

# Connecticut Retirement Plans and Trust Funds 2022 Strategic Asset Allocation Update FINAL

## Pension Funds Management

# Strategic Asset Allocation (SAA) Update

- **Background**

- Asset Allocation is the largest driver of risk-adjusted performance for the Connecticut Retirement Plans and Trust Funds
- Meketa, our fund general consultant, has historically conducted the asset allocation study for the Pension Funds Management (PFM) Division
- The last full Strategic Asset Allocation (SAA) and Asset-Liability study was performed in 2018

- **New Approach - 2022 Strategic Asset Allocation Update Process**

- PFM leveraged Meketa's tools and resources to bring the process in-house and perform a staff-driven analysis to update the SAA
- PFM utilized Meketa's 2022 Capital Market Assumptions (CMAs) to update our new long-term target allocations
- PFM sought input from the Asset Allocation Sub-Committee of the Investment Advisory Council prior to finalizing recommendations to the broader body
- The approved SAA will be updated in the revised 2022 Investment Policy Statement (IPS)

# Refinements to the Strategic Asset Allocation Update

- **Updates based on feedback from the IAC Sub-Committee meeting on June 8, 2022, PFM:**
  - Utilized Meketa's 20-Year expectations instead of the 10-Year expectations to better align with the long-term horizon
  - Tweaked the asset class policy target:
    - Reduced Real Estate by 2% and increased Global Equities by 2%
  - Created a composite "Credit" asset class for flexibility in managing our exposure with the following sub-asset classes:
    - Public Credit
    - Private Credit
  - Incorporated alpha estimates into our assumed rate of return assumptions to account for manager selection not explicitly modeled in the SAA process

# Goals of the Strategic Asset Allocation Update

- **Review the Current Strategic Asset Allocation and recommend necessary updates**
  - An annual review of SAA relative to objectives is part of best practices for prudent governance
  - Market turbulence relative to the pandemic and geopolitical events, with continued uncertainty of outlook validates appropriateness of strategic review of the asset allocation

## Final list of Strategic Asset Allocation topics reviewed by PFM & Meketa:

1. **Revisit Global Equity** – consider one "Global Equities" composite utilizing the three discrete equity asset classes
2. **Disaggregate Real Assets** – examine breaking out Real Assets into its component asset classes (Real Estate, Infrastructure & Natural Resources excluding TIPS)
3. **Review our Fixed Income Asset Classes** – discuss the role of Fixed Income in the portfolio (for capital preservation and return generation relative to Alternatives)
4. **Expand Risk Mitigating Strategies** – evaluate the role and target weight of risk mitigation strategy in the Alternative Investment Fund and the overall portfolio
5. **Innovate our SAA Implementation** – consider how PFM can achieve the asset allocation in a disciplined and thoughtful manner through interim policy targets
6. **Update Policy Benchmarks** – review benchmarks for all asset classes and determine necessary revisions (e.g., Global Equity)

# PFM Staff-Driven Process for Strategic Asset Allocation Update

## Review Prior SAA

Evaluate CMAs from market participants  
Review 2018 CRPTF AA Study  
Review current asset classes with Team

## Initial MV Optimizations

Analyze portfolio optimizations  
Establish model portfolios & targets  
Initial Draft of Updated IPS

## Final Approval of SAA

Review of SAA by IAC

## Review 2022 CMAs

Meketa Review of 2022 CMAs

## Model Portfolios

Construct model portfolios  
Begin review of IPS

## Refine MVOs / Stress Tests

Debate policy portfolios in PFM  
Finalize updates to IPS  
Run portfolio stress tests & scenarios

## Sub-Committee Review

Review with IAC AA Sub-committee  
Incorporate Sub-committee Feedback

## Approve IPS

Final approval of IPS by IAC

JAN

FEB

MAR

APR

MAY

JUN\*

JUL

AUG

SEP

Source: PFM

\*Separate IAC Meeting

# Setting Capital Market Expectations

- Capital Markets Assumptions (CMAs) are the inputs needed to conduct the mean-variance optimization (MVO) relying on both quantitative and qualitative methodologies
- Consultants (including Meketa) generally set CMAs once a year and will periodically update mid-year
- Meketa published the 2022 Capital Market Expectations in January, based on December 31<sup>st</sup> data
- Meketa publishes both 10-Yr and 20-Yr expected return assumptions
- **PFM is using 20-Yr CMAs in this Strategic Asset Allocation Update** following feedback from the sub-committee of the IAC
- MVO is the traditional starting point for determining asset allocation
- This involves using the following inputs for the asset classes:
  - Returns
  - Standard Deviation
  - Pair-wise Correlations of each asset class

# Revisions to the Asset Class Lineup

- PFM took the opportunity to revise our asset classes
  - **Global Equities**
    - In addition to distinct equity asset classes for domestic, international, and emerging markets, PFM will aggregate equities into a single Global Equity Composite tracking the MSCI All Country World Index IMI
    - Rationale: robust management of the largest driver of returns reflecting a global asset mix
  - **Fixed Income**
    - Simplify our approach by utilizing a single asset class for duration and credit
    - Established a new Credit composite consisting of Public Credit (instead of High Yield & Emerging Markets Debt) and Private Credit
    - Public Credit will include both return and risk factors (e.g., Treasury exposure)
  - **Real Assets**
    - Breaking apart Real Estate from Infrastructure & Natural Resources asset classes
    - Rationale: PFM team manages these asset classes separately and each has its own distinct characteristics
    - Eliminating TIPS as a distinct asset class category

# 2022 Capital Market Assumptions for Major Asset Classes

- Composite asset class using 20-Year CMA expected returns & volatility assumptions

Composite Asset Classes	Weight (%)	Expected Return (%)	Standard Deviation (%)
US Equity	58	6.8	18.0
Developed Market Equity (Non-US)	30	7.5	19.0
Emerging Market Equity	12	8.4	24.0
<b>Global Equity Composite</b>	<b>100</b>	<b>7.4</b>	<b>18.2</b>
<b>Core Fixed Income</b>	<b>100</b>	<b>2.4</b>	<b>4.0</b>
High Yield Bonds	80	4.4	11.0
Bank Loans	10	4.0	10.0
Convertible Bonds	10	3.9	19.0
<b>Public Credit Composite</b>	<b>100</b>	<b>4.5</b>	<b>10.3</b>
<b>Liquidity (Cash)</b>	<b>100</b>	<b>1.7</b>	<b>1.0</b>

Source: PFM, Meketa

Note: Returns are geometric, volatility assumptions are 15-yr estimates



# 2022 Capital Market Assumptions for Major Asset Classes

- Composite asset class using 20-Year CMA expected returns & volatility assumptions

Composite Asset Classes	Weight (%)	Expected Return (%)	Standard Deviation (%)
Long-term Government Bonds	8	2.8	12.0
Global Macro	21	5.0	5.0
CTA (Trend Following)	19	4.8	15.0
Long Puts	42	-1.8	6.0
Alternative Risk Premia (ARP)	10	4.6	10.0
<b>Risk Mitigating Strategies Composite</b>	<b>100</b>	<b>2.1</b>	<b>5.3</b>
Buyouts	80	9.8	25.0
Venture Capital	20	10.3	36.0
<b>Private Equity Composite</b>	<b>100</b>	<b>10.2</b>	<b>25.8</b>
Direct Lending	60	7.1	14.0
Mezzanine Debt	30	7.2	16.0
Distressed Debt	10	7.7	21.0
<b>Private Credit Composite</b>	<b>100</b>	<b>7.3</b>	<b>14.5</b>

Source: PFM, Meketa

Note: Returns are geometric, volatility assumptions are 15-yr estimates

# 2022 Capital Market Assumptions for Major Asset Classes

- Composite asset class using 20-Year CMA expected returns & volatility assumptions

Composite Asset Classes	Weight (%)	Expected Return (%)	Standard Deviation (%)
REITs	10	7.1	26.0
Core Real Estate	50	6.1	12.0
Non-Core Real Estate	<u>40</u>	8.1	20.0
<b>Real Estate Composite</b>	<b>100</b>	<b>7.2</b>	<b>15.8</b>
Farmland/Harvested Natural Resources	24	7.2	12.0
Sustainable Natural Resources	6	9.3	26.0
Core Infrastructure	28	7.3	14.0
Non-Core Infrastructure	<u>42</u>	9.3	22.0
<b>Infrastructure &amp; Nat. Resources Composite</b>	<b>100</b>	<b>8.6</b>	<b>15.9</b>

Source: PFM, Meketa

Note: Returns are geometric, volatility assumptions are 15-yr estimates

# 2022 Correlation Expectations for Major Asset Classes

- Composite correlations for the asset classes are shown below
- Risk Mitigating Strategy serves as an overall diversifier in the asset class modeling

	Global Equity	Public Credit	Core Fixed Income	Liquidity	Risk Mitigating	Private Equity	Private Credit	Real Estate	Infra & Nat. Resources
Global Equity	1.00	0.78	0.06	-0.20	-0.17	0.91	0.71	0.52	0.69
Public Credit	0.78	1.00	0.20	-0.21	-0.37	0.76	0.96	0.60	0.73
Core Fixed Income	0.06	0.20	1.00	0.13	0.29	0.00	0.10	0.24	0.28
Liquidity	-0.20	-0.21	0.13	1.00	0.26	0.11	0.10	0.13	0.17
Risk Mitigating	-0.17	-0.37	0.29	0.26	1.00	-0.18	-0.20	-0.06	0.02
Private Equity	0.91	0.76	0.00	0.11	-0.18	1.00	0.77	0.46	0.58
Private Credit	0.71	0.96	0.10	0.10	-0.20	0.77	1.00	0.48	0.53
Real Estate	0.52	0.60	0.24	0.13	-0.06	0.46	0.48	1.00	0.65
Infra & Nat. Resources	0.69	0.73	0.28	0.17	0.02	0.58	0.53	0.65	1.00

Source: Meketa

# Benchmarks for Proposed Policy Allocations

- The table below outlines the proposed benchmarks for each asset class and composite

Composite Asset Class	Performance Benchmarks
<b>Global Equity</b>	<b>MSCI ACWI IMI</b>
Domestic Equity	Russell 3000
Non-US Developed Markets	MSCI World (ex. US) IMI
Emerging Markets	MSCI Emerging Markets IMI
<b>Core Fixed Income</b>	<b>Custom Blend (Bloomberg US Aggregate/US Treasuries)</b>
<b>Credit</b>	
Public Credit	Bloomberg High Yield
Private Credit	S&P/LSTA Leverage Loan Index + 150 basis points
<b>Liquidity Fund</b>	<b>3 Month Treasury Bills</b>
<b>Risk Mitigating</b>	<b>Custom Benchmark (Dynamic Blended)</b>
<b>Private Equity</b>	<b>Russell 3000 + 250 basis points</b>
<b>Real Estate</b>	<b>NCREIF ODCE (Net)</b>
<b>Infrastructure &amp; Nat. Resources</b>	<b>CPI + 400 basis points</b>

Source: PFM, Meketa

# Key Modeling Observations

- Overall expected returns continue to be revised lower in 2022 versus 2021 CMAs highlighting the challenging return environment
- The mean-variance optimizations (MVO) continue to favor strong diversifiers and private assets as the primary means of returns
  - MVO favored Risk Mitigating for its diversification benefits versus the other asset classes
  - MVO favored Private Equity, Infrastructure & Natural Resources
- PFM utilized an iterative approach to perform the optimizations, incorporating constraints on each asset class to arrive at a team consensus for the proposed Long-Term Policy allocation
- Key takeaways for the proposed policy portfolio:
  - Overall increase in our private markets' allocations across the board
  - Increase to our Risk Mitigating Strategy allocation
  - Revise our Core Fixed Income toward Investment Grade bonds for capital preservation

# Mean Variance Optimizations

- PFM & Meketa ran a series of mean-variance optimizations (MVOs) to model three different policy portfolios
- PFM determined a proposed Long-Term Policy allocation (Proposed Long-Term Policy)

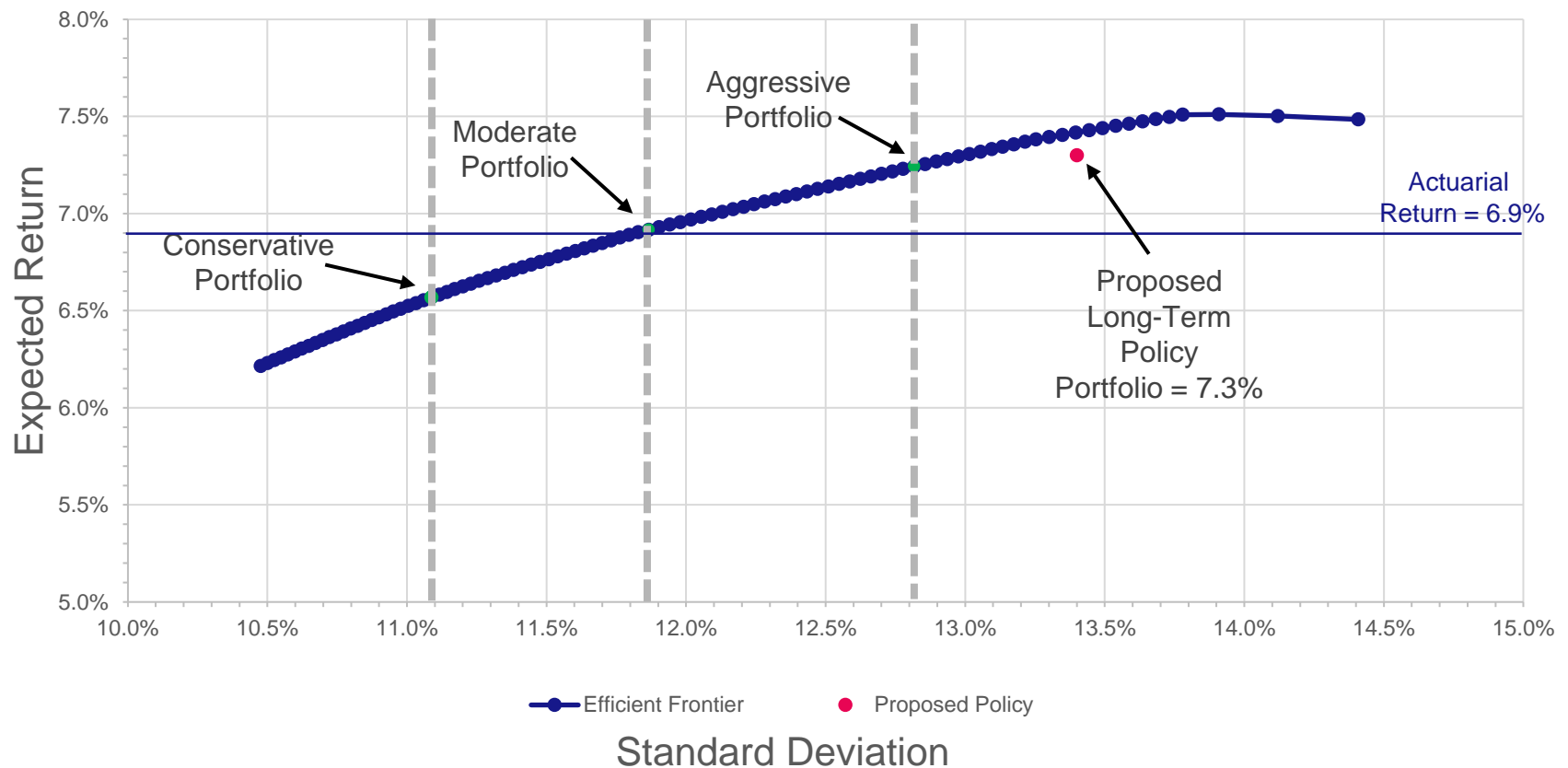
	Actual Weight as of 06/30 (%)	Conservative (%)	Moderate (%)	Aggressive (%)	Proposed Long-Term Policy (%)
Global Equity	43	30	30	30	37
Core Fixed Income	12	20	14	10	13
Public Credit	9	2	2	2	2
TIPS	5	0	0	0	0
Liquidity	1	2	1	1	1
Risk Mitigating	4	10	10	10	5
Private Equity	12	12	12	16	15
Private Credit	3	5	10	10	10
Real Estate	9	12	14	14	10
Infrastructure & Natural Resources	2	7	7	7	7
<b>Expected Return (20 year)</b>	<b>6.8%</b>	<b>6.6%</b>	<b>6.9%</b>	<b>7.2%</b>	<b>7.3%</b>
<b>Standard Deviation</b>	<b>13.0%</b>	<b>11.1%</b>	<b>11.8%</b>	<b>12.7%</b>	<b>13.4%</b>
<b>Sharpe Ratio (Return / Unit Risk)</b>	<b>0.39</b>	<b>0.44</b>	<b>0.44</b>	<b>0.43</b>	<b>0.42</b>

Source: PFM, Meketa

Note: Expected returns are geometric, volatility assumptions are 15-yr estimates

# Efficient Frontier for MVO Portfolios

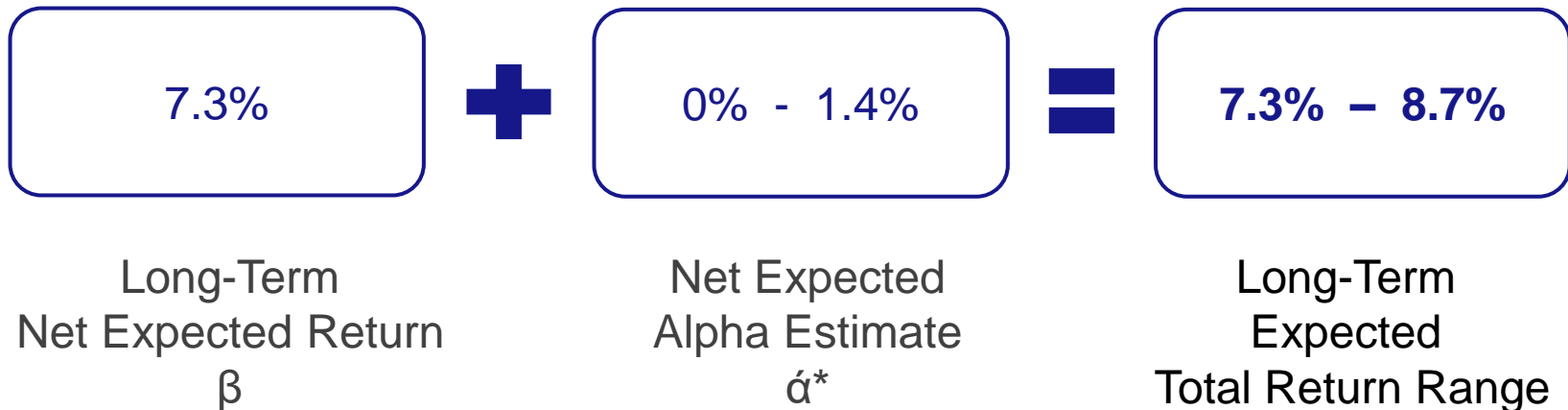
- Meketa ran several optimizations based on PFM's input and selected portfolios at the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles that represent the Conservative, Moderate and Aggressive portfolios respectively
- PFM took these into account and modeled a Long-Term Policy allocation, incorporating other factors that cannot be modeled into the optimization (e.g., liquidity needs)



Source: PFM, Meketa

# Projected Total Return Incorporating Alpha Estimates

- PFM staff worked with Meketa to incorporate a measure of excess returns not explicitly modeled into our optimizations
- Methodology for Long-Term Total Expected Return:
  - Gross alpha estimates for top quartile manager selection in the private markets
  - Estimated a range of net alpha is discounted to account for incremental management fees
- Expected long-term total return estimated to be between 7.3% - 8.7%



Source: Meketa, PFM

\*Alpha Estimates provided by Meketa



# Probability of Returns Analysis for MVO Portfolios

- Probabilities of hitting the actuarial rate of return of 6.9% is improved with the proposed policy portfolio

	Current Policy (%)	Conservative (%)	Moderate (%)	Aggressive (%)	Proposed Long-Term Policy (%)
<b>Probability of Achieving at least a 5% Return</b>					
One Year	55.7	55.6	56.4	56.9	56.7
Three Years	59.8	59.6	60.9	61.9	61.6
Five Years	62.5	62.3	64.0	65.2	64.8
Ten Years	67.4	67.1	69.4	71.0	70.4
Twenty Years	73.8	73.4	76.3	78.3	77.6
<b>Probability of Achieving at least a 6% Return</b>					
One Year	52.5	51.9	52.9	53.7	53.7
Three Years	54.3	53.3	55.1	56.5	56.4
Five Years	55.5	54.3	56.5	58.3	58.2
Ten Years	57.8	56.0	59.2	61.7	61.3
Twenty Years	60.9	58.5	62.9	66.3	66.1
<b>Probability of Achieving at least a 6.5% Return</b>					
One Year	50.9	50.1	51.2	52.1	52.2
Three Years	51.5	50.2	52.1	53.7	53.8
Five Years	51.9	50.2	52.7	54.8	54.9
Ten Years	52.7	50.3	53.9	56.8	56.9
Twenty Years	53.9	50.4	55.5	59.5	59.7
<b>Probability of Achieving at least a 6.9% Return</b>					
One Year	49.3	48.3	49.5	50.6	50.7
Three Years	48.7	47.0	49.2	51.0	51.2
Five Years	48.4	46.2	48.9	51.3	51.5
Ten Years	47.7	44.6	48.5	51.8	52.1
Twenty Years	46.7	42.4	47.8	52.5	53.0

Source: PFM, Meketa

# Proposed Long-Term & Interim Policy Allocations

- PFM acknowledges the difficulty of execution for the proposed policy asset allocation for a large plan with significant constraints (e.g., staffing, RFP process, sizing)
- PFM recommends the creation of two Interim Policy allocation that will provide a meaningful glidepath for implementation of the asset allocation over the next five years (20-month duration to Long-Term Policy)
- The proposed Long-Term Policy experiences a 50-basis point improvement in expected return over the current allocations (7.3% versus 6.8%) with a slightly better Sharpe ratio (0.42 versus 0.39)

Asset Classes	Actual Weight as of 06/30 (%)	Proposed Interim A Policy (%)	Proposed Interim B Policy (%)	Proposed Long-Term Policy (%)
Global Equity	43	44	40	37
Core Fixed Income	12	13	13	13
Public Credit	9	5	3	2
TIPS	5	0	0	0
Liquidity	1	1	1	1
Risk Mitigating	4	5	5	5
Private Equity	12	13	14	15
Private Credit	3	5	8	10
Real Estate	9	10	10	10
Infrastructure & Natural Resources	2	4	6	7
<b>Expected Return (20 year)</b>	<b>6.8%</b>	<b>7.1%</b>	<b>7.2%</b>	<b>7.3%</b>
<b>Standard Deviation</b>	<b>13.0%</b>	<b>13.5%</b>	<b>13.4%</b>	<b>13.4%</b>
<b>Sharpe Ratio</b>	<b>0.39</b>	<b>0.40</b>	<b>0.41</b>	<b>0.42</b>

Source: PFM, Meketa

# Policy Portfolio Characteristics

- Overall characteristics for the Proposed Policy Allocation shifts meaningfully to allocate more toward Private Markets over Public Markets
- Thematic buckets concentrate more toward private market asset classes while maintaining similar exposure to Growth and Credit (capital appreciation), pushing up Inflation exposure through Infrastructure & Natural Resources

Public versus Private	Current Policy (%)	Proposed Interim A Policy (%)	Proposed Interim B Policy (%)	Proposed Long-Term Policy (%)
Public Markets	71	68	62	58
Private Markets	29	32	38	42

Thematic Buckets	Current Policy (%)	Proposed Interim A Policy (%)	Proposed Interim B Policy (%)	Proposed Long-Term Policy (%)
Growth	50	57	54	52
Credit	13	10	11	12
Inflation Hedges	14	14	16	17
Risk Mitigating	23	19	19	19

Source: PFM, Meketa

# Probability of Returns Analysis for Proposed Allocations

- Probabilities are biased downward due to 10-Yr CMAs

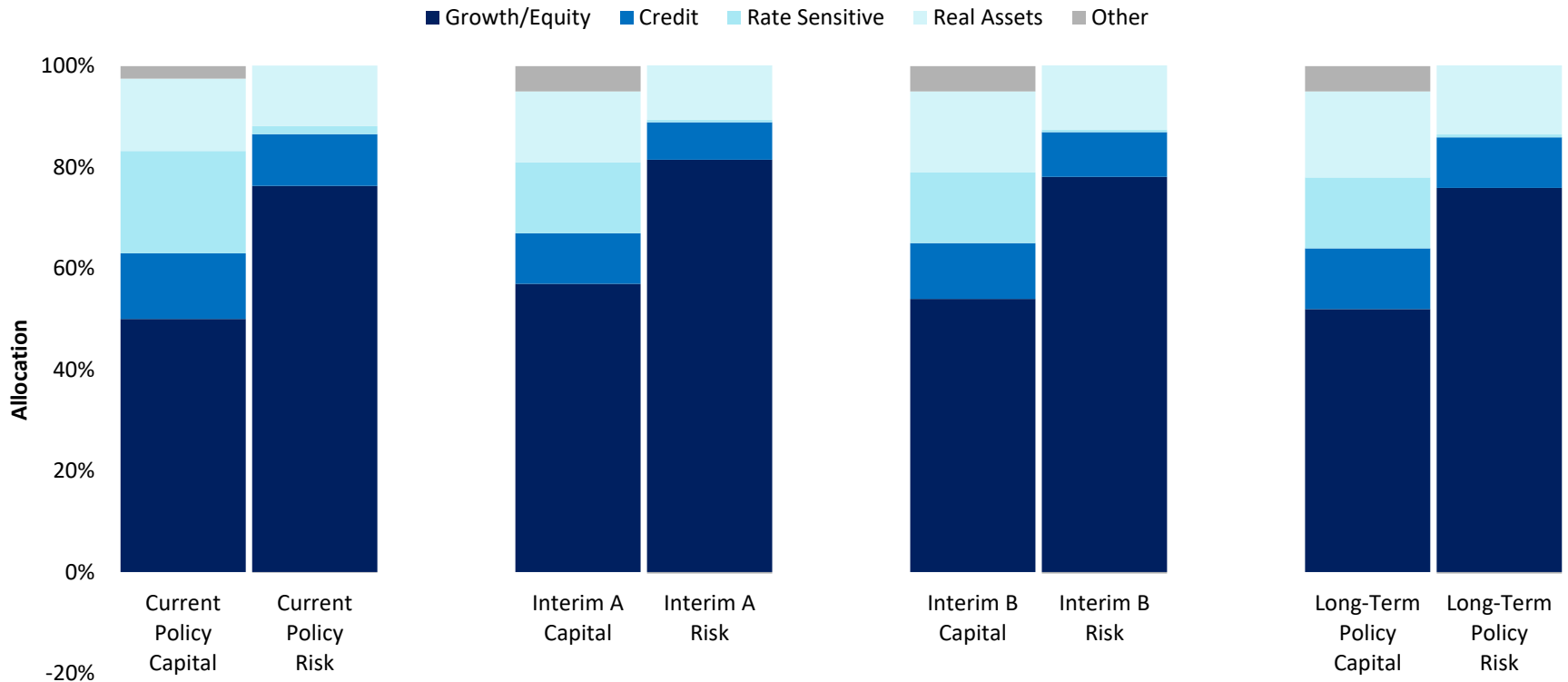
	Current Policy (%)	Proposed Interim A Policy (%)	Proposed Interim B Policy (%)	Proposed Long-Term Policy (%)
<b>Probability of Achieving at least a 5% Return</b>				
One Year	55.7	56.1	56.5	56.7
Three Years	59.8	60.5	61.2	61.6
Five Years	62.5	63.4	64.3	64.8
Ten Years	67.4	68.6	69.8	70.4
Twenty Years	73.8	75.3	76.8	77.6
<b>Probability of Achieving at least a 6% Return</b>				
One Year	52.5	53.1	53.5	53.7
Three Years	54.3	55.3	56.0	56.4
Five Years	55.5	56.8	57.7	58.2
Ten Years	57.8	59.6	60.9	61.3
Twenty Years	60.9	63.5	65.2	66.1
<b>Probability of Achieving at least a 6.5% Return</b>				
One Year	50.9	51.6	52.0	52.2
Three Years	51.5	52.7	53.4	53.8
Five Years	51.9	53.5	54.4	54.9
Ten Years	52.7	55.0	56.2	56.9
Twenty Years	53.9	57.0	58.7	59.7
<b>Probability of Achieving at least a 6.9% Return</b>				
One Year	49.3	50.1	50.5	50.7
Three Years	48.7	50.1	50.8	51.2
Five Years	48.4	50.2	51.0	51.5
Ten Years	47.7	50.2	51.4	52.1
Twenty Years	46.7	50.3	52.0	53.0

Source: PFM, Meketa



# Capital Allocation versus Risk Allocation\* Analysis

- Assets with low relative volatility, such as rate sensitive fixed income, contribute less to risk than their asset weighting implies



Source: PFM, Meketa

\*Risk allocation is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio and then dividing this by the standard deviation of the total portfolio.

# Historical Stress Tests & Scenario Risk Analysis

- Meketa calculated several historical stress tests on various portfolios
- Takeaways indicate better downside protection while marginal upside due to reduced equity exposure

Source: PFM, Meketa

Historical Stress Tests	Current Policy (%)	Proposed Interim A (%)	Proposed Interim B (%)	Long-Term Policy (%)
COVID-19 Market Shock (Feb 2020-Mar 2020)	-16.6	-17.7	-16.3	-15.4
Taper Tantrum (May - Aug 2013)	-1.0	0.6	0.9	1.1
Global Financial Crisis (Oct 2007 - Mar 2009)	-24.3	-27.0	-25.3	-24.1
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-10.9	-15.5	-13.6	-12.3
Long Term Capital Management Collapse (Jul - Aug 1998)	-8.7	-7.6	-6.9	-6.3
Asian Financial Crisis (Aug 97 - Jan 98)	1.4	3.2	3.9	4.5
Rate spike (1994 Calendar Year)	0.8	3.0	3.3	3.5
Early 1990s Recession (Jun - Oct 1990)	-5.4	-5.6	-4.8	-4.2
Crash of 1987 (Sep - Nov 1987)	-9.9	-10.8	-9.7	-8.8
Strong dollar (Jan 1981 - Sep 1982)	5.3	5.1	5.3	5.5
Volcker Recession (Jan - Mar 1980)	-3.5	-3.0	-2.9	-2.8
Stagflation (Jan 1973 - Sep 1974)	-19.2	-20.7	-19.0	-17.9

Historical Stress Tests	Current Policy (%)	Interim A (%)	Interim B (%)	Long-Term Policy (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	32.6	32.3	29.7	27.9
Best of Great Moderation (Apr 2003 - Feb 2004)	29.0	28.8	27.6	26.7
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	47.3	49.3	49.4	49.6
Plummeting Dollar (Jan 1986 - Aug 1987)	50.8	50.3	47.1	44.5
Volcker Recovery (Aug 1982 - Apr 1983)	29.5	31.5	29.1	27.6
Bretton Wood Recovery (Oct 1974 - Jun 1975)	26.6	28.6	26.5	25.1

# Historical Stress Tests & Scenario Risk Analysis

- With negative single shocks to the portfolio, the Long-Term Policy is modeled to perform better than the current policy given our asset allocation

Single Factor (Negative) Shocks	Current Policy (%)	Interim A (%)	Interim B (%)	Long-Term Policy (%)
10-year Treasury Bond rates rise 100 bps	3.8	4.4	4.2	4.0
10-year Treasury Bond rates rise 200 bps	-1.0	-0.4	-0.7	-0.9
10-year Treasury Bond rates rise 300 bps	-3.0	-2.2	-2.6	-2.9
Baa Spreads widen by 50 bps, High Yield by 200 bps	0.7	0.4	0.5	0.5
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-20.0	-21.0	-19.8	-19.1
Trade Weighted Dollar gains 10%	-3.5	-3.2	-3.2	-3.1
Trade Weighted Dollar gains 20%	-2.0	-1.1	-1.2	-1.3
U.S. Equities decline 10%	-5.3	-6.1	-5.9	-5.7
U.S. Equities decline 25%	-16.1	-17.2	-16.5	-16.0
U.S. Equities decline 40%	-25.0	-26.2	-24.8	-23.9
Inflation slightly higher than expected	-0.5	-0.5	-0.5	-0.4
Inflation meaningfully higher than expected	-5.1	-5.4	-4.9	-4.6
Low Growth and Low Inflation	-6.4	-6.0	-5.4	-5.0
Low Growth and High Inflation	-10.1	-9.4	-8.4	-7.7
Brief, moderate inflation spike	-2.9	-2.6	-2.4	-2.2
Extended, moderate inflation spike	-5.3	-5.2	-4.8	-4.6
Brief, extreme inflation spike	-6.7	-6.7	-6.3	-6.0
Extended, extreme inflation spike	-8.9	-9.2	-8.7	-8.3

Source: PFM, Meketa

# Historical Stress Tests & Scenario Risk Analysis

- With positive single shocks to the portfolio, the Long-Term Policy experiences lower upside than Current Policy primarily due to the reduced allocation to equities

Single Factor (Positive) Shocks	Current Policy (%)	Interim A (%)	Interim B (%)	Proposed LT Policy (%)
10-year Treasury Bond rates drop 100 bps	2.1	2.0	1.9	1.9
10-year Treasury Bond rates drop 200 bps	10.0	9.9	9.2	8.7
Baa Spreads narrow by 30bps, High Yield by 100 bps	7.0	7.6	7.5	7.4
Baa Spreads narrow by 100bps, High Yield by 300 bps	12.5	12.3	11.4	10.8
Trade Weighted Dollar drops 10%	7.4	7.1	6.7	6.5
Trade Weighted Dollar drops 20%	20.9	20.7	19.8	19.1
U.S. Equities rise 10%	6.4	6.9	6.7	6.5
U.S. Equities rise 30%	15.2	16.5	15.4	14.7
High Growth and Low Inflation	9.4	9.5	8.8	8.4
High Growth and Moderate Inflation	7.0	7.4	7.0	6.7
High Growth and High Inflation	4.4	5.0	4.8	4.7

Source: PFM, Meketa



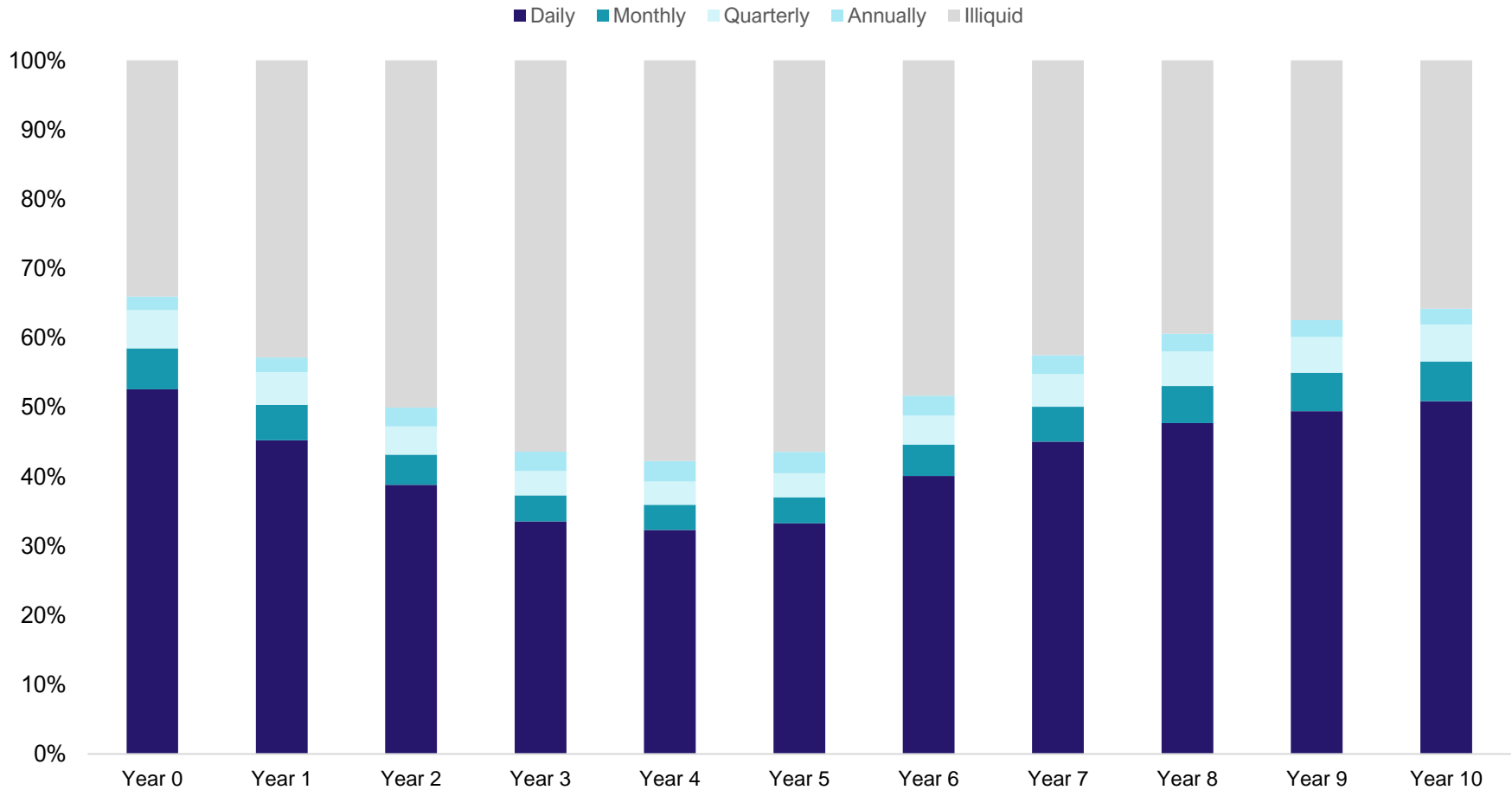
# Meketa Liquidity Stress Test

- Meketa conducted an extreme liquidity stress test using Teachers Employee Retirement Fund (TERF) to analyze the Plan's liquidity using the Proposed Long-Term Policy Allocation
- Specifically, Meketa evaluated whether TERF could:
  - Continue to meet its benefit obligations and expenses (i.e., net outflows),
  - Continue to meet its obligations to fund commitments to private market managers, while staying within its target allocation ranges,
- And at what cost (i.e., to what extent would it be forced to sell stressed or distressed assets)?

## Liquidity Stress Test Design

- The scenario is designed to be extreme
- In Years 1 through 3, we use the returns produced by each asset class in the 4<sup>th</sup> quarter of 2007, 2008, and 1<sup>st</sup> quarter of 2009, respectively. In years 4 – 10, we assume the returns for our 2022 CMAAs for each asset class
- We assume net outflows (projected by the actuary) of \$566.2M in Year 1, growing to \$949.1M in Year 10.
- We assume that contribution and distribution rates for private markets will be consistent with those experienced during and after the GFC (i.e., Year 1 rates match those experienced in 2007, Year 2 rates match 2008, etc.)
- We assume no rebalancing of private markets (or hedge funds) in Years 1 through 5, and up to 10% of private markets value can be bought/sold per year in Years 6 through 10
- We assume the TERF plan would rebalance toward its policy targets each year

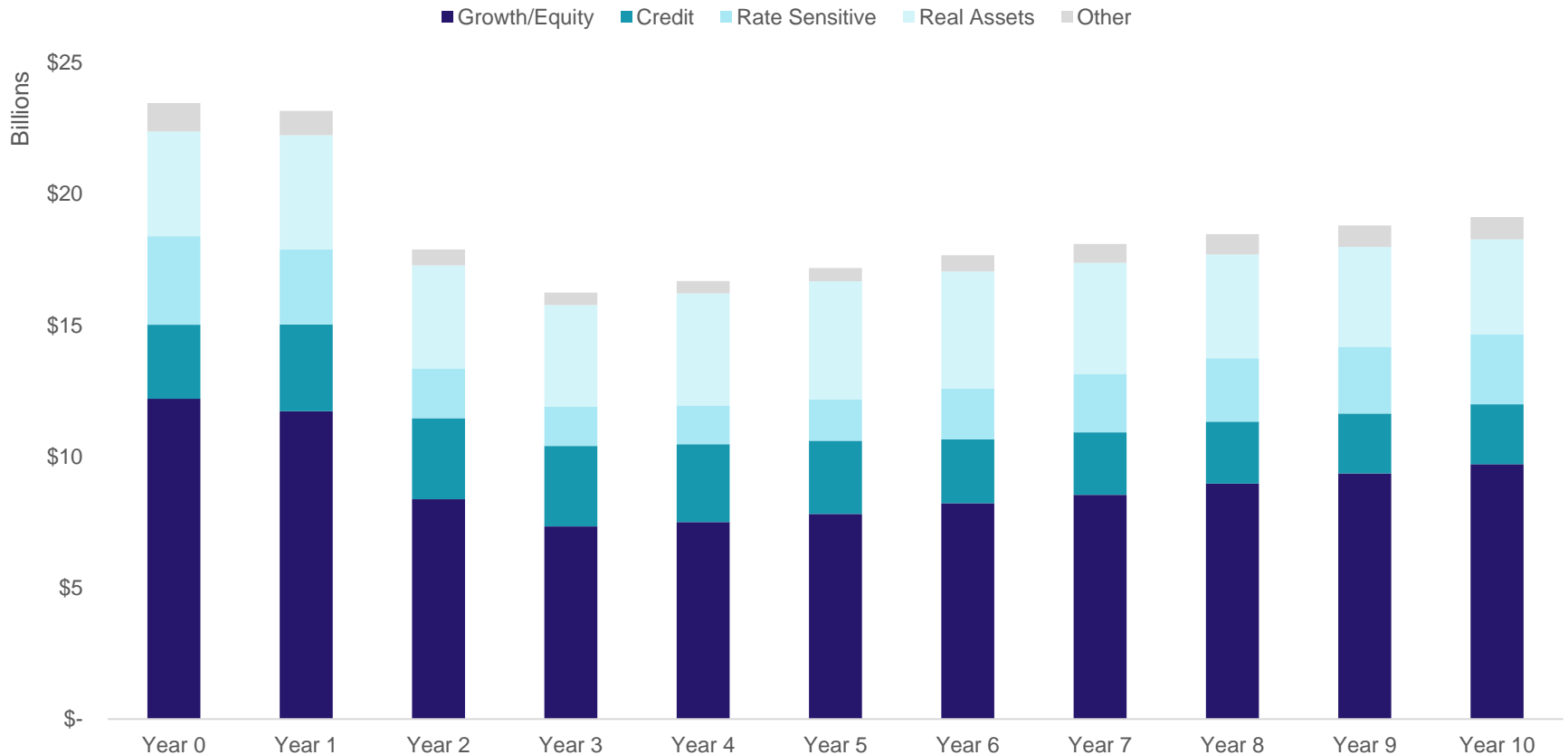
# Meketa Liquidity Stress Test: Liquidity Profile



Source: Meketa

- At the trough, the portfolio would have 32% in daily liquid vehicles

# Meketa Liquidity Stress Test: Market Value and Asset Allocation



Source: Meketa

- The size of the plan’s investment portfolio would shrink and only modestly recover, given the return projections and current cash flow projections.
- Still, there would be ample liquid assets to meet obligations.

# Meketa Liquidity Stress Test: Summary

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Ending Market Value (\$mm)</b>	23,471.0	23,165.8	17,891.4	16,250.1	16,683.9	17,180.6	17,665.7	18,094.8	18,471.0	18,806.4	19,125.1
<b>Net flows (\$mm)</b>		-566.2	-496.5	-693.7	-750.7	-729.7	-775.0	-821.1	-868.6	-918.2	-949.1
<b>Net Flows as % of Market Value</b>		-2.4%	-2.1%	-3.9%	-4.6%	-4.4%	-4.5%	-4.6%	-4.8%	-5.0%	-5.0%
<b>Net Flows from Private Mkts (\$mm)</b>		1,939.3	1,015.2	627.1	-288.1	-783.4	-1,076.7	-928.9	-923.2	-651.3	-993.1
<b>Net Liquidity Needs (\$mm)</b>		-2,505.5	-1,511.7	-1,320.8	-462.6	53.7	301.7	107.8	54.6	-266.9	44.0
<b>Assets Sold in duress (\$mm)</b>		0.0	-738.2	-900.7	-640.7	-816.6	-494.0	-506.3	-533.7	-559.5	-584.6
<b>% of Outflows sold in duress</b>	0%	0%	48.8%	68.2%	61.7%	54.0%	26.7%	28.9%	29.8%	35.6%	30.1%
<b>% of Assets sold in duress</b>	0%	0%	3.2%	5.0%	3.9%	4.9%	2.9%	2.9%	2.9%	3.0%	3.1%
<b>Remaining liquid MV (\$mm)</b>	15,481.5	12,756.3	8,448.6	6,628.4	6,558.2	6,955.7	8,618.5	9,913.8	10,724.1	11,311.7	11,839.6
<b>Total Illiquid Assets (\$mm)</b>	7,989.5	10,409.5	9,442.9	9,621.7	10,125.7	10,224.8	9,047.2	8,181.1	7,746.9	7,494.7	7,285.5
<b>% of Illiquid Assets</b>	34.0%	44.9%	52.8%	59.2%	60.7%	59.5%	51.2%	45.2%	41.9%	39.9%	38.1%
<b>Portfolio Return</b>	0%	1.1%	-20.6%	-5.3%	7.3%	7.4%	7.3%	7.1%	6.9%	6.8%	6.7%

Source: Meketa

- **Even under this extreme scenario, the Plan would maintain sufficient liquidity to meet its obligations**
- The Plan would have to sell some assets that have decreased in value by more than 10% in order to meet its obligations (assuming it is rebalancing to target allocations)

# Conclusions to the IAC on the Strategic Asset Allocation

- **This 2022 SAA Update recommends the IAC approve the adoption of the Proposed Long-Term Policy Allocation designed to achieve a projected beta return of 7.3% net of fees**
- PFM staff expects that the CRPTF will be able to exceed the 6.9% actuarial return assumption in the long-term with the current allocation inclusive of alpha estimates
- Implementation of interim policy allocations (A & B) will minimize the delta in performance and better manage the pacing to private market assets toward the Long-Term Policy Allocation
- Proposed changes to the asset class composition, refinement of our asset class benchmarks will increase the likelihood that PFM to be able to implement the proposed policy asset allocation
- Staffing remains a significant challenge in meeting the Long-Term Asset Allocation

# Appendix

# Capital Markets Expectations – Peer Survey

- Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.<sup>1</sup>
- The Horizon survey is a useful tool to determine whether a consultant's expectations for returns (and risk) are reasonable.

Asset Class	10-Year Average (%)	Meketa 10-Year (%)	20-Year Average (%)	Meketa 20-Year (%)
Cash Equivalents	1.2	0.7	1.9	1.1
TIPS	1.6	1.2	2.4	1.8
US Core Bonds	2.1	1.2	3.2	1.8
US High Yield Bonds	3.8	3.3	5.0	4.2
Emerging Market Debt	4.2	3.9	5.3	3.8
Private Debt	6.5	6.6	6.9	6.8
US Equity (large cap)	5.8	5.2	6.7	6.8
Developed Non-US Equity	6.4	6.7	7.1	7.1
Emerging Non-US Equity	7.2	7.5	7.8	8.1
Private Equity	8.8	8.0	9.6	9.1
Real Estate	5.5	6.5	6.2	6.9
Infrastructure	6.2	7.1	6.8	7.0
Commodities	3.1	3.4	4.0	3.7
Hedge Funds	4.5	3.4	5.3	4.3
Inflation	2.1	2.3	2.2	2.1

<sup>1</sup> The 10-year horizon included all 39 respondents, and the 20-year horizon included 24 respondents. Figures based on Meketa's 2021 CMEs.

# Meketa Risk Analysis Methodology

- The historical scenario analysis and stress tests are designed to show how the various portfolios would perform in different market environments
- The historical scenario analysis uses actual benchmark performance during these periods and weights it by the different policy weights. In periods where the ideal benchmark was not yet available, we used the next closest benchmark as a proxy
- The stress test models each portfolio's performance under hypothetical scenarios based on various factors. It assumes that assets not directly exposed to the factor are affected, nonetheless
- The scenarios for each asset class are arrived at in two parts:
  - First, looking at each asset class returns during which that scenario has been experienced
  - Secondly, identify the relationship through the time each asset has with the underlying scenario returns
- We then take a weighted average of these two components to estimate each asset's outcome in the various scenarios



# Risk Mitigating Strategies - Overview

## 1. Designed to mitigate large total portfolio risks

- Most often Growth Risk (most portfolios' largest risk)
- Provide significant positive returns during a Growth Risk crisis
- Maintain a very low correlation to Growth Risk on average

## 2. Practical implementation

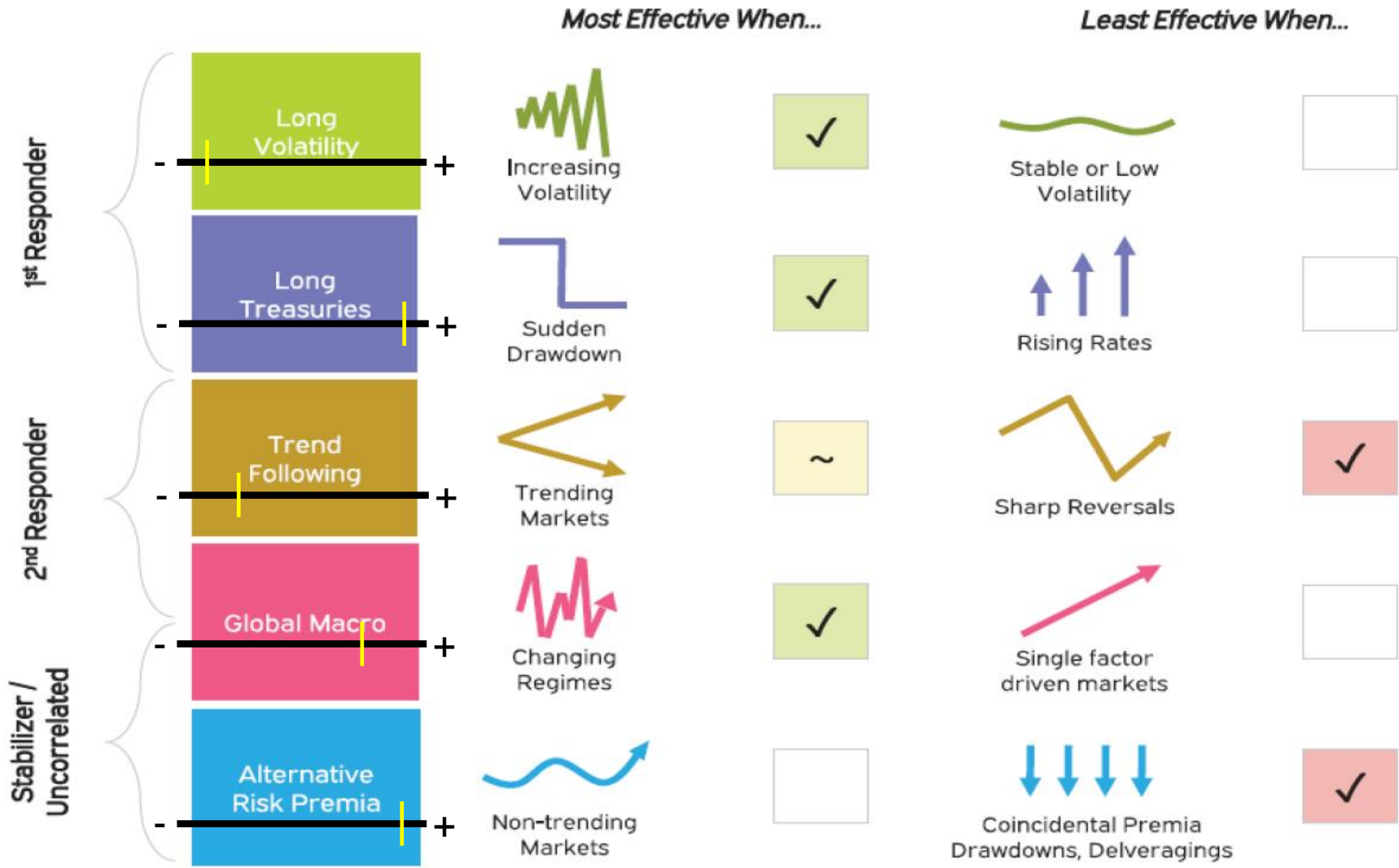
- Desire positive returns when equities decline substantially
- Positive expected standalone return to risk
- Provide meaningful diversification / impact

## 3. Potential Components

<b>Risk Mitigating Strategies Composite</b>	<b>Weight (%)</b>
Long-term Government Bonds	8
Global Macro	21
CTA (Trend Following)	19
Long Puts	42
Alternative Risk Premia (ARP)	10
<b>Total</b>	<b>100</b>

Source: PFM, Meketa

# Risk Mitigating Strategies – Market Analysis



Source: Meketa

“Est. Carry Spectrum” → - ————— +