       16.50       4.10       4.35       4.30       3.55       8.20         12.00       13.00       21.00       22.15       0.75       5.20       10.85       6.50       8.00         5.50       6.50       6.75       9.00       3.85       4.85       4.80       4.05       6.20         17.00       18.00       26.00       29.65       0.75       4.70       9.85       6.00       10.00         3.50       4.50       4.75       6.00       3.85       5.85       6.30       4.55       5.20         22.00       23.00       31.00       37.15       0.75       5.70       11.85       7.50       12.00         (4.50)       (3.50)       (3.25)       (6.00)       3.35       6.85       7.80       6.55       1.20         27.00       28.00       36.00       44.65       0.75       6.70       13.85       9.00       15.00         (44.50)       (43.50)       (43.25)       (41.00)       2.85       14.85       19.80       16.55       (13.80)	10.50       11.50       11.75       16.50       4.10       4.35       4.30       3.55       8.20       10.75         12.00       13.00       21.00       22.15       0.75       5.20       10.85       6.50       8.00       13.50         5.50       6.50       6.75       9.00       3.85       4.85       4.80       4.05       6.20       5.75         17.00       18.00       26.00       29.65       0.75       4.70       9.85       6.00       10.00       17.50         3.50       4.50       4.75       6.00       3.85       5.85       6.30       4.55       5.20       3.75         22.00       23.00       31.00       37.15       0.75       5.70       11.85       7.50       12.00       21.50         (4.50)       (3.50)       (3.25)       (6.00)       3.35       6.85       7.80       6.55       1.20       (4.25)         27.00       28.00       36.00       44.65       0.75       6.70       13.85       9.00       15.00       27.50         (44.50)       (43.50)       (43.25)       (41.00)       2.85       14.85       19.80       16.55       (13.80)       (44.25)	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

\* For Plans: KERS Non-Hazardous Retirement and SPRS Retirement.

\*\* For All Remaining Plans: KERS Hazardous Retirement, KERS Non-Haz, Hazardous Insurance and SPRS Insurance.

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### Stress Testing: Regime Descriptions Regime Descriptions

- Expansionary/Above Trend Growth Regime when the economy is coming out of a recession or the economy is running above long-run capacity. Wilshire does not project the economy to remain in this regime over longer periods.
- Baseline/Trend Growth The long term expected state of the economy. Wilshire's capital market assumptions are based on this regime.
- Slow Growth/Below Trend Regime when the economy is running at less than full capacity.
- **Recessionary/Negative Growth** Regime when the economy has below zero growth. Wilshire expects the economy would be in a recession.
- Severe Recession/Deflation Regime when the economy defined by significantly negative growth. Wilshire does not project the economy to remain in this regime over longer periods.



# Appendix – Economic Factor Exposures

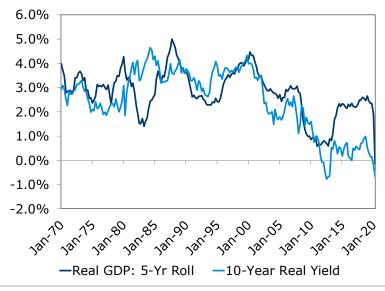
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### Why Introduce Factors?

- **Risk Assessment:** Including factors within the asset allocation process provides an opportunity to measure asset class (and portfolio) exposures to key economic factors
- Economic Efficiency: If the underlying economic activity that drives asset performance can be identified, perhaps it can be used to assist in building economically-efficient portfolios
- Portfolio Stability: Macroeconomic risk factors when separated from the valuation component inherent in investment pricing – may exhibit more stable correlations and, therefore, can better inform the allocation process

### Growth Proxy

- Interest rates contain information and can reflect economic factors
- Nominal yields aggregate two important and distinct sources of economic information real yields and expected inflation
- Disaggregating these factors should prove beneficial in developing a set of factors with improved explanatory power

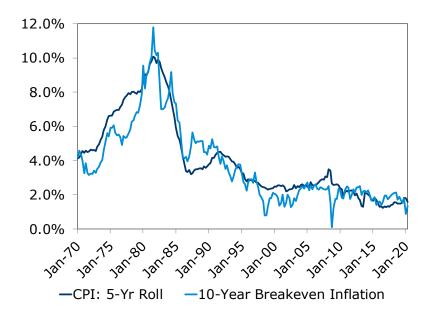


Data Source: Federal Reserve, Bridgewater

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### Inflation Proxy

- Breakeven inflation is the market's expectation for inflation
- Tends to follow closely with actual, recent inflation and can act as a timely signal of trends in consumer prices



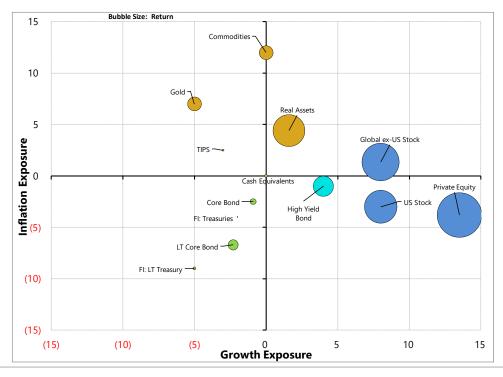
Data Source: Federal Reserve, Bridgewater

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## Wilshire's Approach

- Employ a 2-factor regression model (growth and inflation) to formulate factor assumptions
- Growth proxy is enhanced by high yield bond spreads to better capture shifts in growth forecasts



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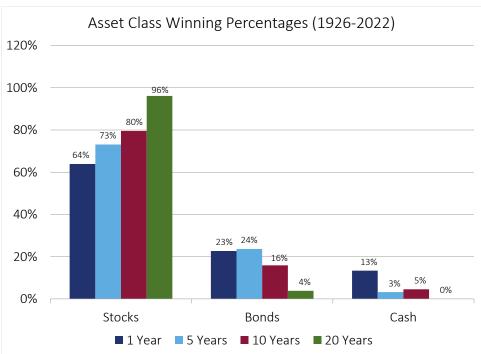
# Appendix – Liquidity

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## Liquidity Risk: What Are The Consequences?

Default/Insolvency is the most severe outcome from having insufficient liquidity, but... There are many other, more likely, disruptive impacts that a lack of liquidity can impose on an investment portfolio

- Liquidity breaches can rob an investor of their biggest advantage: a long-term investment horizon
- The timing and price of such sales dictated by liquidity needs rather than by explicit investment rationale
- Can destroy portfolio value and effectively strip a portfolio from its ability to recover from market sell-offs



## Wilshire Liquidity Metric

Wilshire's Liquidity Metric framework has two levels:

- Market Level of Liquidity
- Stressed Level of Liquidity

#### Market Level of Liquidity

- Quantified on scale from 0% (low liquidity) to 100% (high liquidity)
- Designed to capture general notion of marketable versus private/off-market transactions
  - Marketable asset classes typically reflect a 90% or 100%
  - Private asset classes reflect 0%
- Goal is to reflect the tradability of assets, which is helpful in connecting these values back to our definitional framework (i.e., to quantify the differences between Convertible Liquidity and Delayed Liquidity)

## Wilshire Liquidity Metric

Wilshire's Liquidity Metric framework has two levels:

- Market Level of Liquidity
- Stressed Level of Liquidity

#### **Stressed Liquidity Metric**

Includes a penalty process to reflect the loss in practical liquidity due to asset class volatility and sensitivity to particular economic environments

Penalty components:

- 1. Growth Penalty:
  - Impacts asset classes with vulnerability to slowing growth
  - Recognizes the hit to liquidity that can occur during growth related bear markets
- 2. Inflation Penalty:
  - Impacts asset classes with vulnerability to rising inflation
  - Recognizes the hit to liquidity that can occur during inflation driven bear markets
- 3. Volatility Penalty:
  - Impacts higher volatility asset classes
  - Recognizes the hit to liquidity that can occur from any form of volatility

## Wilshire Stressed Liquidity Metric

Stressed Level of Liquidity Metric

	Market	Liquidity Penalty Components			Applied	Stressed
Asset Class	Liquidity	Growth	Inflation	Volatility	Penalty	Liquidity
US Equity	100	50		24	50	0
Dev ex-US Equity	100	50		26	50	0
EM Equity	90	50		40	50	0
Private Equity	0	50		40	0	0
Cash Equivalents	100				0	100
Core Bonds	100		8		8	86
High Yield Bonds	80	40		10	40	0
US Real Estate Securities	90	50		24	50	0
Private Real Estate	0	50		18	0	0
Commodities	90			20	20	55

Applied Penalty = Min(Max(Growth + Inflation, Volatility), Market Liquidity)

Stressed Liquidity \* = Market Liquidity - (1.75 x Applied Penalty)

\* If less than 20, Stressed Liquidity is assumed to be 0

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# **KRS Investment Committee** Real Return Recommendation – Saba Capital

January 18, 2024

### **Top Candidate Characteristics – Saba Capital** Closed-End Funds Separately Managed Account *\$75 Million Recommendation*

Saba Capital Management ("Saba") is a New York-based investment firm founded in 2009 focused on relative value and arbitrage strategies. The firm was founded by Boaz Weinstein, who was previously co-head of the Global Credit Trading business at Deutsche Bank. Saba utilizes its credit analysis and trading background to arbitrage dislocations and hedge risk across capital structures and markets.

Since 2013, the firm has been investing in listed closed-end funds and investment trusts that trade at sizable discounts to net asset value (NAV). Saba selectively pursues activism and legal judgments to unlock shareholder value and monetize the discount to NAV.

During 2023, Saba won legal judgments or helped closed discounts related to funds managed by BlackRock, Brookfield, Franklin Templeton, and Goldman Sachs, among others.

This investment would provide exposure to listed equity and fixed income securities at a discount, including meaningful exposure to real assets through the energy, utilities, materials, and infrastructure sectors.

#### **Due Diligence Summary**

Date of First KPPA Meeting 1/28/2020 (Conference)

Date of Subsequent Meetings 3/3/2023 (Call) 4/24/2023 (Call) 6/26/2023 (Call) 8/2/2023 (Onsite – NYC) 8/22/2023 (Call) 10/11/2023 (Virtual) 10/31/2023 (Call) 12/7/2023 (Call)

Date of Operational Due Diligence Report 6/28/2023

Date of Consultant Manager Report 7/7/2023

> Legal Negotiation Initiated 8/18/2023

Comparable Strategies Reviewed 10 (closed end funds)



#### **Executive Summary**

# Saba | Capital

Saba is a registered investment advisor focused on relative value strategies. The Firm seeks to profit from dislocations between credit and equity instruments and deliver convex returns, particularly in volatile markets.

Saba has \$4.7 billion in AUM and 51 employees, including 15 investment professionals.<sup>1</sup>

- Saba was founded in 2009 by Boaz Weinstein, who was previously co-head of the Global Credit Trading business at Deutsche Bank, where he managed a team of approximately 650 people. Boaz is known for pioneering a number of credit relative value and capital structure investing strategies.
- Boaz's 28 years of experience in relative value credit strategies deeply informs Saba's investment philosophy.
- Saba's investment team has been at the forefront of hedging tail risk and arbitraging dislocations between bonds, loans, structured credit, and derivatives across capital structures and term structures.
- Saba uses a rigorous investment process that combines quantitative models with fundamental and technical analysis.
- Saba began investing in investment trusts/closed-end funds in 2013 and is the industry leader in activism and relative value trading, currently managing a ~\$5.1 billion<sup>2</sup> portfolio.
- Saba pursues activism where corporate actions may be an effective tool to unlock shareholder value and monetize the discount to NAV.
- Saba has a diverse institutional investor base, including funds of funds, pensions, foundations, endowments, family offices and HNW individuals.

<sup>1</sup>As of 1/1/2024. <sup>2</sup>Long exposure of closed-end funds owned firm-wide as of 12/31/2023. Nothing here is a guarantee or assurance of successful or profitable outcomes.

#### Firm Overview

# Saba | Capital

#### Founded in 2009, Saba manages \$4.7 billion in several Funds:

- Multi-Strategy Relative Value (Flagship)
- Tail Hedge
- Closed-End Fund Arbitrage

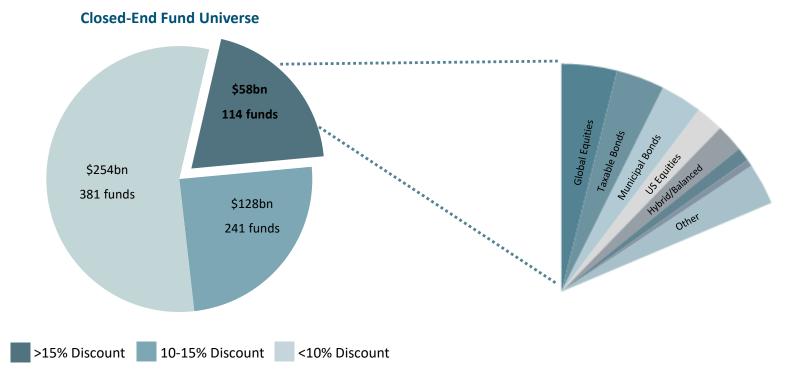


<sup>1</sup>Includes funds of one for Flagship as well as funds and accounts for sub-strategies not currently available for investment. <sup>2</sup>Strategy AUM includes AUM for Saba's sub-advised Fund, The Saba Closed-End Funds ETF (CEFS). AUM estimated as of 1/1/2024.

#### Current Closed-End Fund Universe<sup>1</sup>

# Saba | Capital

- The closed-end fund universe is substantial with over \$440 billion AUM across 735+ funds globally
- Currently, at least \$58 billion market value of CEFs trade at a discount to NAV greater than 15%
  - The opportunity to own assets at double digit discounts is diversified across equities, corporate credit, municipal bonds and more



<sup>1</sup>Includes all active listed closed-end funds in USD, GBP, AUD and CAD, excluding interval funds and funds where asset class is Private Equity or Real Estate and for which current and historical data is available on Bloomberg. As of 11/30/2023. Sources: Saba, Bloomberg, Bloomberg Fund Screening Tool (FSRC). Statements about the investment universe or pipeline are not a guarantee that certain investments will be available, or that such investments will be profitable.

#### Bloomberg 2023 Global Activism Review

# Saba | Capital

By All Campaigns	Top Activists	Top Activists of 2023			
Activist	Total Campaigns	Activist	\$1b+ Campaigns		
Saba Capital Management	64	Elliott Investment Management	15		
Elliott Investment Management	17	Dalton Investments LLC	7		
Nippon Active Value Fund	12	Starboard Value LP	7		
Dalton Investments LLC	10	ValueAct Capital Management	7		
Murakami Funds	10	Saba / Align / Ancora ( <i>tie</i> )	6		
Oasis Management	10	Inclusive Capital	5		

Investment Companies	
& EMEA REITS	
Sales Desk Note	
21 <sup>st</sup> June 2023	

#### From Jefferies market communication on the UK CEF market

"The investment trusts sector has become fat on cheap money and it needs to adapt. There are also too many funds. Many are obsolete because they could be equally well managed in an open-ended wrapper. Many are sub-scale and trade at permanent discounts. But that doesn't mean that there aren't many good ones run by first-class management teams which have sufficient scale and liquidity not only to survive but thrive. Activist capital is probably required to catalyse the creative destruction necessary to shift the sector into a healthier position better tailored to the buy-side's needs."

Source: Bloomberg. For Fiscal Year 2023. League table rankings may vary between quarterly/year-end publications and data found on the Bloomberg Professional Service. While Saba believes that the information from Bloomberg L.P. and its suppliers was obtained from reliable sources, it cannot guarantee its accuracy. Information contained herein is not a rating or endorsement by any third party.

· Mark-to-market risk during periods of market stress

Portfolio Manager

Portfolio Manager

Founder, CIO

Experience

RBC, Merrill Lynch

Deutsche Bank, Soc Gen

Deutsche Bank

Title

Key Investment Personnel

Name

Paul Kazarian

Boaz Weinstein

Pierre Weinstein

# Saba Closed End Fund Strategy

#### **Preliminary Diligence**

Investment Type	Primary	Firm Overview	Track Record			
Firm AUM (M)	\$4,700					
Strategy AUM (M)	\$1,030	Saba Capital ("Saba" or "the Firm") is an alternative asset manager	Oct 2015 – Dec 2023	Saba CEF Opps	<b>HFRI Relative</b>	Bloomberg US
Firm Inception	2009	focused on relative value strategies. As of December 2023, the Firm	OCI 2013 - DEC 2023	1 Onshore LP	Value Index	High Yield
Fund Inception	2015	employs 51 individuals and is headquartered in New York. The Firm was founded in 2009 by Boaz Weinstein as a lift-out of the Deutsche Bank	Ann. Return	10.19%	4.22%	5.61%
Asset Class	Multi-Asset	proprietary credit trading group. Saba manages nearly \$5 billion across	Ann. Volatility	14.91%	4.66%	8.03%
Sector	Closed End Fund Arbitrage	four core strategies: the flagship multi-strategy hedge fund, tail hedging,	Correlation	-	0.86	0.89
Geographic Focus	Global	closed-end fund arbitrage, and SPACs. The closed end fund arbitrage	Beta	-	2.76	1.65
Subscriptions	Monthly	strategy is managed by Partner and Portfolio Manager Paul Kazarian, who	Alpha	-	-1.44%	0.92%
Redemptions	Quarterly	joined the Firm in 2013 from RBC, where he served as a Director in the	Source: Saba Capital, Bloomberg, HFRI. Saba performance calculated using			
Notice	65 days	Global Arbitrage and Trading Group.	equivalent fee structure of proposed SMA.			
Lock-Up	None	Investment Strategy		Investment M	/erits	
Gate	25% quarterly		Employee owned firm			aiortaam
Management Fee	0.75%	Saba's Closed End Fund Arbitrage strategy is offered to investors through	<ul> <li>Employee-owned firm with experienced and tenured senior team</li> <li>Experienced manager and industry leader in CEF activism</li> <li>Favorable market dynamics</li> <li>Meaningful track record across a number of market environments</li> </ul>			
Performance Fee	25%	separate accounts, funds of one, and several commingled vehicles – most notably, Saba Capital CEF Opportunities 1 – in both a long-only and				
Preferred Return	1.5x iShares iBoxx High Yield Corporate Bond ETF Class USD Inc	motably, saba capital CEF Opportunities 1 – In both a long-only and market neutral approach. The strategy focuses on the purchase of				
Organization		shares/interests in closed end funds and investment trusts at significant				
		discounts to NAV to capture incremental yield relative to the underlying	Concentrated ownership structure			
		instruments, which include bonds, loans, and equity securities. Discounts	<ul> <li>Lean dedicated team to the CEF arbitrage strategy</li> </ul>			
	30	are often driven by differences in cost structures and liquidity, retail	<ul> <li>Regulatory risk as it p</li> </ul>	ertains to UK Inve	stment Trusts	

flows, changes in regulations, and market dislocations.

Investments are intended to generate positive returns through positive

performance of the underlying and narrowing of the discount. Additionally, Saba looks to pursue an activist approach in special

situations where corporate actions (liquidation, tendering, open-ending)

can drive value and monetize the discount. The strategy generally holds

40-80 closed-end funds and will generally be a long-only/long-biased

portfolio, though Saba has discretion to hedge as deemed necessary.



Past performance is not indicative of future results.



**KENTUCKY PUBLIC PENSIONS AUTHORITY** 



INVESTMENTS

To: KRS Investment Committee

From: Anthony Chiu, Deputy CIO

Date: January 18, 2024

Subject: Investment Recommendation – Saba Capital Closed-End Funds strategy

KPPA Investment Staff is proposing a separate account investment with Saba Capital Management ("Saba" or the "Firm"). Based in New York, Saba is pursuing a value and activist strategy targeting listed closed-end funds ("CEF" or "CEFs") that are trading at significant (>15%) discounts to their net asset value ("NAV").

Currently there are more than 735 closed-end funds globally with \$440 billion of assets under management. These funds are retail investment products that are sold (not bought) through the wealth management channel and largely consist of portfolios of listed securities. Equity and fixed income funds each comprise around 40% of the market, with the rest in real assets funds that hold utilities, MLPs, infrastructure).

As a result of the asset allocation that took effect in 2022, KPPA's target portfolio weight for Real Return was increased to either 10% or 13%, depending on the underlying plan. After a sizable Putnam mandate was terminated in 2022, KPPA's plans each had around a 2-3% allocation to Real Return. This proposed investment would help the plans continue moving toward target weights and be fully invested during the first half of 2024.

In identifying this investment opportunity, KPPA staff utilized a competitive search process in accordance with the Investment Policy Statement and Investment Procurement Policy in its search for strategies that provide favorable stand-alone risk-adjusted returns, low correlations to the existing portfolio, and a propensity for positive real returns across the cycle.

#### **Business / People:**

Saba was founded in 2009 by Boaz Weinstein to focus on relative value and arbitrage strategies. Boaz was previously co-head of Global Credit Trading at Deutsche Bank, where he worked for 11 years and led a team of over 600 people. Saba Capital was a liftout of the proprietary credit trading group that Boaz started and utilizes its credit analysis and trading background to arbitrage dislocations and hedge risk across capital structures and markets. At the beginning of 2024, Saba had \$4.7 billion of assets under management and a team of 51, including 15 investment professionals.

Saba's flagship fund allocates flexibly across market opportunities. In the firm's early years, it was perhaps most famous for the "London whale" trade, in which Saba noticed and took advantage of a market anomaly in the credit default swaps market that turned out to be the result of a JPMorgan trader's outsized "hedging" positions.

Saba began trading CEFs in 2013 shortly after Paul Kazarian joined from RBC Capital Markets, where he had worked in proprietary trading and bond ETF arbitrage for 6 years. While Boaz is Saba's Chief Investment Officer, Paul has primary responsibility for CEFs and is the key person on this strategy. Paul is solely dedicated to CEFs and makes day-to-day decisions with close oversight from Boaz.

Pierre Weinstein (no relation) has worked with Boaz since 2005 at Deutsche Bank, where he managed the equity derivatives, international convertible bond and SPAC arbitrage strategies. He joined Saba at launch in 2009 and worked on CEFs more when Saba was first getting involved. Pierre spends a large majority of his time on convert and volatility arbitrage but still contributes to the CEF strategy as well.

#### **Investment Process and Portfolio:**

Because CEFs are sold and not bought, they do not have a naturally consistent source of demand. As a result, when investors look to sell, a discount is typically required to clear the market. Since the underlying assets of CEFs are often listed and straightforward to value, the 10-year median discount for CEFs is 7% as of November 2023.

However, market and investor sentiment can significantly influence the discount toward the 13-15% levels that start to interest Saba. The Federal Reserve's interest rate hikes and 2022's market rout have helped push CEF discounts to historically wide levels. For example, in October 2023 municipal CEF discounts were near the widest levels seen over the past 20 years, as shown below.

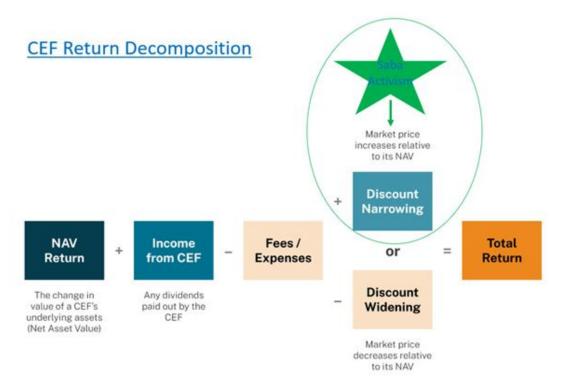


Sources: BlackRock, Morningstar

Saba first started investing in CEFs in 2013 and currently has over \$5 billion of long exposure across the firm in what on the surface appears to be a thinly traded market. However, a combination of steady daily buying and block trades has allowed Saba to accumulate meaningful positions in dozens of CEFs.

While buying assets inexpensively can be a good investment strategy, discounts can also persist indefinitely, especially if maintaining the status quo serves the interest of the asset manager. In the case of closed-end funds, the fund manager can instantly close the discount if they choose. Tendering for shares, merging with an open-end fund, or simply liquidating the underlying assets will do the job – but also reduce the manager's fee income. So that is unlikely without a catalyst.

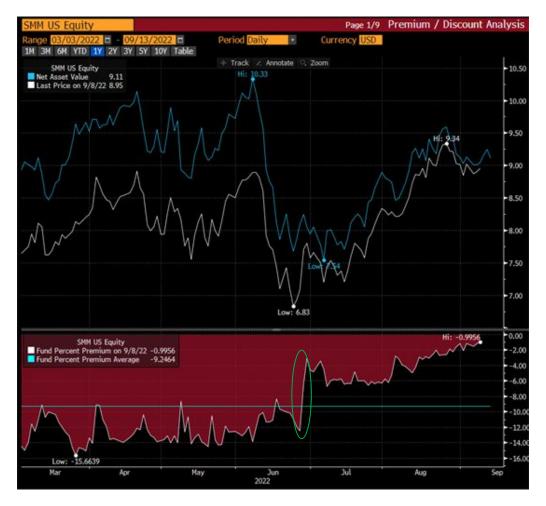
Thus, the second part of Saba's strategy is activism. Saba has taken 92 corporate actions since 2015 that have resulted in a partial or full monetization of the discount to NAV. Since January 2021, Saba was the lead activist on 28 of the 29 corporate actions it undertook and currently has 13Ds filed (>5% ownership) in 53 different closed-end funds.



An example of Saba catalyzing action is Salient Midstream & MLP Fund (SMM), which traded at a 19% discount at the beginning of November 2021 when Saba filed their initial 13D. Saba nominated Paul and Pierre for SMM board membership at Salient's annual meeting in late June 2022. The following week the fund's trading was halted and Salient agreed to merge SMM into Salient MLP & Energy Infrastructure Fund (SMLPX), its open-end mutual fund. As shown below, about 2/3 of the discount was closed immediately when the merger was announced, with the remainder occurring when the merger closed.



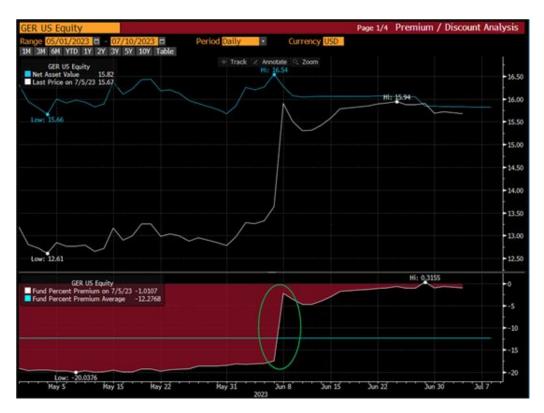
After careful consideration of a variety of factors and alternatives, the Board of Trustees determined that it would be in the best interest of shareholders to merge SMM into SMLPX.



With Saba's growing activity and success, CEF managers that find Saba as a top holder of their funds have occasionally been proactive in improving shareholder value. For example, Saba initiated a position in the Goldman Sachs MLP and Energy Renaissance fund (GER) in 1Q 2022 and became the fund's largest holder by the end of 1Q 2023. But before Saba even engaged, Goldman announced in early June that it was liquidating the fund, which instantly closed the fund's 20% discount to NAV.

#### Goldman Sachs Asset Management Announces Liquidation of Goldman Sachs MLP and Energy Renaissance Fund

New York, NY, June 7, 2023 — Goldman Sachs Asset Management ("GSAM"), investment adviser for the Goldman Sachs MLP and Energy Renaissance Fund (the "Fund") (NYSE: GER), announced today that the Fund's Board of Trustees, at the recommendation of GSAM, has approved a plan of liquidation and dissolution (the "Plan") for the Fund. Under the Plan, which is effective today, the Fund will begin the process of liquidating portfolio assets and unwinding its affairs in an orderly fashion over time. The Plan is not subject to shareholder approval.



Many CEF managers have been less cooperative, which has led to a significant amount of litigation. Saba has sued and recently won judgments against managers including BlackRock, Eaton Vance, and Nuveen that have implemented provisions that limit Saba's shareholder voting rights.

Saba believes their activist trades typically span 1 to 1.25 years from inception to exit. However, with litigation some campaigns could stretch to 2 years or more – and could end up with a legal loss at the end. Additionally, the sentiment dynamics mentioned above that are a feature of the CEF landscape could cause additional discount widening, volatility, and negative returns in the short to medium term.

However, we believe Saba's approach of finding assets at discount and creating value through activism is likely to continue having success, and today's historically wide discounts provide an attractive entry point. Saba seems to share that belief as well, with its flagship fund having increased its exposure to CEFs from 9% at the end of 2021 to 46% at the end of November 2023.

				Since	Inception
Fund	1 yr	3 yr	5 yr	Inception	Date
Saba CEF Opportunities 1	17.8%	7.3%	12.3%	10.7%	Oct-15
60/40 Portfolio	17.7%	4.7%	10.0%	8.9%	
S&P Real Assets Index	7.8%	3.9%	5.9%	5.1%	

#### **Performance:**

#### Source: Bloomberg, Saba Capital as of 12/31/2023

Since inception in October 2015, Saba's closed-end fund strategy has outpaced a blended equity and fixed income portfolio (which comprises the majority of the CEF universe) as well as a real assets benchmark.

**Conclusion:** Given the attractive economics and compelling market opportunity, Staff is recommending an investment of \$75 million to be shared among all K and S plans pending successful investment management agreement negotiations. When fully funded, this would represent an additional  $\sim$ 1.0-1.1% of plan assets (depending on fluctuations in market value). It is anticipated this investment would be funded by existing cash or the unwinding of proxy positions based on the specific needs of each plan.

Investment and Term	<u>s Summary</u>
Type of Investment:	Real Return
Structure:	Separate Account
Management Fee:	0.75%
<b>Performance Fee:</b>	25% over a benchmark (60/40 portfolio)
Purpose:	Provide KRS with exposure to listed real asset, fixed income, and equity
	securities at a discount. Earn yield and monetize closed-end fund discounts
	through successful shareholder activism and litigation.
Risks:	Volatility, Liquidity, Key Person, Legal
Exp. Net Return:	8% - 12%

\*No placement agents have been involved or will be compensated as a result of this recommendation.