Meeting Agenda
NOTICE AND AGENDA OF A PUBLIC MEETING
OF THE ARIZONA STATE RETIREMENT SYSTEM
INVESTMENT COMMITTEE

August 29, 2022
1:30 p.m.

Pursuant to A.R.S. § 38-431.02(F), notice is hereby given to the Trustees of the Arizona State Retirement System (ASRS) Investment Committee (IC) and to the general public that the ASRS IC will hold a meeting open to the public on Monday, August 29, 2022, beginning at 1:30 p.m., in the First Floor Board Room of the ASRS offices at 3300 N. Central Avenue, Phoenix, Arizona 85012.

The meeting will be livestreamed on the ASRS YouTube Channel: https://www.youtube.com/c/AzasrsGov.

This is a regularly scheduled meeting of the Investment Committee; however, due to possible attendance by other ASRS Board Trustees, this meeting may technically become a meeting of the Board or one of its committees. Actions taken will be consistent with Investment Committee governance procedures. Actions requiring Board authority will be presented to the full Board for final decision.

Pursuant to A.R.S. § 38-431.03(A)(3), the ASRS Investment Committee may vote to go into executive session, which will not be open to the public, for the purpose of obtaining legal advice on any item on the Agenda.

The Chair may take public comment during any agenda item.

The following agenda topics are proposed action items: 2, 6, 7, 8

The Agenda for the meeting is as follows:

1. Call to Order; Roll Call; Opening Remarks (Estimated time: 2 minutes) ...........Mr. Michael Lofton
   Chair, Investment Committee

2. Approval of the Minutes of the May 23, 2022, Public Meeting of the ASRS Investment Committee
   (Action item; estimated time 1 minute) .................................................................Mr. Michael Lofton

   Proposed Action Item: The Committee may decide whether to amend and approve the minutes, approve the minutes as written, or not approve the minutes at this time.
3. Presentation, Discussion, and Appropriate Action Regarding the Investment Market Environment and Outlook, ASRS Investment Management Division House Views, and Investment Allocations:  
(Informational and discussion item; estimated time 30 minutes)

……………………………….…………………………………………………………….Mr. Paul Matson  
Director  
……………………………….…………………………………………………………………………………………Mr. Michael Viteri  
Chief Investment Officer (CIO)  
……………………………………………………………………………………………...Mr. Chris Levell  
Partner, NEPC  
…………………………………………………………………………………………Mr. Samer Ghaddar  
Deputy CIO  
…………………………………………………………………………………………Mr. Al Alaimo  
Deputy CIO  
………………………………………………………………………………………Mr. Micheal Copeland  
Private Markets Portfolio Manager

Objective:
The General Investment Consultant, NEPC, will discuss the current economic and investment environment. The Director, Chief Investment Officer, and ASRS Investment Division staff will present the investment house views and investment allocations. No action is expected on this item. The Investment Committee or its members may decide to express views or offer guidance on the matters discussed, or make motions.

4. Presentation, Discussion, and Appropriate Action Regarding the Independent Reporting, Monitoring and Oversight (Informational and discussion item; estimated time 20 minutes)

……………………………………………………………………………………………...Mr. Chris Levell  
…………………………………………………………………………………......Mr. Michael Malchenko  
Sr. Analyst, NEPC

Objective:
The General Investment Consultant, NEPC, will present total fund performance results for the periods ending June 30, 2022, and will report on their monitoring of Investment Management Division activities. No action is expected on this item. The Investment Committee or its members may decide to express views or offer guidance on the matters discussed, or make motions.

5. Presentation, Discussion, and Appropriate Action Regarding Investment Compliance  
(Informational and discussion item; estimated time 5 minutes).........................Mr. Robert Butler  
Investment Risk and Compliance Officer

Objective:
The Investment Risk and Compliance Officer will report on compliance activities. No action is expected on this item. The Investment Committee or its members may decide to express views or offer guidance on the matters discussed, or make motions.

6. Presentation, Discussion, and Appropriate Action Regarding the Current Asset Liability Study  
(Action Item; estimated time 60 minutes).............................................................. Mr. Paul Matson  
……………………………………………………………………………………………Mr. Michael Viteri  
…………………………………………………………………………………………Mr. Chris Levell

Your money. Your future. Secure for your lifetime.
Objective:
The Director, Chief Investment Officer, and General Investment Consultant (NEPC) will report on the current asset liability study. The Director and CIO will provide a portfolio mix recommendation. NEPC will also provide insight into the various allocations.

Proposed Action Item: The Committee may move to recommend to the Board the staff recommendation, provide an alternate motion, or make no motion. If there is a motion, it will be referred to the full Board for final action.

7. Presentation, Discussion, and Appropriate Action Regarding Updates to the Strategic Investment Policies (Action Item; estimated time 20 minutes).................................Mr. Paul Matson
..........................................................................................................................Mr. Michael Viteri

Objective:
The Director and Chief Investment Officer, will provide a background and recommendation for approval of Strategic Investment Policy updates for SIP002 and SIP006. The Investment Committee or its members may decide to express views or offer guidance on the matters discussed, or make motions.

Proposed Action Item: The Committee may move to recommend to the Board the staff recommendation, provide an alternate motion, or make no motion. If there is a motion, it will be referred to the full Board for final action.

8. Presentation, Discussion, and Appropriate Action Regarding the Incentive Compensation Plan (ICP) for Internal Investment Professionals (Action Item; estimated time 30 minutes)
..........................................................................................................................Mr. Paul Matson
..........................................................................................................................Mr. Michael Viteri

Objective:
The Director and Chief Investment Officer, will provide a background and recommendation for approval of an amended Incentive Compensation Plan.

Proposed Action Item: The Committee may move to recommend to the Board the staff recommendation, provide an alternate motion, or make no motion. If there is a motion, it will be referred to the full Board for final action.

9. Request for Future Agenda Items (Discussion item; estimated time 5 minutes)…Mr. Michael Lofton
..........................................................................................................................

10. Call to the Public ......................................................................................................Mr. Michael Lofton

If any member of the public wishes to speak, they should complete a Request to Speak Form and provide it to the Committee Administrator, if attending in person. If not attending in person, public comments must be submitted any time prior to the meeting to ASRSPublicMeetings@azasrs.gov. Commenters should submit by email their full name, affiliation (if none, indicate "member of the public"), address, phone number, email address, the specific agenda item they wish to comment on, and their comments. Emailed comments will be read and kept to under three minutes. The
Chair reserves the right to impose other constraints in the interest of maintaining an orderly meeting. Trustees are prohibited by A.R.S. § 38-431.01(H) from discussing or taking legal action on matters raised during an open Call to the Public unless the matters are properly noticed for discussion and legal action. As a result of public comment, the Trustees may respond to criticism made by those who have addressed the Committee, may direct staff to review a matter, or may ask that a matter be put on a future agenda.

11. The next ASRS Investment Committee Meeting is scheduled for November 28, 2022 at 1:30 p.m.

12. Adjournment of the ASRS Investment Committee Meeting.

A copy of the Agenda's background materials provided to Investment Committee Trustees (with the exception of material relating to possible executive sessions) is available for public inspection at the ASRS offices located at 3300 North Central Avenue, 14th Floor, Phoenix, Arizona. The agenda is subject to revision up to 24 hours prior to the meeting. These materials are also available on the ASRS website https://www.azasrs.gov/content/board-and-committee-meetings approximately 48 hours prior to the meeting.

Persons with disabilities may request alternate formats of this document by contacting Tracy Darmer, ADA Coordinator at (602) 240-5378 in Phoenix or 1-800-621-3778, ext. 5378 outside metro Phoenix. Requests should be made as early as possible to allow time to arrange the accommodations.

Dated August 22, 2022

ARIZONA STATE RETIREMENT SYSTEM

Signature on File
Bridget French
Committee Administrator

Signature on File
Michael Viteri
Chief Investment Officer
Agenda Item #2
MINUTES OF A PUBLIC MEETING
OF THE ARIZONA STATE RETIREMENT SYSTEM
INVESTMENT COMMITTEE

Monday, May 23, 2022
1:30 p.m. Arizona Time

A quorum of the Investment Committee (IC) of the Arizona State Retirement System (ASRS) met in public session in person, in the First Floor Board Room of the ASRS Office, 3300 N. Central Avenue, Phoenix, Arizona 85012.

Mr. Mike Lofton, Chair of the Investment Committee, called the meeting to order at 1:31 p.m.

1. Call to Order; Roll Call; Opening Remarks

Present: Mr. Mike Lofton, Chair
Mr. Kevin McCarthy, Vice Chair – virtual
Ms. Diane Landis
Mr. Jim Mueller – virtual

A quorum of the IC was present to conduct business.

Ms. Bridget French, ASRS IC Administrator, provided all attendees with virtual meeting guidelines.

2. Approval of the Minutes of February 28, 2022, Public Meeting of the ASRS Investment Committee

Motion: Ms. Diane Landis moved to approve the minutes of the February 28, 2022, Investment Committee meeting. Mr. Jim Mueller seconded the motion.

By a roll call vote of 4 in favor, 0 opposed, 0 abstentions, 0 excused, and 0 vacancies, the motion was approved. The trustee votes were as follows:

Mr. Michael Lofton - approved
Mr. Kevin McCarthy – approved
Ms. Diane Landis – approved
Mr. Jim Mueller – approved

3. Presentation, Discussion, and Appropriate Action Regarding Market Environment and Outlook, ASRS Investment Management Division House Views

Mr. Michael Viteri, ASRS Chief Investment Officer, introduced Mr. Chris Levell, NEPC.
Mr. Levell presented information on the first quarter economic environment, including inflation, selloffs in equities, commodities, unemployment, and higher interest rates. At the end of last year, the market was robust, but it is difficult in 2022 across the capital markets to find anything positive. It is a challenging economic environment, but the ASRS asset allocation is resilient. Mr. Levell discussed key market themes, including economic crossroads that have changed from neutral to prevalent.

Ms. Diane Landis, Trustee, asked how much of the unemployment rates are people not looking for work. Mr. Levell responded there are fewer people in the workforce than three years ago, and ideally, rising wages will increase the workforce.

Mr. Levell discussed historical inflation rates throughout the world and their differences.

Mr. Viteri and Mr. Levell discussed the co-movement of asset classes and cross-quarter opportunities attributed to the pandemic and the future expectation. Mr. Levell explained that more internal infrastructure is needed to better the economy. All countries are looking at their supply chain issues and reevaluating their local industry. Globalization should slow down as a result of the pandemic.

Mr. Samer Ghaddar, Deputy CIO, presented information and materials relating to public equity, performance, and valuations. Both the S&P and World Index are down over -12%. The 10-year Treasury yield movement has been very volatile, and equities are sensitive to this. The US 10-year treasury yields are at the highest in 12 months, and the US markets across segments of the market witnessed negative performance year-to-date. As of March 31, 2022, we had $21.16 billion invested in the Public Equity asset class, representing a 41.3% allocation within the Total Fund. The ASRS is at equal weight as of March 31, 2022, to its benchmark index: MSCI ACWI IMI.

Ms. Landis asked for clarification on the 10-year treasury yields regarding rate increases, the market drop, and the long-term shift out of equities. Mr. Ghaddar responded that this increase should not increase movement out of equities into other asset classes as this is a short-term event and just affecting valuations.

Mr. Ghaddar continued his presentation with international developed markets and emerging markets valuations.

Mr. Ghaddar presented information and materials relating to private equity market conditions, performance, and valuations. Total private equity uncalled capital is at an all-time high, and the first quarter witnessed a drop in the number of deals compared to Q4 2022 and should continue throughout the year. As of April 30, 2022, the ASRS had $6.06 billion invested in the Private Equity asset class representing a 12.2% allocation. The ASRS Private Equity team is very selective in making commitments at this time.

Mr. Viteri began his presentation on behalf of Mr. Al Alaimo, Deputy CIO, regarding the credit asset class information and materials. As of April 29, 2022, the ASRS had $11.2 billion invested in the credit asset class representing a 22.7% allocation versus a Strategic Asset Allocation (SAA) target of 20.0%. The goal of the credit portfolio is to maintain a well-diversified portfolio and general low double-digit returns over a multi-year period. The ASRS is overweight to the asset class.
Private debt represents 70% of the overall credit portfolio. The ASRS believes Private Debt asset offers the most attractive opportunity in the fixed income markets, with double-digit expected returns available for investors.

Ms. Landis asked for clarification regarding tradable credit markets with lower volatility and whether private debt offers significantly higher returns with lower volatility. Mr. Viteri and Mr. Matson responded that the ASRS fund-of-one accounts allow better economic terms with lower volatility. The private debt market has lower volatility than the public market and significantly higher rates of return.

Mr. Viteri presented information and materials regarding Distressed Debt, representing over 18% of our total portfolio. The distressed debt, such as pools of non-performing loans sold primarily by European banks, will likely provide investment opportunities over time as banks will need to shed defaulted loans stemming from the economic impact of the pandemic.

Mr. Viteri presented information and materials regarding Other Credit, representing over 16% of the total credit portfolio. Other credit strategies include partnerships that invest in the niche, private market opportunities, including life settlements, risk-sharing transactions, equipment leasing, litigation finance, and infrastructure collateralized loan obligations.

Mr. Viteri presented information and materials regarding Interest Rate Sensitive assets. As of April 29, 2022, we are underweight in the Interest Rate Sensitive Fixed Income with an allocation of 6.9% versus a 10.4% Interim SAA target. The index's yield has historically been a good indicator of long-term expected returns of the asset class.

Mr. Micheal Copeland, Private Markets Portfolio Manager, presented information and materials regarding the Real Estate Investment Portfolio. Mr. Copeland discussed inflation and its effect on real estate. Negative changes since last quarter include increased construction costs, issues with labor availability, and office utilization. Positives include industrial demand staying strong and needing more space. Home affordability is an issue and increases the demand for rental properties.

Ms. Landis and Mr. Copeland discussed the report of grocery-anchored centers and that favorable leasing and sales are being seen post-pandemic in these centers.

Mr. Copeland presented materials and information about different property markets and their outlooks: multifamily, office, retail, industrial, and hotel. The ASRS is selling its student housing and storage portfolio and selective retail.

Mr. Lofton asked for the rationale for selling off student housing assets. Mr. Copeland responded that there had been a decrease in college enrollment, and online classes are replacing in-person courses. The properties in question were further off-campus with fewer amenities. Mr. Jim Mueller, a Trustee, commented that high school graduation classes continue to decline significantly, and colleges expect lower enrollment and increased competition for students. Mr. Viteri and Mr. Copeland explained that the ASRS internally manages this asset, and they are selling the best assets in this portfolio.

Mr. Viteri commented that the total performance summary for the period ending 4/30/2022 has a total fund valuation of $49,552.61 billion with strong 3- and 5-year inception to date numbers. Since the last meeting, Ms. Landis commended the ASRS staff for a job well done to increase
fund valuation. Mr. Matson responded that the ASRS portfolio numbers are because of the developed structure of the seven market accounts, and the ASRS is underweight in the asset classes that have fallen the most. Discussion occurred with Mr. Levell and Mr. Allan Martin, NEPC, about other pension funds and their fiscal year-to-date returns related to the ASRS. Mr. Martin commended the ASRS on their asset allocation and selection of assets. Mr. Matson briefly explained the idea of smart risk and being patient for a high rate of return.

4. Presentation, Discussion, and Appropriate Action Regarding Independent Reporting, Monitoring, and Oversight

Mr. Martin presented information and materials regarding the independent program oversight for the period ending March 31, 2022. Mr. Martin reported that in the first quarter, the S&P was down 4.7% due to the equity market returns being severely impacted by various factors. The Bloomberg Aggregate, an index for publicly traded bonds, was down by 5.9%. Mr. Martin noted that for the same period, a typical 60/40 portfolio was down over 5%, but thanks to the Fund’s positioning, the ASRS was only down by 1.6% for the quarter, which in this environment, the ASRS fared much better than its peers.

Mr. Martin explained the seven strategic plan objectives that follow the goal to design, implement and maintain the portfolio that maximizes rates of return for acceptable levels of risk, including the asset allocation study and strategic asset allocation benchmarks. The ASRS structure of the portfolio has consistently added approximately 1% per year. Mr. Matson referenced the asset allocation study and the goal to increase performance levels internally and in comparison to their peers. Mr. Martin continued to present his materials on the 1-, 3-, 5-, and 10-year ASRS returns compared to their peers. The ASRS is in the top 10% of its peers. The ASRS has earned higher returns with lower volatility. Across the four major asset classes, the private market asset has significantly outperformed on 1- and 3-year returns in relation to benchmarks.

Mr. Martin presented information and materials regarding independent oversight and compliance. The ASRS is operating the Fund well within the Board-approved targets. The ASRS strategic positioning and manager selections significantly account for their success. Mr. Matson commented that the ASRS also invests the health insurance and LTD monies.

5. Presentation, Discussion, and Appropriate Action Regarding Risk Management

Mr. Robert Butler, Investment Risk & Compliance Officer, presented information and materials on the ASRS risk philosophy, asset class correlation and contribution to volatility, hypothetical stress test scenarios, and public market exposures. The ASRS investment goals include maximizing fund rate of return for acceptable risk levels and mitigating contribution rate volatility. Investment risk is multi-dimensional, and volatility is only one of the risks involved. Mr. Butler explained more about the definition of volatility as risk. Mr. Butler discussed asset class correlation and the diversified portfolio of the ASRS. Mr. Matson commented that there are multiple definitions of risk, including the standard deviation of returns.

Mr. Butler continued his presentation on current and historical asset class market value allocation and total volatility contributions. The ASRS has a much more diversified portfolio than
the typical pension fund portfolio. Mr. Butler provided information about the hypothetical scenarios of the ASRS portfolio during historical world events since 1973.

Mr. Butler briefly presented information about the public market's top 20 global issuers, which are less than 3% of the total ASRS portfolio. The internal and externally managed public investment market is about 50% of the holdings. Blackrock and Legal & General managers are very important with the number of assets they manage.

6. Presentation, Discussion, and Appropriate Action Regarding Investment Compliance

Mr. Butler presented information and materials regarding the internally managed portfolios pre-trade compliance system, the custody bank investment compliance program, and the private markets investment compliance program. There were no exceptions for the period under review for the ASRS internally managed portfolios pre-trade compliance system. Regarding the custody bank investment compliance review, the total ASRS fund investments passed the five mandated statutes on investment limits and the Arizona Restricted Country Test for all periods. RCLCO provides the real estate separate account investment compliance review, and they have completed 21 compliance reviews. They found immaterial inconsistencies, and all findings have been corrected. Meketa Investment Group performed a compliance review of the commingled funds and non-real estate separate accounts investments. They have completed nine compliance reviews, and no material issues were identified, with an additional 30 funds under review.

7. Presentation, Discussion, and Appropriate Action Regarding an Introduction to the Current Asset Liability Study

Mr. Matson began the presentation of the Asset Liability Study with a detailed background of the study, which takes place every three to five years. The study aims to determine whether the portfolio in aggregate is structured at a high level most efficiently. Mr. Matson discussed the terms efficient frontier and the various definitions of risk, including standard deviation, and then discussed the pros and cons of traditional risk metrics versus the ASRS perspective. ASRS focuses on the average long-term contribution rates, the volatility of the contribution rates, actuarial funded status, and the unsmoothed financial funded status. The ASRS is looking to optimize the long-term average rate of return to maximize the portfolio value. The ASRS and NEPC have constructed ten possible portfolio structures for the Board to review. The study includes the most significant asset classes but does not include smaller asset classes or asset classes that have very low returns and modest diversification value.

Mr. Levell discussed that asset allocation is the essential critical investment decision to determine portfolio performance. The policy targets, policy ranges, and benchmarks will be reviewed as part of the asset allocation. The ASRS portfolio is already very diversified, and the current asset allocation is favorable, and any changes would only slightly change the portfolio value. Mr. Levell explained in detail the process of valuing the asset class assumptions.

Ms. Landis asked if the asset allocation process is model-driven or includes human input. Mr. Levell responded that there is both model and human input throughout their asset allocation team.
The NEPC beta capital market assumptions of return and risk expectations were reviewed regarding 10 and 20-year forward-looking assumptions. Mr. Levell discussed the capital market assumptions for the ten possible portfolio structures and the returns in a 10- and 20-year cycle, including volatility. Mr. Matson explained that the ASRS asset class and investment strategy input is essential to the development of the asset mix. Mr. Matson invited Committee members to participate in this analysis by offering any input or recommendations. Mr. Matson discussed the definition and comparison of NEPC and ASRS capital market expectations and the ASRS portfolio construction theory.

Mr. Mueller, Mr. Matson, Mr. Martin, Mr. Viteri, and Mr. Lofton discussed capital market assumptions and the various analysis.

8. Request for Future Agenda Items

No requests for future agenda items were made.

9. Call to the Public

No members of the public requested to speak.

10. The next scheduled ASRS Investment Committee Meeting is scheduled for August 29, 2022 at 1:30 p.m.

Mr. Lofton noted the next scheduled IC meeting is scheduled for August 29, 2022, at 1:30 p.m.

11. Adjournment of the ASRS IC Meeting.

Mr. Lofton adjourned the meeting at 4:09 p.m.

Respectfully submitted by:

Bridget French
Investment Committee Administrator
ARIZONA STATE RETIREMENT SYSTEM
Agenda Item #3
ASRS Investment Program Update
Investment Committee Meeting
August 29, 2022
Agenda

#3 -Market Environment & Outlook: NEPC
  -Staff House Views:
    Public Equity & Private Equity – Samer Ghaddar, Deputy CIO
    Private Credit & Interest Rate Sensitive – Al Alaimo, Deputy CIO
    Real Estate – Micheal Copeland, Private Markets Portfolio Manager
    Preliminary Fund Performance period ending 7/29/22 – Michael Viteri, CIO

#4 -Independent Investment Program Oversight – NEPC

#5 -IMD Compliance Report – Robert Butler (Investment Risk and Compliance Officer)

#6 -Current Asset Liability Study (Paul Matson Director, Michael Viteri CIO, NEPC)

#7 -Strategic Investment Policy Updates (Paul Matson-Director, Michael Viteri-CIO)

#8 -Incentive Compensation Plan Amendments (Paul Matson-Director, Michael Viteri - CIO)
MARKET ENVIRONMENT

JUNE 30, 2022
Q2 Real GDP (advance estimate) decreased at an annual rate of -0.9%.
- Retail sales ended May at +6.9% on a YoY basis. In the same period last year the YoY growth rate was +24.5%.
- Corporate profits as a percent of GDP ended January 2022 at 11.2%, up from 10.7% in the same period last year and remain elevated relative to historical levels.
- The inventory-to-sales ratio ended May was 1.3. Levels have remained relatively constant since early 2010 with a spike to 1.7 in April 2020.
- The U.S. trade deficit narrowed in Q2, but remains elevated.

The unemployment rate was 3.6% in Q2, flat when compared to Q1; U-6, a broader measure of unemployment, decreased to 6.7% in Q2 from 6.9% in Q1.
- The labor force participation rate ended Q2 at 62.2% down from 62.4% Q1 after declining to 60.2% in April 2020 and is at levels below the 10 year pre-pandemic average of 63.0%.

The Case-Shiller Home Price Index (ended May) increased to 305.98 up from 294.72 (in March) and remains at levels higher than that of pre-financial crisis levels of 150.9.

Rolling 12-month seasonally-adjusted CPI printed ended Q2 at 9.01% up from 8.67% in Q1. In the same period last year, it was 5.44%; Capacity Utilization increased to 80% in Q2 up from 78.3% in Q1.

Fed Funds rate was increased by 1.25% to a targeted range of 1.50%-to-1.75% up from 0.25%-to-0.50%. The 10-year Treasury Yield (constant maturity) finished Q2 at 3.1% up from 2.1% in Q1.
- At its meeting on July 26 – July 27, 2022 the Fed increased the Fed Funds rate 0.75% to a targeted rate of 2.25%-to-2.50%

The Fed continues scaling back asset purchases. The Fed’s balance sheet is beginning to shrink after a period of rapid growth post-pandemic.

S&P valuations decreased in Q2 to 29.3 from 34.3 in Q1 and remain higher than the 10-year average of 28.6x.
- Cyclically adjusted Shiller PE ratio remains above the long-term average of 16.95x.
## MARKET ENVIRONMENT

### Q2 2022 OVERVIEW

- **As of 3/31/2022**

### World Equity Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSCI ACWI IMI (Net)</td>
<td>-15.83%</td>
<td>-16.52%</td>
<td>5.98%</td>
<td>6.79%</td>
<td>8.71%</td>
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<tr>
<td>MSCI ACWI Net (USD)</td>
<td>-15.86%</td>
<td>-15.79%</td>
<td>8.21%</td>
<td>7.06%</td>
<td>8.76%</td>
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<tr>
<td>MSCI ACWI (Local)</td>
<td>-13.64%</td>
<td>-12.37%</td>
<td>7.41%</td>
<td>7.68%</td>
<td>10.05%</td>
</tr>
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### Domestic Equity Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell 3000</td>
<td>-16.70%</td>
<td>-13.87%</td>
<td>9.77%</td>
<td>10.66%</td>
<td>12.57%</td>
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<tr>
<td>S&amp;P 500</td>
<td>-16.10%</td>
<td>-19.62%</td>
<td>10.60%</td>
<td>11.31%</td>
<td>12.96%</td>
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<tr>
<td>Russell 1000</td>
<td>-18.67%</td>
<td>-19.04%</td>
<td>15.17%</td>
<td>11.09%</td>
<td>12.82%</td>
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<tr>
<td>Russell 1000 Growth</td>
<td>-20.92%</td>
<td>-18.77%</td>
<td>12.58%</td>
<td>14.29%</td>
<td>14.80%</td>
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<tr>
<td>Russell 1000 Value</td>
<td>-12.21%</td>
<td>-6.82%</td>
<td>8.67%</td>
<td>7.17%</td>
<td>10.50%</td>
</tr>
<tr>
<td>Russell 2000</td>
<td>-17.29%</td>
<td>-25.20%</td>
<td>4.21%</td>
<td>5.17%</td>
<td>9.30%</td>
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<tr>
<td>Russell 2000 Growth</td>
<td>-19.23%</td>
<td>-33.43%</td>
<td>1.40%</td>
<td>4.89%</td>
<td>9.30%</td>
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<tr>
<td>Russell 2000 Value</td>
<td>-15.28%</td>
<td>-18.28%</td>
<td>8.19%</td>
<td>4.89%</td>
<td>9.05%</td>
</tr>
<tr>
<td>NASDAQ Composite</td>
<td>-22.28%</td>
<td>-23.43%</td>
<td>12.18%</td>
<td>13.47%</td>
<td>15.40%</td>
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<td>NASDAQ Biotechnology</td>
<td>-9.76%</td>
<td>-26.57%</td>
<td>3.73%</td>
<td>3.56%</td>
<td>11.22%</td>
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### International Equity Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSCI ACWI Ex USA World ex-US</td>
<td>-13.73%</td>
<td>-19.42%</td>
<td>1.35%</td>
<td>2.59%</td>
<td>4.83%</td>
</tr>
<tr>
<td>MSCI EAFE Net (USD) Int'l Developed</td>
<td>-14.91%</td>
<td>-17.77%</td>
<td>1.07%</td>
<td>2.29%</td>
<td>5.40%</td>
</tr>
<tr>
<td>MSCI EAFE (Local) Int'l Developed (Local Currency)</td>
<td>-7.63%</td>
<td>-6.59%</td>
<td>4.37%</td>
<td>4.27%</td>
<td>8.33%</td>
</tr>
<tr>
<td>Russell 1000 Small Cap</td>
<td>-17.89%</td>
<td>-23.38%</td>
<td>1.32%</td>
<td>1.72%</td>
<td>7.18%</td>
</tr>
<tr>
<td>MSCI Emerging Markets</td>
<td>-11.45%</td>
<td>-25.29%</td>
<td>0.57%</td>
<td>2.18%</td>
<td>3.06%</td>
</tr>
</tbody>
</table>

### Domestic Fixed Income Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barclays US High Yield</td>
<td>-9.83%</td>
<td>-12.82%</td>
<td>0.21%</td>
<td>2.19%</td>
<td>4.47%</td>
</tr>
<tr>
<td>CSFB Levered Loans</td>
<td>-4.35%</td>
<td>-2.68%</td>
<td>2.03%</td>
<td>2.97%</td>
<td>3.90%</td>
</tr>
<tr>
<td>BoA MTL US 3-Month T-Bill</td>
<td>0.11%</td>
<td>0.17%</td>
<td>0.63%</td>
<td>1.11%</td>
<td>0.64%</td>
</tr>
<tr>
<td>Bloomberg US TIPS 1-10 Yr</td>
<td>-3.42%</td>
<td>-2.03%</td>
<td>3.37%</td>
<td>3.24%</td>
<td>1.75%</td>
</tr>
</tbody>
</table>

### Global Fixed Income Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barclays Global Aggregate</td>
<td>-8.26%</td>
<td>-15.29%</td>
<td>-3.22%</td>
<td>-0.56%</td>
<td>0.11%</td>
</tr>
<tr>
<td>FTSE WGBI</td>
<td>-8.91%</td>
<td>-16.77%</td>
<td>-4.28%</td>
<td>-1.17%</td>
<td>-0.69%</td>
</tr>
<tr>
<td>BC Global Credit</td>
<td>-8.20%</td>
<td>-16.66%</td>
<td>-2.60%</td>
<td>-0.61%</td>
<td>1.41%</td>
</tr>
<tr>
<td>JPM GBI-EM (Global. Diversified) Em. Mkt. Bonds (Local Currency)</td>
<td>-8.93%</td>
<td>-19.28%</td>
<td>-5.99%</td>
<td>-2.31%</td>
<td>-1.49%</td>
</tr>
<tr>
<td>JPM EMBI+</td>
<td>-12.46%</td>
<td>-27.11%</td>
<td>-8.66%</td>
<td>-4.02%</td>
<td>0.37%</td>
</tr>
</tbody>
</table>

### Alternative Benchmarks

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>1 Qtr.</th>
<th>1 Yr.</th>
<th>3 Yr.</th>
<th>5 Yr.</th>
<th>10 Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloomberg Commodity Index</td>
<td>-3.96%</td>
<td>24.27%</td>
<td>14.34%</td>
<td>8.49%</td>
<td>-8.02%</td>
</tr>
<tr>
<td>FTSE MONEF Global. Diversified Fund of Hedge Funds</td>
<td>-4.06%</td>
<td>-5.66%</td>
<td>3.98%</td>
<td>-0.59%</td>
<td>3.73%</td>
</tr>
<tr>
<td>Cambridge PE Lagged*</td>
<td>0.76%</td>
<td>27.34%</td>
<td>22.67%</td>
<td>19.33%</td>
<td>15.93%</td>
</tr>
<tr>
<td>FTSE NAREIT All Equity REITs REIT</td>
<td>-14.08%</td>
<td>-5.99%</td>
<td>8.34%</td>
<td>8.53%</td>
<td>8.34%</td>
</tr>
<tr>
<td>CPI + 2%</td>
<td>3.15%</td>
<td>11.16%</td>
<td>7.06%</td>
<td>5.95%</td>
<td>4.64%</td>
</tr>
</tbody>
</table>

* As of 3/31/2022
The S&P 500 had its worst start since 1970

- Large-Cap stocks outperformed Small-Cap, and Value outperformed Growth.
- Global markets continued to broadly decline.

Inflation keeps accelerating

- Headline CPI jumped to 9.1% in June. Core CPI was up 6%.
- The Federal Reserve raised its benchmark interest rate by 75 basis points, the largest hike since 1994.

Headline labor rates indicate recovery

- However, the Labor Force Participation Rate remains below pre-pandemic levels.
- The 3-month moving average of overall wage growth continues to climb.
# Bear Markets Can Be Lengthy

## Length and Depth of S&P 500 Bear Markets

<table>
<thead>
<tr>
<th>Start</th>
<th>End</th>
<th>Length of Bear Market (Months)</th>
<th>Length of Recovery* (Months)</th>
<th>S&amp;P 500 Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/03/2022</td>
<td>?</td>
<td>6*</td>
<td>?</td>
<td>-22%*</td>
</tr>
<tr>
<td>02/19/2020</td>
<td>03/23/2020</td>
<td>1</td>
<td>5</td>
<td>-34%</td>
</tr>
<tr>
<td>10/09/2007</td>
<td>03/09/2009</td>
<td>17</td>
<td>59</td>
<td>-55%</td>
</tr>
<tr>
<td>03/24/2000</td>
<td>10/09/2002</td>
<td>31</td>
<td>80</td>
<td>-47%</td>
</tr>
<tr>
<td>08/25/1987</td>
<td>12/04/1987</td>
<td>3</td>
<td>20</td>
<td>-34%</td>
</tr>
<tr>
<td>11/28/1980</td>
<td>08/12/1982</td>
<td>21</td>
<td>3</td>
<td>-27%</td>
</tr>
<tr>
<td>01/11/1973</td>
<td>10/03/1974</td>
<td>21</td>
<td>69</td>
<td>-48%</td>
</tr>
</tbody>
</table>

Notes: 2022 bear market is ongoing; represents historical bear markets since 1970. *Length of Recovery represents time to recoup losses from the start of the bear market. Sources: S&P, FactSet, NEPC
GLOBAL MARKETS BROADLY DECLINED
QUARTERLY TOTAL RETURNS

Source: MSCI, S&P, Russell, MSCI, Bloomberg, JPM, FactSet
WORST START FOR THE S&P IN OVER 50 YEARS

TOP 10 S&P 500 LOSSES IN FIRST HALF OF THE YEAR

Source: S&P, FactSet
DOLLAR STRENGTH WEIGHED ON NON-US ASSETS

CUMULATIVE CURRENCY RETURN

Source: FactSet
INFLATION CONTINUED TO TREND HIGHER
ANNUAL U.S. CPI-U CHANGES

Source: FactSet
RATE HIKE EXPECTATIONS INCREASED

FEDERAL FUNDS FUTURES

Source: FactSet
INFLATION AND FED FUNDS NEED TO CONVERGE

HISTORICAL RELATIONSHIP BETWEEN FED FUNDS AND INFLATION

Sources: U.S. Department of Labor, Federal Reserve, FactSet
INFLATION
U.S. CONSUMER PRICE INDEX

Source: Bureau of Labor Statistics, FactSet
U.S. UNEMPLOYMENT RATES

Source: FactSet
HISTORICAL INFLATION
IMF PROJECTIONS

Source: IMF, FactSet
CENTRAL BANK POLICY RATES

Source: Federal Reserve, ECB, Bank of Japan, Bank of England, FactSet
CENTRAL BANK BALANCE SHEETS
AS A PERCENTAGE OF GDP

Source: FactSet
## CURRENCIES
### RELATIVE TO THE U.S. DOLLAR

<table>
<thead>
<tr>
<th>Currencies</th>
<th>Spot</th>
<th>1 Month</th>
<th>YTD</th>
<th>1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro</td>
<td>1.05</td>
<td>-2.4%</td>
<td>-8.1%</td>
<td>-11.8%</td>
</tr>
<tr>
<td>British Pound</td>
<td>1.21</td>
<td>-3.6%</td>
<td>-10.3%</td>
<td>-12.1%</td>
</tr>
<tr>
<td>Japanese Yen</td>
<td>135.86</td>
<td>-5.3%</td>
<td>-15.2%</td>
<td>-18.3%</td>
</tr>
<tr>
<td>Swiss Franc</td>
<td>0.96</td>
<td>0.1%</td>
<td>-4.8%</td>
<td>-3.4%</td>
</tr>
<tr>
<td>Australian Dollar</td>
<td>0.69</td>
<td>-4.1%</td>
<td>-5.4%</td>
<td>-8.4%</td>
</tr>
<tr>
<td>New Zealand Dollar</td>
<td>1.61</td>
<td>-4.5%</td>
<td>-9.2%</td>
<td>-11.0%</td>
</tr>
<tr>
<td>Canadian Dollar</td>
<td>1.29</td>
<td>-1.9%</td>
<td>-2.1%</td>
<td>-4.0%</td>
</tr>
<tr>
<td>Chinese Yuan</td>
<td>6.69</td>
<td>-0.6%</td>
<td>-4.8%</td>
<td>-3.5%</td>
</tr>
<tr>
<td>Taiwanese Dollar</td>
<td>29.73</td>
<td>-2.4%</td>
<td>-7.0%</td>
<td>-6.3%</td>
</tr>
<tr>
<td>Korean Won</td>
<td>1298</td>
<td>-4.7%</td>
<td>-8.4%</td>
<td>-13.3%</td>
</tr>
<tr>
<td>Vietnamese Dong</td>
<td>23265</td>
<td>-0.3%</td>
<td>-2.0%</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Thai Baht</td>
<td>35.36</td>
<td>-3.2%</td>
<td>-5.5%</td>
<td>-9.3%</td>
</tr>
<tr>
<td>Philippines Peso</td>
<td>54.99</td>
<td>-4.7%</td>
<td>-7.3%</td>
<td>-11.2%</td>
</tr>
<tr>
<td>Indian Rupee</td>
<td>78.97</td>
<td>-1.7%</td>
<td>-5.9%</td>
<td>-5.9%</td>
</tr>
<tr>
<td>Russian Ruble</td>
<td>54.75</td>
<td>15.1%</td>
<td>37.0%</td>
<td>33.4%</td>
</tr>
<tr>
<td>Mexican Peso</td>
<td>20.18</td>
<td>-2.3%</td>
<td>1.4%</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Brazilian Real</td>
<td>5.23</td>
<td>-9.4%</td>
<td>6.5%</td>
<td>-4.0%</td>
</tr>
<tr>
<td>Chilean Peso</td>
<td>0.03</td>
<td>-9.3%</td>
<td>-1.7%</td>
<td>-12.5%</td>
</tr>
<tr>
<td>Argentine Peso</td>
<td>125.22</td>
<td>-4.0%</td>
<td>-18.0%</td>
<td>-23.6%</td>
</tr>
<tr>
<td>South African Rand</td>
<td>16.38</td>
<td>-4.9%</td>
<td>-2.6%</td>
<td>-12.8%</td>
</tr>
</tbody>
</table>

Source: FactSet
EQUITY INDEX PERFORMANCE

Source: MSCI, S&P, Russell, FactSet
MSCI ACWI IMI WEIGHTS

Source: MSCI, FactSet
EQUITY INDEX PERFORMANCE
TOP 10 COUNTRIES BY MARKET CAP IN MSCI ACWI IMI INDEX

Source: MSCI, FactSet
STYLE INDEX PERFORMANCE

Source: MSCI, Russell, FactSet
<table>
<thead>
<tr>
<th>Sector</th>
<th>Monthly Return</th>
<th>YTD</th>
<th>Trailing 12M Return</th>
<th>Index Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MSCI ACWI IMI</strong></td>
<td>-8.6%</td>
<td>-20.4%</td>
<td>-16.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Communication Services</td>
<td>-7.6%</td>
<td>-26.9%</td>
<td>-30.0%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Consumer Discretionary</td>
<td>-8.1%</td>
<td>-29.4%</td>
<td>-29.5%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>-3.5%</td>
<td>-10.3%</td>
<td>-5.8%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Energy</td>
<td>-14.8%</td>
<td>15.6%</td>
<td>21.9%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Financials</td>
<td>-10.0%</td>
<td>-16.4%</td>
<td>-12.1%</td>
<td>14.4%</td>
</tr>
<tr>
<td>Health Care</td>
<td>-3.0%</td>
<td>-12.8%</td>
<td>-8.7%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Industrials</td>
<td>-8.7%</td>
<td>-21.5%</td>
<td>-18.8%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Information Technology</td>
<td>-10.4%</td>
<td>-29.8%</td>
<td>-21.0%</td>
<td>19.8%</td>
</tr>
<tr>
<td>Materials</td>
<td>-15.0%</td>
<td>-18.1%</td>
<td>-16.5%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>-8.1%</td>
<td>-20.1%</td>
<td>-14.4%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Utilities</td>
<td>-6.5%</td>
<td>-6.0%</td>
<td>2.8%</td>
<td>3.2%</td>
</tr>
<tr>
<td><strong>S&amp;P 500</strong></td>
<td>-8.3%</td>
<td>-20.0%</td>
<td>-10.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Communication Services</td>
<td>-7.7%</td>
<td>-30.2%</td>
<td>-29.1%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Consumer Discretionary</td>
<td>-10.8%</td>
<td>-32.8%</td>
<td>-24.2%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Consumer Staples</td>
<td>-2.5%</td>
<td>-5.6%</td>
<td>6.7%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Energy</td>
<td>-16.8%</td>
<td>31.8%</td>
<td>40.0%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Financials</td>
<td>-10.9%</td>
<td>-18.7%</td>
<td>-12.7%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Health Care</td>
<td>-2.7%</td>
<td>-8.3%</td>
<td>3.4%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Industrials</td>
<td>-7.4%</td>
<td>-16.8%</td>
<td>-13.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Information Technology</td>
<td>-9.3%</td>
<td>-26.9%</td>
<td>-13.6%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Materials</td>
<td>-13.8%</td>
<td>-17.9%</td>
<td>-8.7%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>-6.9%</td>
<td>-20.0%</td>
<td>-5.2%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Utilities</td>
<td>-5.0%</td>
<td>-0.6%</td>
<td>14.3%</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

Source (Top): MSCI, FactSet
Source (Bottom): S&P, FactSet
EQUITY VOLATILITY INDEX (VIX)

Source: CBOE, FactSet
GLOBAL EQUITY VALUATIONS

S&P 500
MSCI EAFE
MSCI EM

Median calculated based on 20-year monthly data
Source: S&P, MSCI, FactSet
SAFE-HAVEN FIXED INCOME PERFORMANCE

Source: Bloomberg, FactSet
## FIXED INCOME CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>Yield to Worst</th>
<th>Spread (bps)</th>
<th>Duration (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloomberg Aggregate</td>
<td>3.72%</td>
<td>55</td>
<td>6.4</td>
</tr>
<tr>
<td>Bloomberg TIPS</td>
<td>3.38%</td>
<td>-</td>
<td>5.1</td>
</tr>
<tr>
<td>Bloomberg Treasury</td>
<td>3.09%</td>
<td>-</td>
<td>6.4</td>
</tr>
<tr>
<td>Bloomberg Agency</td>
<td>3.23%</td>
<td>17</td>
<td>3.6</td>
</tr>
<tr>
<td>Bloomberg MBS</td>
<td>3.77%</td>
<td>46</td>
<td>5.9</td>
</tr>
<tr>
<td>Bloomberg Muni</td>
<td>3.21%</td>
<td>-</td>
<td>6.8</td>
</tr>
<tr>
<td>Bloomberg Corp IG</td>
<td>4.70%</td>
<td>155</td>
<td>7.6</td>
</tr>
<tr>
<td>Bloomberg Long Treasury</td>
<td>3.33%</td>
<td>-</td>
<td>17.2</td>
</tr>
<tr>
<td>Bloomberg Long Credit</td>
<td>5.09%</td>
<td>184</td>
<td>13.4</td>
</tr>
<tr>
<td>Bloomberg Long Gov/Credit</td>
<td>4.30%</td>
<td>101</td>
<td>15.1</td>
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<tr>
<td>Bloomberg STRIPS 20+</td>
<td>3.34%</td>
<td>-</td>
<td>25.4</td>
</tr>
<tr>
<td>Bloomberg Global Agg</td>
<td>2.91%</td>
<td>57</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Source: Bloomberg, FactSet
US TREASURY REAL YIELD CURVE

Notes: *Real yields are calculated based on a weighted average of select off-the-run TIPS yields
Source: NEPC, Bloomberg, FactSet
LONG DURATION CORPORATE SPREADS

Median calculated based on 20-year of monthly data
Source: Bloomberg, FactSet
RETURN-SEEKING CREDIT INDEX PERFORMANCE

Source: Bloomberg, S&P, JPM, FactSet
## RETURN-SEEKING CREDIT CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>Yield to Worst</th>
<th>Spread (bps)</th>
<th>Duration (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bloomberg HY Muni</strong></td>
<td>5.30%</td>
<td>-</td>
<td>10.5</td>
</tr>
<tr>
<td><strong>Bloomberg High-Yield</strong></td>
<td>8.89%</td>
<td>569</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>Bloomberg BB-Rated</strong></td>
<td>7.24%</td>
<td>404</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Bloomberg B-Rated</strong></td>
<td>9.53%</td>
<td>631</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Bloomberg CCC-Rated</strong></td>
<td>13.63%</td>
<td>1043</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>S&amp;P/LSTA Leveraged Loan 100</strong></td>
<td>6.94%</td>
<td>466</td>
<td>-</td>
</tr>
<tr>
<td><strong>Bloomberg Convertible Bond</strong></td>
<td>0.68%</td>
<td>400</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>JPM EMBI Global</strong></td>
<td>8.57%</td>
<td>542</td>
<td>6.9</td>
</tr>
<tr>
<td><strong>JPM GBI - EM</strong></td>
<td>5.21%</td>
<td>-</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: Bloomberg, S&P, JPM, FactSet
CREDIT SPREADS

Median calculated based on 20-year of monthly data
Source: Bloomberg, S&P, JPM, FactSet
REAL ASSETS INDEX PERFORMANCE

Source: Bloomberg, Alerian, NAREIT, S&P, FactSet
### REAL ASSETS INDEX PERFORMANCE

<table>
<thead>
<tr>
<th>Index</th>
<th>1 Month</th>
<th>3 Month</th>
<th>YTD</th>
<th>1 Year</th>
<th>3 Year</th>
<th>5 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloomberg Commodity Index</td>
<td>-10.8%</td>
<td>-5.7%</td>
<td>18.4%</td>
<td>24.2%</td>
<td>14.3%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Bloomberg Sub Agriculture Index</td>
<td>-9.1%</td>
<td>-5.7%</td>
<td>13.0%</td>
<td>18.8%</td>
<td>18.7%</td>
<td>6.8%</td>
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<td>Coffee</td>
<td>-0.4%</td>
<td>1.9%</td>
<td>1.9%</td>
<td>39.9%</td>
<td>19.0%</td>
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<td>Corn</td>
<td>-12.1%</td>
<td>-10.7%</td>
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<td>Cotton</td>
<td>-16.8%</td>
<td>-13.7%</td>
<td>6.2%</td>
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<td>Soybean Oil</td>
<td>-12.5%</td>
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<td>Sugar</td>
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<td>Bloomberg Sub Energy</td>
<td>-14.6%</td>
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<td>Brent Crude</td>
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<td>Natural Gas</td>
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<td>WTI Crude Oil</td>
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<td>9.0%</td>
<td>50.8%</td>
<td>59.6%</td>
<td>8.4%</td>
<td>10.6%</td>
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<td>Bloomberg Sub Industrial Metals</td>
<td>-16.0%</td>
<td>-26.4%</td>
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<td>7.5%</td>
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<td>Aluminum</td>
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<td>-30.4%</td>
<td>-13.2%</td>
<td>-3.9%</td>
<td>7.8%</td>
<td>3.2%</td>
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<tr>
<td>Copper</td>
<td>-13.8%</td>
<td>-22.2%</td>
<td>-17.1%</td>
<td>-13.3%</td>
<td>10.2%</td>
<td>5.8%</td>
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<tr>
<td>Nickel</td>
<td>-20.1%</td>
<td>-29.3%</td>
<td>10.4%</td>
<td>26.5%</td>
<td>21.5%</td>
<td>19.2%</td>
</tr>
<tr>
<td>Zinc</td>
<td>-19.2%</td>
<td>-24.1%</td>
<td>-9.8%</td>
<td>8.0%</td>
<td>8.4%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Bloomberg Sub Precious Metals</td>
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<td>-10.5%</td>
<td>-4.4%</td>
<td>-4.8%</td>
<td>7.1%</td>
<td>5.6%</td>
</tr>
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<td>Gold</td>
<td>-2.1%</td>
<td>-7.6%</td>
<td>-1.5%</td>
<td>1.3%</td>
<td>6.9%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Silver</td>
<td>-6.4%</td>
<td>-19.4%</td>
<td>-13.4%</td>
<td>-23.0%</td>
<td>7.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Bloomberg Sub Livestock</td>
<td>-0.3%</td>
<td>-8.7%</td>
<td>-3.4%</td>
<td>-3.6%</td>
<td>-6.7%</td>
<td>-6.6%</td>
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<tr>
<td>Lean Hogs</td>
<td>-3.5%</td>
<td>-14.9%</td>
<td>2.8%</td>
<td>0.7%</td>
<td>-8.1%</td>
<td>-9.4%</td>
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<tr>
<td>Live Cattle</td>
<td>1.8%</td>
<td>-4.3%</td>
<td>-6.1%</td>
<td>-5.6%</td>
<td>-5.8%</td>
<td>-5.3%</td>
</tr>
</tbody>
</table>

Source: Bloomberg, FactSet
WTI VERSUS BRENT CRUDE SPOT PRICES

Source: WTI, Brent, FactSet
GOLD SPOT PRICE

Source: FactSet
House Views
Investment Committee Meeting
Aug 29, 2022
Public Equity, Performance and Valuations

- US markets, measured by S&P 1500 Index, went through a correction in the first 7 months of the year, dropping ~12.45% for the period. The Y-T-D performance for the MSCI ACWI Index (All Country World Index), followed suit and as of July 31st, stands at ~ -14.35%

- The Federal Reserve started implementing its most aggressive monetary policy tightening cycle in decades. The Federal Open Market Committee (FOMC) delivered its first 75 bps interest-rate hike on June 15th, and that was followed by another hike of 75 bps on July 27th

- The markets rebounded in July, with the S&P 1500 Index rallying 9.33% and the MSCI ACWI Index (All Country World Index), followed suit at 7.02% for the month. This came after the second quarter’s correction of approximately -16%

- The strong rebound in global equities in July was mainly driven by declines in long-term bond yields, the 10-year in particular, and inflation expectations

- US markets’ valuation (measured by the Forward Price-to-Earnings ratio) currently stands at 18x, as presented in the charts below, and looks cheaper compared to the start of the year. It now sits at approximately the 30-year mean
As of July 31, 2022, $18.78 billion is invested in the Public Equity asset class, representing a 37.4% allocation within Total Fund.

We are at equal weight as of July 31, 2022, to our benchmark index: MSCI ACWI IMI (MSCI All Country World Index, Investable Market Index)
US 10-year treasury yields highest in 12 months

- 10-year yield volatility during the last 45 days
- After peaking at 3.47% in mid-June, the 10-year yield dropped to 2.57% on 1st of August
US markets, across market caps, witnessed positive performance in July 2022
Current S&P 500 Forward P/E ratio stands at ~18x (at ~ the 30-year mean)
International: All indexes were up across regions in July, while Chinese Equities were down. With the exception of India and the UK, YTD Performance is negative across markets.
International Equity Valuations

Current MSCI Emerging Markets P/E ratio stands at ~10.6x, at -1.5 standard deviations lower than the average over 4-year period

Current MSCI Developed Markets P/E ratio stands at ~12x, at -1.5 standard deviations lower than the average over 4-year period

As of Aug. 2, 2022
Cross regional emerging markets valuations

As of Aug. 2, 2022
Private Equity
Private Equity

Market conditions:
- Total global private equity returns for Q1 2022 stood at -1.18%, compared to -0.88% for US focused funds*
- Q2 2022 witnessed a drop in number of Buyout deals compared to Q1 2022. Aggregate deal value in Q2 stood at $133.6 billion, compared to $193.5 billion in Q1 2022**
- Buyout deal multiples decreased to a median EV/EBITDA*** & at 9.8x in Q3 2022 (July), compared to 12.6x in Q2 2022, and after recording an all-time high of 13.6x in Q4 2021

Implications:
- We expect private markets deal entry multiples across strategies, geographies and sectors to keep contracting for the coming quarters after the first half drop in public markets multiples
- We also project that the rest of 2022 will continue to witness a drop in the number of deals and exits, in particular
- As of Aug 3, 2022, $6.2 billion is invested in the Private Equity asset class, representing a 12.5% allocation
- Overall implication for ASRS: Private Equity team is being very selective in making new commitments

* Burgiss Universe
** Preqin As of Aug 3, 2022,
*** Enterprise Value/ Earnings before interest, taxes, depreciation and amortization
Private Equity Capital Fundraising, after peaking in Q4 2021
Aggregated number of buyout deals and value dropped in Q2 2022, compared to Q1 2022 & Q4 2021

As of Aug 4, 2022
Prequin
Median deal multiples dropped to 9.8x, after peaking at 13.6x in Q4 2021
Credit
Credit

- As of July 29, 2022, we had $11.4 billion invested in the Credit asset class representing a 22.7% allocation versus an SAA target of 20.0% (with a range of 10-30%).

- We are overweight the Credit asset class as we believe there are compelling investment opportunities to exceed the 7% target return of the total fund over an extended period of time.

- Historically, the asset class has delivered returns well in excess of the 7% target with a lower relative contribution to the volatility of the total fund.

- We believe the most attractive investment opportunities in Credit are almost exclusively in private rather than public markets. In addition to significantly higher expected returns, private markets provide investors with the opportunity for full due diligence and bespoke tailoring of deal terms.

- We generally do not believe that public credit markets (such high yield bonds, broadly-syndicated leveraged loans and asset-backed securities) offer as attractive investment opportunities in comparison to the private markets as public market opportunities will likely not meet the return of the Credit asset class benchmark over an extended, multi-year period of time.
Credit

- We have created a well diversified asset class of 18 strategies that are actively investing capital in the US and Europe. This includes 10 in Private Debt, 3 in Distressed Debt, and 5 in Other Credit.

- Private Debt investments are privately-sourced loans primarily for highly-leveraged middle market buyouts and M&A transactions in the U.S. and Europe.
  - We believe Private Debt offers the most attractive, large-scale opportunity in the Credit markets with double-digit expected returns available for investors willing to accept illiquidity, and when appropriate, employ leverage. The market opportunity is principally driven by regulatory constraints that make it unattractive for banks to hold illiquid loans or other debt of below investment-grade credit quality.
  - ASRS's investments in Private Debt are well diversified by industry and are primarily in senior, secured debt which is typically floating-rate.

- Distressed Debt investments are loans that have defaulted or are expected to default.

- Other Credit investments are comprised of niche opportunities that we believe are attractive and currently include risk sharing transactions, life settlements, equipment leasing, litigation finance, and infrastructure CLOs.
Interest Rate Sensitive
ARIZONA STATE RETIREMENT SYSTEM

Interest Rate Sensitive

- As of July 29, 2022, we are underweight Interest Rate Sensitive Fixed Income with an allocation of 6.9% versus a 10.0% Interim SAA target. We are underweight as we do not expect the asset class to achieve the fund’s target return.
- The Bloomberg Barclays U.S. Aggregate Bond Index, the benchmark for Interest Rate Sensitive Fixed Income, is now yielding 3.6% vs. only 1.1% at the beginning of 2021. The yield of the index has historically been a good indicator of long-term expected returns of the asset class.
- Since the beginning of 2022, interest rates have significantly risen resulting in negative returns year-to-date for the Interest Rate Sensitive Fixed Income asset class.
- In response to a substantial rise in the rate of inflation, the Federal Reserve is raising short-term interest rates and reversing the expansionary monetary policy actions it undertook in response to the economic contraction in 2020 stemming from COVID-19. The European Central Bank and the Bank of England are raising rates and pulling back from monetary expansion as well.
- While we are underweight our target allocation, we expect to maintain a meaningful investment in the asset class to use as a source of liquidity to meet the total fund’s needs and to serve as a counter-balance to potential sell-offs in risky assets such as equities.
Real Estate
U.S. Economic Summary
As of August 2022

► The Russian invasion of Ukraine continues to drive uncertainty around near-term economic forecasts particularly for food and energy supplies and prices. These risks are likely to be more acute in Europe but still relevant to the US.

► The US economy has slowed materially (adjusted for inflation) in 2022 as the Federal Reserve has adopted its most hawkish policy direction in decades.

► Economic news has been mixed in Q2 2022:
  » GDP growth was negative for a second consecutive quarter at -0.9% for Q2, marking a “technical recession” as inventory investments, fixed investments, and government spending all decreased. Exports and personal consumption (led by services) increased. (With solid job growth, the first half of 2022 will likely not be deemed a recession.)
  » Job growth moderated somewhat but remained strong (1.1 million) in Q2 for a trailing year total of 6.3 million; nearly all jobs lost to COVID have been restored. The unemployment rate fell to 3.6% in March and remained there throughout Q2.
  » Headline inflation was 1.3% in June and 9.0% for the past year, the fastest rise since 1981. The TIPs-implied 5-year inflation rate fell 60 bps from the end of Q1 to 2.73% on July 29, indicating market participants’ cooling inflation expectations.
  » The Federal Reserve has signaled that it will fight inflation aggressively, kicking off quantitative tightening in June and increasing the Fed Funds target rate by a total of 225 bps YTD to a range of 2.25% to 2.5% as of its July 27 meeting.
  » The interest rate on the 10-Year UST ended Q2 at 2.98%, up 146 basis points since the start of the year. As of August 3, it was down to 2.75%. Real estate borrowing spreads (both residential and commercial) have widened, and prices are starting to adjust.

► Private real estate returns began to moderate but remained high in Q2, with NFI-ODCE and NPI posting quarterly returns of 4.8% and 3.2%, respectively. Trailing one-year ODCE returns hit a new high at 29.5% with NPI at 21.5%, just below its record. One-year industrial NPI returns moderated 4 ppts but were still exceptionally high at 47.7%. Returns are likely to slow in 2022.
RFA House View – Shallow Recession Likely in Near Term
Base Case As of August 2022, ~60% Probability

► US GDP growth will slow (0-2%) in 2022 with a shallow recession likely. High inflation (particularly energy), higher interest rates, lingering supply chain issues and weaker global growth will negatively impact the US economy. Depending on energy prices and supply chain issues, trend (2-3%) growth will resume in 2024.

► Job growth will moderate to around 1 million (annual) in 2023 and 2024 but is unlikely to turn negative. Job openings are at record levels, indicating a mismatch between employer needs and employee skills.

► The 10-Year US Treasury has been volatile so far in Q3 and is currently at 2.75% as of early August. Economists and futures markets expect that the UST will remain in the 3.0-3.5% range for the next several years.

► As the economy slows, US real estate fundamentals will likely soften, with slightly higher vacancy rates and slower rent growth over next 3 years: Industrial rent growth will see the least impact strong while office and neighborhood retail rents will trend towards 0%.

► Real estate capital markets are likely to stay resilient. Real estate borrowing spreads have risen post-Ukraine, as lenders price in more risk. Equity dry powder from institutions has declined due to the denominator effect, although non-traded REITS continue to expand.

► Higher borrowing rates have led to bid/ask spreads and modest price declines (5-10%), but further large decreases are unlikely.
### RFA House View – Base Case
As of August 2022 ~60% Probability

<table>
<thead>
<tr>
<th></th>
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<td>GDP</td>
<td>2.3%</td>
<td>-3.4%</td>
<td>5.7%</td>
<td>0-2%</td>
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<td>Job Change (M)</td>
<td>1.8</td>
<td>-9.7</td>
<td>6.0</td>
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<td>0.5-1.5</td>
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<td>Unemploy. Rate (ann. avg.)</td>
<td>3.7%</td>
<td>8.1%</td>
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<td>4-4.5%</td>
<td>5.9%</td>
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<td>Inflation (ann. avg.)</td>
<td>1.8%</td>
<td>1.2%</td>
<td>4.7%</td>
<td>7-8%</td>
<td>3-4%</td>
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<td>10 Year Treasury</td>
<td>1.9%</td>
<td>0.9%</td>
<td>1.5%</td>
<td>3-3.5%</td>
<td>3-3.5%</td>
<td>3-3.5%</td>
<td>2.9%</td>
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<tr>
<td><strong>Real Estate</strong></td>
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<td>Transaction Vol. ($B)</td>
<td>$581</td>
<td>$419</td>
<td>$816</td>
<td>~600</td>
<td>~400</td>
<td>~500</td>
<td>$367</td>
</tr>
<tr>
<td>NPI Returns</td>
<td>6.4%</td>
<td>1.6%</td>
<td>17.7%</td>
<td>~14%</td>
<td>~6%</td>
<td>~6%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Apartment Rent Growth</td>
<td>2.6%</td>
<td>0.3%</td>
<td>8.9%</td>
<td>~9%</td>
<td>~2%</td>
<td>~1%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Industrial Rent Growth</td>
<td>5.6%</td>
<td>5.1%</td>
<td>7.5%</td>
<td>~11%</td>
<td>~3%</td>
<td>~1%</td>
<td>2.6%</td>
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<td>Office Rent Growth</td>
<td>4.0%</td>
<td>0.8%</td>
<td>-0.9%</td>
<td>~1%</td>
<td>~1%</td>
<td>~0%</td>
<td>1.5%</td>
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<tr>
<td>Neigh. Retail Rent Growth</td>
<td>2.7%</td>
<td>2.2%</td>
<td>2.7%</td>
<td>~4%</td>
<td>~1%</td>
<td>~0%</td>
<td>1.0%</td>
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<tr>
<td><strong>Housing</strong></td>
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<tr>
<td>Total Home Starts (000s)</td>
<td>1,292</td>
<td>1,397</td>
<td>1,605</td>
<td>~1,700</td>
<td>~1,350</td>
<td>~1,200</td>
<td>1,263</td>
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<tr>
<td>SF Home Starts (000s)</td>
<td>889</td>
<td>1,004</td>
<td>1,131</td>
<td>~1,200</td>
<td>~900</td>
<td>~800</td>
<td>942</td>
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<tr>
<td>MF Home Starts (000s)</td>
<td>403</td>
<td>393</td>
<td>473</td>
<td>~500</td>
<td>~450</td>
<td>~400</td>
<td>321</td>
</tr>
<tr>
<td>New Home Price Change</td>
<td>-1.2%</td>
<td>4.9%</td>
<td>17.3%</td>
<td>12-14%</td>
<td>2-4%</td>
<td>1-3%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Source: Moody’s, Oxford, RCA, US Federal Reserve, NCREIF, CoStar, NAHB, ULI, RCLCO.
Note: rent growth forecasts based on CoStar’s moderate downside scenario.
Headline CPI Increased Again in June at Fastest Rate Since November 1981
CPI for All Items Up 9.0% YoY, Excluding Food and Gas Up 5.9%

Trailing 12-Month CPI Change

Data are as of June 2022.
Source: U.S. Bureau of Labor Statistics; FRED; Oxford Economics; Moody's
Property Markets Outlook
As of Q2 2022

**Multifamily**
Multifamily’s record-setting performance continued in Q2 with rents up nearly 12% YoY in response to strong demand and lagging supply. Vacancy rates have correspondingly fallen to record lows. Fundamentals are projected to remain favorable but moderate somewhat as net absorption has begun to slow and deliveries increase.

RFA expects mid-term operating and investment performance to be strong. Higher employment, a partial return to offices, and demographic trends should increase renter demand in coming years.

**Office**
Office rent growth turned positive – increasing a modest 0.6% – for the first time in six quarters in Q2 as absorption meaningfully improved. Vacancies, however, further increased to a new high, underscoring the weakness of office fundamentals.

Newer office buildings have experienced more favorable performance, illustrating a “flight to quality” in office markets. The trend towards greater employee flexibility could be a headwind for the sector.

**Retail**
Grocery-anchored retail performed well in Q2. Absorption has been strong relative to both historical averages and new supply, and rent growth has increased to record highs.

For retail overall, NCREIF reports that NOI growth has been strong at more than 14% over the past year. Retail NOI remains 5% below pre-pandemic levels with super-regional mall NOI down 16% and power center NOI up 10%.

As commerce further shifts online, retail centers will continue to incorporate experiential tenants.

**Industrial**
Industrial remains the strongest major property type in Q2 with record low vacancies and rents growing over 10% YoY. Absorption continues to outpace new supply by considerable margins, setting the stage for continued above-average rent growth in the near term.

Industrial fundamentals are expected to moderate somewhat but will likely continue to outperform other asset classes through 2023 in part due to strong logistics demand generated by the sectoral shift towards e-commerce.

**Hotel**
Hotel fundamentals have rebounded as the omicron variant fades and travel resumes. RevPAR and ADR both rose and are up YoY by 17% and 13%, respectively, registering record high quarterly averages in Q2. Over the past four quarters, the hotel sector has shown signs of a return to its pre-pandemic seasonality.

Hotel performance outlook depends in part on the degree to which business travel resumes in the coming years and how businesses and cities respond to the increasing omicron subvariants.
Elevated Office Vacancies Projected to Persist
Industrial, Apartment, and Retail Vacancies Expected to Stay Below Average

Data as of July 18, 2022.

Notes: Vacancy rates are rolling four-quarter averages; retail data refer to neighborhood centers; office and apartment data are filtered for Class A & B.
Source: CoStar
Office and Retail Rents to Suffer Most In a Downturn
Industrial and Apartment Rent Growth Projected to Moderate

Data as of July 18, 2022.
Notes: Vacancy rates are rolling four-quarter averages; retail data refer to neighborhood centers; office and apartment data are filtered for Class A & B.
Source: CoStar
Q2 Transaction Volumes Moderated but Remained High at $160B
Lending Standards Started to Tighten in Q2 2022

Transaction Volume

Net % of Banks Tightening Lending Standards

Excludes portfolio sales. Data as of Q2 2022.
Source: RCA, The Federal Reserve
ODCE Returns Remain at All-time High Led by Industrial
West and South Lead ODCE Regionally

Average Annual ODCE Returns (Gross, Unlevered)

<table>
<thead>
<tr>
<th>Property Type</th>
<th>1-Yr</th>
<th>3-Yr</th>
<th>5-Yr</th>
<th>10-Yr</th>
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</thead>
<tbody>
<tr>
<td>Hotel</td>
<td>8.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment</td>
<td>25.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>7.5%</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>52.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td>5.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self Storage</td>
<td>37.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>19.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>27.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>28.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midwest</td>
<td>12.2%</td>
<td></td>
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</tr>
<tr>
<td>ODCE</td>
<td>24.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data as of Q2 2022.
Note: Returns are unlevered, gross of fees at ownership share.
Source: NCREIF
Rolling 4Q NPI Real Estate Returns Remain Near Forty-year High
Moderation Projected in Industrial and Multifamily; Office and Retail Expected to Be Steady

![Annual NPI Returns](image)

**Forecast NPI Total Returns (PREA Consensus)**

- **Total**: 2021 (Actual) -6.5%, 2022 13.1%, 2023 14.3%, 2024 10.5%
- **Office**: 2021 (Actual) -16.8%, 2022 8.0%, 2023 7.0%, 2024 6.4%
- **Retail**: 2021 (Actual) -25%, 2022 17.7%, 2023 21.5%
- **Industrial**: 2021 (Actual) -20%, 2022 1.6%, 2023 15.0%, 2024 20.0%
- **Multifamily**: 2021 (Actual) -15%, 2022 10.5%, 2023 11.0%, 2024 11.8%

* Rolling four-quarter return as of 2022 Q2.
Note: Annual return figures reflect compounded annual returns.
Source: NCREIF; PREA

The information contained in this report is confidential, may be legally privileged, and is intended only for the use of select clients of RCLCO Fund Advisors.
REITs Fall Below Pre-pandemic Levels with Sharp Q2 Downturn
YTD the Nareit Price Index Has Contracted More Sharply Than the S&P 500 but Less than Nasdaq

![Graph](image.png)

**US Stock Indices**

**US Equity REIT Performance, Jan. 2020 - Jun. 2022**

<table>
<thead>
<tr>
<th>Sector</th>
<th>2020</th>
<th>2021</th>
<th>YTD 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTSE Nareit All Equity REITs</td>
<td>-5.1%</td>
<td>41.3%</td>
<td>-19.2%</td>
</tr>
<tr>
<td>Industrial</td>
<td>12.2%</td>
<td>62.0%</td>
<td>-26.6%</td>
</tr>
<tr>
<td>Office</td>
<td>-18.4%</td>
<td>22.0%</td>
<td>-27.4%</td>
</tr>
<tr>
<td>Retail</td>
<td>-25.2%</td>
<td>51.9%</td>
<td>-20.5%</td>
</tr>
<tr>
<td>Apartments</td>
<td>-15.3%</td>
<td>63.6%</td>
<td>-20.1%</td>
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<tr>
<td>Single Family</td>
<td>6.0%</td>
<td>52.8%</td>
<td>-19.8%</td>
</tr>
<tr>
<td>Lodging/Resorts</td>
<td>-23.6%</td>
<td>18.2%</td>
<td>-16.1%</td>
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<tr>
<td>Health Care</td>
<td>-9.9%</td>
<td>16.3%</td>
<td>-10.2%</td>
</tr>
<tr>
<td>Self Storage</td>
<td>12.9%</td>
<td>79.4%</td>
<td>-20.1%</td>
</tr>
<tr>
<td>Data Centers</td>
<td>21.0%</td>
<td>25.5%</td>
<td>-22.0%</td>
</tr>
</tbody>
</table>

*Data as of June 2022.*
*Source: Nareit, FRED*
Cap Rate Spread to Treasuries Continues to Narrow
National Cap Rates Largely Steady Around 5.2% Over Last Six Quarters

UST Yields and Cap Rates

- Spread
- Going-In Cap Rate (%)
- Recession
- Average spread (1991-2021)
- 10 Year Treasury Yield

Data as of Q2 2022.
Note: Quarterly yields reflect averaged daily yields over the quarter.
Source: RCA; FRED
Cap Rates Continue to Be Relatively Stable with Slight Compression
Rates for Most Property Types Down 20 to 40 bps YoY; Rates Stable in Most Gateway Markets

Cap Rates by Property Type

- Multifamily
- Hotel
- Office (CBD)
- Office (Suburban)
- Industrial (Warehouse)

Cap Rates by Metro*

- Washington DC
- Boston
- Chicago
- Los Angeles
- New York
- San Francisco

Data as of Q2 2022.
*Cap rates for all property types.
Source: RCA
Institutional Dry Powder Hovers Near 2021 Levels in H1 2022

Institutional Allocations to Real Estate Trending Up

**Weighted Average Target Allocation to Real Estate**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Weighted Average</td>
<td>8.9%</td>
<td>9.3%</td>
<td>9.9%</td>
<td>10.1%</td>
<td>10.4%</td>
<td>10.6%</td>
<td>10.7%</td>
<td>11.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dry Powder by Strategy**

- **Value-Add**
- **Opportunistic**
- **Core**

Data as of Q2 2022.
Source: Preqin
Preliminary Fund Performance period ending July 29, 2022
<table>
<thead>
<tr>
<th>Account Name</th>
<th>Benchmark Name</th>
<th>Market Value (M)</th>
<th>% of Total</th>
<th>Month</th>
<th>3 Months</th>
<th>Fiscal YTD</th>
<th>1 Year</th>
<th>3 Years</th>
<th>5 Years</th>
<th>ITD</th>
<th>Inception Date</th>
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<tbody>
<tr>
<td>Total Plan</td>
<td></td>
<td>50,221.56</td>
<td>100.00</td>
<td>3.08</td>
<td>1.34</td>
<td>3.08</td>
<td>3.69</td>
<td>9.35</td>
<td>8.61</td>
<td>9.63</td>
<td>7/1/1975</td>
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<td>Interm SAA Policy</td>
<td></td>
<td>1.89</td>
<td>-0.42</td>
<td>1.89</td>
<td>-0.42</td>
<td>1.89</td>
<td>-0.99</td>
<td>7.89</td>
<td>7.22</td>
<td>9.16</td>
<td>7/1/1975</td>
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<tr>
<td>Excess Return</td>
<td></td>
<td>1.19</td>
<td>1.77</td>
<td>1.19</td>
<td>1.98</td>
<td>4.88</td>
<td>1.46</td>
<td>1.39</td>
<td>0.48</td>
<td>7/1/1975</td>
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<td>Total Equity</td>
<td></td>
<td>24,997.14</td>
<td>49.77</td>
<td>5.28</td>
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<td>-2.68</td>
<td>10.56</td>
<td>9.15</td>
<td>7.41</td>
<td>1/1/1998</td>
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<td>Custom Total Equity</td>
<td>Benchmark</td>
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<td>3.11</td>
<td>-10.00</td>
<td>8.77</td>
<td>8.03</td>
<td>6.79</td>
<td>1/1/1968</td>
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<td>Excess Return</td>
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<td>2.17</td>
<td>2.76</td>
<td>2.17</td>
<td>7.32</td>
<td>1.79</td>
<td>1.12</td>
<td>0.62</td>
<td>1/1/1998</td>
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<tr>
<td>Total Public Equity</td>
<td></td>
<td>18,786.60</td>
<td>37.41</td>
<td>7.16</td>
<td>-1.84</td>
<td>7.16</td>
<td>-10.59</td>
<td>8.09</td>
<td>7.34</td>
<td>7.04</td>
<td>1/1/1998</td>
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<tr>
<td>Total Public Equity BM</td>
<td></td>
<td>7.16</td>
<td>-1.97</td>
<td>7.16</td>
<td>-10.78</td>
<td>8.63</td>
<td>7.84</td>
<td>6.77</td>
<td>1/1/1998</td>
<td></td>
<td></td>
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<tr>
<td>Excess Return</td>
<td></td>
<td>0.00</td>
<td>0.13</td>
<td>0.00</td>
<td>0.19</td>
<td>-0.54</td>
<td>-0.60</td>
<td>0.27</td>
<td>1/1/1998</td>
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<tr>
<td>Excess Return</td>
<td></td>
<td>7.84</td>
<td>10.58</td>
<td>7.84</td>
<td>38.58</td>
<td>10.30</td>
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<td>9/1/2007</td>
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<td>Interest Rate Sensitive</td>
<td>Bloomberg U.S. Aggregate Bond Index</td>
<td>2.44</td>
<td>1.49</td>
<td>2.44</td>
<td>-9.12</td>
<td>-0.21</td>
<td></td>
<td>1.28</td>
<td></td>
<td>7/1/1975</td>
<td></td>
</tr>
<tr>
<td>Excess Return</td>
<td></td>
<td>-0.05</td>
<td>0.01</td>
<td>-0.05</td>
<td>0.30</td>
<td>0.18</td>
<td></td>
<td>0.12</td>
<td></td>
<td>7/1/1975</td>
<td></td>
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<tr>
<td>Credit</td>
<td>S&amp;P Lever Loan +250 BP Lagged</td>
<td>0.42</td>
<td>0.37</td>
<td>0.42</td>
<td>5.52</td>
<td>6.33</td>
<td>6.66</td>
<td>6.48</td>
<td>1/1/1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess Return</td>
<td></td>
<td>0.12</td>
<td>1.69</td>
<td>0.12</td>
<td>6.05</td>
<td>3.11</td>
<td>2.63</td>
<td>1.71</td>
<td></td>
<td>7/1/2013</td>
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</tr>
<tr>
<td>Real Estate</td>
<td>Custom ASRS ODCE (Net)</td>
<td>9,854.57</td>
<td>19.62</td>
<td>1.28</td>
<td>6.29</td>
<td>1.28</td>
<td>22.04</td>
<td>9.64</td>
<td>8.89</td>
<td>7.03</td>
<td>12/1/2005</td>
</tr>
<tr>
<td>Excess Return</td>
<td></td>
<td>1.28</td>
<td>0.85</td>
<td>1.28</td>
<td>-5.22</td>
<td>-0.49</td>
<td></td>
<td></td>
<td></td>
<td>12/1/2005</td>
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<tr>
<td>Cash</td>
<td>Cash Custom Index</td>
<td>530.35</td>
<td>1.06</td>
<td>0.24</td>
<td>1.00</td>
<td>0.24</td>
<td>1.15</td>
<td>1.01</td>
<td>2.37</td>
<td>3.73</td>
<td>4/1/1990</td>
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<tr>
<td>Excess Return</td>
<td></td>
<td>0.19</td>
<td>0.95</td>
<td>0.19</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4/1/1990</td>
<td></td>
</tr>
</tbody>
</table>
Agenda Item #4
Independent ASRS Investment Program Oversight for the Period Ending June 30, 2022

Allan Martin, Partner, NEPC
Chris Levell, Partner, NEPC
Michael Malchenko, Consultant, NEPC
CONTENTS

ASRS Investment Objectives & Plan Performance

Independent Oversight/Compliance
- SAA Policy Compliance
- Total Fund and Asset Class Performance
- Asset Class Committee Monitoring

Appendix: SAA Policy History
DISCLOSURE

- NEPC has developed reports for both the Investment Committee and Board designed to 1) provide the appropriate level of investment information for the purposes of independent oversight (ASRS SAAP compliance, Asset Class Committee minutes review, investment selection due diligence packet compliance and oversight of the investment program data used to compile NEPC and ASRS reporting); 2) provide ASRS investment program performance relative to its goals/objectives (presented quarterly); and 3) communicate NEPC’s perspectives on the market environment, investment outlook or other initiatives or topics they believe are important to convey to the Board.

- NEPC has completed a quarter-end quality control process and warrants that IMD Staff materials are accurate subject to the following process:
  - Investment results were calculated using data provided by the Plan’s custodian bank that is deemed “final” as of June 30, 2022.
  - Investment performance oversight includes reconciliation and confirmation of portfolio level valuations, cash flows, transactions and composite construction including interpretation of investment accounting methods used to track IMD Staff instructed activities.
  - Oversight of performance calculation includes verification of Staff data used to produce reporting as well as verification of processes and procedures in custom investment performance calculations.
  - NEPC performed tests of the data produced by IMD Staff and the Plan’s custodian bank (book of record) using underlying financial records provided by the custodian bank and IMD Staff. The net effect of uncorrected misstatements has been brought to the attention of IMD Staff.
ASRS INVESTMENT OBJECTIVES
Goal #4: Design, implement, and maintain an investment management program that maximizes rates of return for acceptable levels of risk.

a) Develop, approve and implement an Asset Allocation program that is expected to achieve a 20-year rolling average annual return at or above the actuarial assumed return
   - Goal met: Yes

b) Achieve a total fund net return in the top quartile of the peer universe
   - Goal met: Yes

c) Achieve a 1 year total fund net return greater than the Strategic Asset Allocation Benchmark
   - Goal met: Yes

d) Achieve a 3-year total fund net return greater than the Strategic Asset Allocation Benchmark
   - Goal met: Yes

e) Achieve 1 year asset class net returns greater than the respective Asset Allocation Benchmarks
   - Goal met: Yes

f) Achieve 3 year asset class net returns greater than the respective Asset Allocation Benchmarks
   - Goal met: Partial

g) Sufficient cash will be maintained to meet all payment requirements
   - Goal met: Yes

Source: ASRS Strategic Plan, August 2018
Note: Total Fund comparison versus Interim SAAP
# EXPECTED 20 YEAR RETURN

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Policy Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>50.00%</td>
</tr>
<tr>
<td>Interest Rate Sensitive Bonds</td>
<td>10.00%</td>
</tr>
<tr>
<td>Credit</td>
<td>20.00%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>20.00%</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>20 Year Expected Return</strong></td>
<td>7.29%</td>
</tr>
<tr>
<td><strong>Expected Standard Deviation</strong></td>
<td>9.75%</td>
</tr>
<tr>
<td><strong>ASRS Actuarial Rate of Return</strong></td>
<td>7.0%*</td>
</tr>
</tbody>
</table>

Standard deviation is calculated using NEPC Capital Market Assumptions and NEPC accounting volatility. Real Estate uses RCLCo capital market assumptions. Capital market assumptions are as of December 31, 2021. * As of July 30, 2021
Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > $1 Billion Net Universe. The InvMetrics Public Funds DB > $1 Billion Net Universe contains 62 observations for the period ending June 30, 2022.
UNIVERSE COMPARISON – 1 YEAR

Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > $1 Billion Net Universe. The InvMetrics Public Funds DB > $1 Billion Net Universe contains 62 observations for the period ending June 30, 2022.
Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns.
Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > $1 Billion Net Universe.
The InvMetrics Public Funds DB > $1 Billion Net Universe contains 62 observations for the period ending June 30, 2022.
Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns.
Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > $1 Billion Net Universe.
The InvMetrics Public Funds DB > $1 Billion Net Universe contains 62 observations for the period ending June 30, 2022.
Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > $1 Billion Net Universe. The InvMetrics Public Funds DB > $1 Billion Net Universe contains 62 observations for the period ending June 30, 2022.
## TOTAL FUND PERFORMANCE NET OF FEES

<table>
<thead>
<tr>
<th></th>
<th>3 Mo (%)</th>
<th>YTD (%)</th>
<th>1 Yr (%)</th>
<th>3 Yrs (%)</th>
<th>5 Yrs (%)</th>
<th>10 Yrs (%)</th>
<th>Inception (%)</th>
<th>Inception Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fund</td>
<td>-4.1</td>
<td>-5.6</td>
<td>1.1</td>
<td>8.4</td>
<td>8.3</td>
<td>8.9</td>
<td>9.6</td>
<td>Jul-75</td>
</tr>
<tr>
<td>Interim SAA Policy</td>
<td>-6.2</td>
<td>-6.9</td>
<td>-2.1</td>
<td>7.5</td>
<td>7.1</td>
<td>7.6</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>Over/Under</td>
<td>2.1</td>
<td>1.3</td>
<td>3.2</td>
<td>0.9</td>
<td>1.2</td>
<td>1.3</td>
<td>0.5</td>
<td></td>
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</tbody>
</table>
## ASSET CLASS PERFORMANCE VS. BENCHMARK

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>1 Year Return</th>
<th>3 Year Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Equity (TWR)</td>
<td>-7.1%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Custom Total Equity Benchmark (TWR)</td>
<td>-11.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Excess Return</td>
<td>4.5%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Interest Rate Sensitive (TWR)</td>
<td>-10.0%</td>
<td>-0.7%</td>
</tr>
<tr>
<td>Bloomberg Barclays US Aggregate Bond Index (TWR)</td>
<td>-10.3%</td>
<td>-0.9%</td>
</tr>
<tr>
<td>Excess Return</td>
<td>0.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Credit (TWR)</td>
<td>11.3%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Custom Credit Benchmark (TWR)</td>
<td>5.8%</td>
<td>6.8%</td>
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<tr>
<td>Excess Return</td>
<td>5.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Real Estate (TWR)</td>
<td>20.9%</td>
<td>9.3%</td>
</tr>
<tr>
<td>NCREIF ODCE Net 1 Qtr. Lag (TWR)</td>
<td>27.3%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Excess Return*</td>
<td>-6.4%</td>
<td>-1.0%</td>
</tr>
</tbody>
</table>

Note: Composition of ASRS Custom Asset Class Benchmarks can be found in the appendix.

TWR is Time Weighted Return
# CASH MANAGEMENT

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<tr>
<th>Month</th>
<th>External CFs</th>
<th>Last day of the Month Ending Balance*</th>
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</thead>
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<td>Jun - 21</td>
<td>($42.8)</td>
<td>$707.0</td>
</tr>
<tr>
<td>Jul – 21</td>
<td>($134.3)</td>
<td>$680.0</td>
</tr>
<tr>
<td>Aug – 21</td>
<td>($128.3)</td>
<td>$953.4</td>
</tr>
<tr>
<td>Sept - 21</td>
<td>($93.8)</td>
<td>$917.8</td>
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<td>Oct - 21</td>
<td>($78.9)</td>
<td>$806.5</td>
</tr>
<tr>
<td>Nov - 21</td>
<td>($97.7)</td>
<td>$640.6</td>
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<td>Dec - 21</td>
<td>($57.7)</td>
<td>$1,414.2</td>
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<tr>
<td>Jan - 22</td>
<td>($97.9)</td>
<td>$1,188.6</td>
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<tr>
<td>Feb - 22</td>
<td>($106.6)</td>
<td>$1,108.1</td>
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<td>Mar - 22</td>
<td>($93.7)</td>
<td>$937.6</td>
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<td>Apr - 22</td>
<td>($87.8)</td>
<td>$489.9</td>
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<td>May - 22</td>
<td>($76.0)</td>
<td>$980.1</td>
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<tr>
<td>Jun - 22</td>
<td>($53.4)</td>
<td>$524.3</td>
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</tbody>
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*Includes assetized & unassetized cash balances (Inception of 1/26/15); represents monies to be used for funding needs that occur in subsequent month(s). Generally, monthly pension payments occur on the first day of month.
INDEPENDENT OVERSIGHT/COMPLIANCE
SAA POLICY COMPLIANCE

Note:
Values shown for private markets portfolios include cash flows that occurred during Q2 2022.
Total Equity market value includes futures positions profit and loss as well as notional values of futures positions.

*Interim SAA Policy includes proration of unfunded Credit assets and unfunded in Real Estate assets. According to policy, the proration is applied 83.3% to Total Equity and 16.7% to Interest Rate Sensitive.*

*Policy Ranges shown are relative to the long-term SAAP and may cause some asset classes to be out of range while implementation of the long-term SAAP is in process.*

*Market values include manager held cash.*
<table>
<thead>
<tr>
<th>Allocation</th>
<th>Market Value ($)</th>
<th>% of Portfolio</th>
<th>Performance (%)</th>
<th>3 Mo (%)</th>
<th>YTD (%)</th>
<th>1 Yr (%)</th>
<th>3 Yrs (%)</th>
<th>5 Yrs (%)</th>
<th>Inception (%)</th>
<th>Inception Date</th>
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<tr>
<td>Over/Under</td>
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<td>0.2</td>
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<td>5.5</td>
<td>3.0</td>
<td>2.9</td>
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</tr>
<tr>
<td>Over/Under</td>
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<td>-4.9</td>
<td>-6.4</td>
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<td>-0.3</td>
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### PUBLIC MARKET ASSET CLASS ANALYSIS

#### 3 Year

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<th>Asset Class</th>
<th>3 Year Return</th>
<th>3 Year Standard Deviation</th>
<th>3 Year Tracking Error</th>
<th>3 Year Information Ratio</th>
<th>3 Year Jensen Alpha</th>
<th>3 Year Beta</th>
<th>3 Year Sharpe Ratio</th>
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<tr>
<td>Total Public Equity</td>
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<td>0.9</td>
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<td>0.0</td>
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<td>0.2</td>
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</tr>
<tr>
<td>BBgBarc US Aggregate TR</td>
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<td>-0.5</td>
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#### 5 Year

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<th>5 Year Standard Deviation</th>
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<th>5 Year Information Ratio</th>
<th>5 Year Jensen Alpha</th>
<th>5 Year Beta</th>
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</thead>
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<td>1.0</td>
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Note: Performance is reported net of fees.
Underlying composites do not add up to 100% because the chart excludes private market composites.
Ranks for statistics shown above are based on the respective universe against which the portfolio is ranked on the asset class performance summary that precedes this section of the analysis.
Rankings are from highest (1) to lowest (100) in the eVestment Universe.
Composition of Interim SAA Policy and ASRS Custom Benchmarks can be found in the appendix.
ASSET CLASS COMMITTEE MEETINGS
FIDUCIARY OVERSIGHT

NEPC attended nine Combined Asset Class Committee Meetings since the last time we provided an update to the Board.

• May 17, 2022 – Combined Asset Class Committee
  – Credit manager recommendation ($400mm)
    ▪ Staff recommendation to commit capital to a new investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation

• May 24, 2022 – Combined Asset Class Committee
  – Private Equity manager recommendation (€50mm)
    ▪ Staff and extension consultant recommendation to commit new capital to an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Private Equity manager recommendation (€95mm)
    ▪ Staff and extension consultant recommendation to commit new capital to a new investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Real Estate recommendation
    ▪ Staff and extension consultant recommendation to sell an asset
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
ASSET CLASS COMMITTEE MEETINGS
FIDUCIARY OVERSIGHT

• May 31, 2022 – Combined Asset Class Committee
  – Real Estate recommendation
    ▪ Staff and extension consultant recommendation to sell an asset
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Private Equity manager recommendation ($50k)
    ▪ Staff recommendation to roll forward an investment adding additional capital to an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation

• June 7, 2022 – Combined Asset Class Committee
  – Real Estate recommendation
    ▪ Staff and extension consultant recommendation to sell an asset
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation

• June 21, 2022 – Combined Asset Class Committee
  – Real Estate recommendation
    ▪ Staff and extension consultant recommendation to sell an asset
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
ASSET CLASS COMMITTEE MEETINGS
FIDUCIARY OVERSIGHT

• June 21, 2022 – Combined Asset Class Committee (continued)
  – Real Estate recommendation
    • Staff and extension consultant recommendation to sell an asset
    • Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    • Committee approved the recommendation
  – Real Estate recommendation
    • Staff and extension consultant recommendation to sell an asset
    • Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    • Committee approved the recommendation

• June 28, 2022 – Combined Asset Class Committee (email)
  – Real Estate recommendation
    • Staff and extension consultant recommendation to sell an asset
    • Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    • Committee approved the recommendation

• June 30, 2022 – Combined Asset Class Committee
  – Private Equity manager recommendation ($150mm)
    • Staff and extension consultant recommendation to commit new capital to a new investment manager relationship
    • Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    • Committee approved the recommendation
ASSET CLASS COMMITTEE MEETINGS

FIDUCIARY OVERSIGHT

• June 30, 2022 – Combined Asset Class Committee (continued)
  – Private Equity manager recommendation ($150mm)
    ▪ Staff and extension consultant recommendation to commit new capital to a new investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Private Equity manager recommendation ($100mm)
    ▪ Staff and extension consultant recommendation to commit new capital to an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Real Estate variance request
    ▪ Staff and extension consultant recommendation to modify investment guidelines
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Credit manager recommendation
    ▪ Staff recommendation to extend the investment period in an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation

• July 21, 2022 – Combined Asset Class Committee
  – Real Estate recommendation
    ▪ Staff and extension consultant recommendation to sell an asset
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
ASSET CLASS COMMITTEE MEETINGS

FIDUCIARY OVERSIGHT

• **July 21, 2022 – Combined Asset Class Committee (continued)**
  – Private Equity manager recommendation ($75mm)
    ▪ Staff and extension consultant recommendation to commit new capital to an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation

• **August 2, 2022 – Combined Asset Class Committee**
  – Private Equity manager recommendation ($75mm)
    ▪ Staff and extension consultant recommendation to commit new capital to an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
  – Private Equity manager recommendation
    ▪ Staff recommendation to sell an asset within an existing investment manager relationship
    ▪ Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
    ▪ Committee approved the recommendation
GENERAL OBSERVATIONS

• Staff continues to seek to optimize the plan’s assets through equitizing cash balances

• The Plan is outperforming its Interim Strategic Asset Allocation Policy benchmark over longer timer periods
  – Short-run performance is strong

• Total Equity has contributed positively to relative performance over the medium-to-long term
  – Total Equity has strong absolute returns and is outperforming its benchmark over all periods evaluated
  – Staff’s strategic plan focused on addressing the underperformance in public equity and has resulted in outperformance in the short-run

• Private markets contributing to positive longer-term results
  – Private Equity program has contributed positively in absolute terms and benchmark-relative terms
  – Credit is outperforming its benchmark and is providing the plan with strong cash yield
  – Real Estate is contributing negatively to relative performance over the longer time period

• Current positioning is consistent with IMD House Views and strategic implementation plans
  – Credit has moved into an overweight position per strategic plan and house view
  – Current underweight position in Interest Rate Sensitive assets and Real Estate is consistent with IMD house views
INDEPENDENT OVERSIGHT/COMPLIANCE: LTD
## PERFORMANCE SUMMARY
### LONG-TERM DISABILITY

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<th>Quarter</th>
<th>1 Year</th>
<th>3 Years</th>
<th>5 Years</th>
<th>10 Years</th>
<th>Since Inception (July-02)</th>
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<td>0.7%</td>
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1 - LTD SAA Policy composition can be found in the appendix.
APPENDIX

SAA POLICY HISTORY
### STRATEGIC ASSET ALLOCATION POLICY HISTORY

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<thead>
<tr>
<th>Period</th>
<th>Allocation Details</th>
</tr>
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<tbody>
<tr>
<td>7/1/75 – 12/31/79</td>
<td>40% S&amp;P 500/60% Barclays Capital Aggregate</td>
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<td>1/1/80 – 12/31/83</td>
<td>50% S&amp;P 500/50% Barclays Capital Aggregate</td>
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<td>1/1/84 – 12/31/91</td>
<td>60% S&amp;P 500/40% Barclays Capital Aggregate</td>
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<td>1/1/92 – 12/31/94</td>
<td>50% S&amp;P 500/10% MSCI EAFE/40% Barclays Capital Aggregate</td>
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<td>1/1/95 – 6/30/97</td>
<td>45% S&amp;P 500/15% MSCI EAFE/40% Barclays Capital Aggregate</td>
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<tr>
<td>7/1/97 – 12/31/99</td>
<td>50% S&amp;P 500/15% MSCI EAFE/35% Barclays Capital Aggregate</td>
</tr>
<tr>
<td>1/1/00 – 9/30/03</td>
<td>53% S&amp;P 500/17% MSCI EAFE/30% Barclays Capital Aggregate</td>
</tr>
<tr>
<td>10/1/03 – 12/31/06</td>
<td>53% S&amp;P 500/15% MSCI EAFE/ACWI ex-U.S.1/26% Barclays Capital Aggregate/6% NCREIF ODCE</td>
</tr>
<tr>
<td></td>
<td>(lagged one quarter)</td>
</tr>
<tr>
<td>1/1/07 – 10/31/2009</td>
<td>31% S&amp;P 500/7% S&amp;P 400/7% S&amp;P 600/18% MSCI ACWI ex-U.S./5% Russell 2000 (lagged one quarter)/26% Barclays Capital Aggregate/6% NCREIF ODCE (lagged one quarter)</td>
</tr>
<tr>
<td>11/1/2009 – 6/30/2012</td>
<td>28% S&amp;P 500/6% S&amp;P 400/6% S&amp;P 600/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% NCREIF ODCE (lagged one quarter)/3% Dow Jones/UBS Commodities Index</td>
</tr>
<tr>
<td>7/1/2012 – 3/31/2015</td>
<td>23% S&amp;P 500/5% S&amp;P 400/5% S&amp;P 600/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/13% Barclays Capital Aggregate/5% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/3% S&amp;P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/8% NCREIF ODCE (lagged one quarter)/3% Dow Jones/UBS Commodities Index</td>
</tr>
<tr>
<td>4/1/2015 – 3/31/2017</td>
<td>20% S&amp;P 500/3% S&amp;P 400/3% S&amp;P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/4% Barclays Capital High Yield/10% S&amp;P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index</td>
</tr>
<tr>
<td>4/1/2017 – 6/30/2018</td>
<td>20% S&amp;P 500/3% S&amp;P 400/3% S&amp;P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&amp;P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index</td>
</tr>
<tr>
<td>7/1/2018 – Present</td>
<td>50% MSCI ACWI IMI Net w/ USA Gross, 20% NCREIF ODCE, 20% S&amp;P/LSTA Levered Loan Index + 250 basis points (lagged one quarter), 10% Barclays US Capital Aggregate</td>
</tr>
</tbody>
</table>

*Interim SAA Policy:* 52.2% MSCI ACWI IMI Net w/ USA Gross, 10.4% BBG Barclays US Aggregate Bond Index, 17.4% NCREIF ODCE, 20% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)

**Note:** *Interim SAA Policy includes proration of a total of Credit and Real Estate. Unfunded amounts were allocated 83.3% to Equity and 16.7% to Interest Sensitive Fixed Income. Recently approved Strategic Asset Allocation Policy effective July 1, 2018.*

Note: All International MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.
LONG-TERM DISABILITY STRATEGIC ASSET ALLOCATION POLICY HISTORY

- **1/1/2005 – 2/28/2007** - 53% Russell 3000/15% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- **3/1/2007 – 12/31/2010** - 50% Russell 3000/18% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- **1/1/2011 – 12/31/2012** - 40% Russell 1000/7% Russell 2000/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% DJ Wilshire Real Estate Securities Index/3% Bloomberg Commodity Index
- **1/1/2013 – 2/28/2016** - 34% Russell 1000/6% Russell 2000/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/13% Barclays Capital Aggregate/8% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/8% DJ Wilshire Real Estate Securities Index/4% Bloomberg Commodity Index
- **2/29/2016 – 7/26/2017** - 24% Russell 1000/12% Russell 2000/18% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/19% Barclays Capital Aggregate/7% Barclays Capital High Yield/11% DJ Wilshire Real Estate Securities Index/2% Bloomberg Commodity Index
- **7/27/2017 – 6/30/2018** - 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index
- **7/1/2018 – Present** - 50% MSCI ACWI IMI Net w/ USA Gross, 20% NCREIF ODCE, 20% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter), 10% Barclays US Capital Aggregate

*Interim SAA Policy:* 52.2% MSCI ACWI IMI Net w/ USA Gross, 10.4% BBG Barclays US Aggregate Bond Index, 17.4% NCREIF ODCE, 20% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)

Note: All International MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.
STRATEGIC ASSET ALLOCATION POLICY HISTORY

• **ASRS Custom Total Public Equity Benchmark** was 77% S&P 500, 23% MSCI EAFE through 12/31/1999; 76% S&P 500, 24% MSCI EAFE through 9/30/2003; 78% S&P 500, 22% MSCI EAFE/ACWI ex-U.S.¹ through 12/31/2006; 49% S&P 500, 11% S&P 400, 11% S&P 600, 29% MSCI ACWI ex-U.S. through 10/31/2009; 48% S&P 500, 10% S&P 400, 10% S&P 600, 23% MSCI EAFE, 4% MSCI EAFE Small Cap, 5% MSCI Emerging Markets through 6/30/2012; 41% S&P 500, 9% S&P 400, 9% S&P 600, 25% MSCI EAFE, 5% MSCI EAFE Small Cap, 11% MSCI Emerging Markets through 3/31/2015; 40% S&P 500, 6% S&P 400, 6% S&P 600, 34% MSCI EAFE, 4% MSCI EAFE Small Cap, 10% MSCI Emerging Markets through 6/30/2018; Asset weighted ACWI IMI w/USA Gross (Net) (public equity assets) and ACWI IMI w/USA Gross (Net) 1 qtr Lagged (private equity assets) thereafter

• **ASRS Custom Domestic Equity Benchmark** was S&P 500 through 12/31/2006; 74% S&P 500, 13% S&P 400, 13% S&P 600 through 12/31/2010; 70% S&P 500, 15% S&P 400, 15% S&P 600 through 3/31/2015.; 77% S&P 500, 11.5% S&P 400, 11.5% S&P 600 through 6/30/2018; 100% MSCI USA IMI thereafter.

• **ASRS Custom Domestic Large Cap Equity Benchmark** was the S&P 500 Index through 6/30/2018; MSCI USA Large Cap Index thereafter.

• **ASRS Custom Domestic Mid Cap Equity Benchmark** was the S&P 400 Index through 6/30/2018; MSCI USA Mid Cap Index thereafter.

• **ASRS Custom Small Cap Equity Benchmark** was the Russell 2000 Index through 12/31/2006; S&P 600 Index through 6/30/2018; MSCI USA Small Cap Index thereafter.

• **ASRS Custom International Equity Benchmark** was MSCI EAFE through 9/30/2005; MSCI ACWI ex-U.S. through 12/31/2010; 72% MSCI EAFE, 11% MSCI EAFE Small Cap and 17% MSCI Emerging Markets through 6/30/2012; 61% MSCI EAFE, 13% MSCI EAFE Small Cap and 26% MSCI Emerging Markets through 3/31/2015; 71% MSCI EAFE, 8% MSCI EAFE Small Cap and 21% MSCI Emerging Markets through 6/30/2018; MSCI ACWI IMI ex USA thereafter.

• **ASRS Custom Private Equity Benchmark** was the Russell 2000 Index 1 quarter lagged from inception to 6/30/2018; MSCI ACWI IMI Net w/ USA Gross 1 quarter lagged thereafter.

• **Custom Credit Benchmark** was 42% BBG US High Yield Index, 25% S&P LSTA Index lagged 1 quarter + 2.50%, 33% JP Morgan GBI-EM Global Diversified from 7/1/2012-3/31/2015; 29% BBG US High Yield Index, 71% S&P LSTA Index lagged 1 quarter + 2.50% from 4/1/2015-3/31/2017; 14% BBG US High Yield Index, 86% S&P LSTA Index lagged 1 quarter + 2.50% from 4/1/2017-6/30/2018; 100% S&P LSTA Index lagged 1 quarter + 2.50% thereafter

¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All International MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.
Information Disclaimer

• Past performance is no guarantee of future results.

• All investments carry some level of risk. Diversification and other asset allocation techniques are not guaranteed to ensure profit or protect against losses.

• NEPC’s source for portfolio pricing, calculation of accruals, and transaction information is the plan’s custodian bank. Information on market indices and security characteristics is received from other sources external to NEPC. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.

• Some index returns displayed in this report or used in calculation of a policy, allocation or custom benchmark may be preliminary and subject to change.

• This report is provided as a management aid for the client’s internal use only. Information contained in this report does not constitute a recommendation by NEPC.

• This report may contain confidential or proprietary information and may not be copied or redistributed to any party not legally entitled to receive it.

Reporting Methodology

• The client’s custodian bank is NEPC’s preferred data source unless otherwise directed. NEPC generally reconciles custodian data to manager data. If the custodian cannot provide accurate data, manager data may be used.

• Trailing time period returns are determined by geometrically linking the holding period returns, from the first full month after inception to the report date. Rates of return are annualized when the time period is longer than a year. Performance is presented gross and/or net of manager fees as indicated on each page.

• For managers funded in the middle of a month, the “since inception” return will start with the first full month, although actual inception dates and cash flows are taken into account in all Composite calculations.

• This report may contain forward-looking statements that are based on NEPC’s estimates, opinions and beliefs, but NEPC cannot guarantee that any plan will achieve its targeted return or meet other goals.
Agenda Item #5
Investment Compliance Reporting
Robert Butler, Investment Risk & Compliance Officer

Investment Committee Meeting
August 29, 2022
Agenda

- Internally Managed Portfolios Pre-Trade Compliance System

- ASRS Custody Bank’s Investment Compliance Program
  - Public Markets Portfolios Independent Investment Compliance Review
  - Total Fund Monthly Statutory Investment Compliance Review

- Private Markets Investment Compliance Program
  - RCLCO - Real Estate Separate Account Investment Compliance Review
  - Meketa Investment Group - Commingled Funds & Non-Real Estate Separate Accounts Investment Compliance Review
Internally Managed Portfolios Pre-Trade Compliance System

- For the internally managed portfolios, the Investment Management Division (IMD) utilizes Bloomberg’s Trade Order Management System (OMS) for executing and processing trades.

- The OMS platform has built-in pre-trade compliance rules capabilities to ensure trades will not surpass the established portfolio guidelines.

- Compliance rules are based on the investment guidelines:
  - Approved Investment Strategy Papers.
  - Applicable Arizona Revised Statutes.
Internally Managed Portfolios Pre-Trade Compliance System Review

Summary:

- Pre-Trade Compliance was performed on all internally managed fixed income and equity portfolios, for the period May 2022– July 2022.

- No exceptions occurred during the period under review.
Custody Bank Investment Compliance Program

Public Markets Portfolios Independent Investment Compliance Review.

- The ASRS Custody Bank’s Compliance Group provides daily and monthly compliance monitoring at the individual portfolio level, for all the internal and external investment portfolios on a post-trade basis.

- Daily monitoring allows for closer insight into the managers activity.

- The investment compliance rules are based on the investment guidelines:
  - Letters of Direction & Clarification (LODs) for the externally managed portfolios.
  - Investment Strategy Papers for the internally managed portfolios.
  - Applicable Arizona Revised Statutes.
Investment Compliance Reporting

Additional Layers of Compliance for countries currently designated by the United States Department of State as State Sponsors of Terrorism

- Our Public Market Investments are based on Indices that do not include state sponsors of terrorism or other sanctioned countries.

- Bloomberg flags sanctioned companies on their system, thus restricting trading and information related to those companies within their system.

- For public investments, our custody bank runs screens of our portfolio holdings to confirm that there are no investments in companies in violation of federal anti-terrorism laws.

- For private investments, our agreements with general partners inform them of our policy to not invest in any company that is violation of federal anti-terrorism laws.
Investment Compliance Reporting

Custody Bank Investment Compliance Program

Total Fund Monthly Statutory Investment Compliance Review.

- The ASRS Custody Bank’s Compliance Group provides compliance reporting and monitoring at the Total Fund level, known as the “Monthly Statute Tests Compliance” for:

  - Five mandated Arizona Revised Statutes on investment limits, under §A.R.S. 38-718.H-L.
    1. Max 80% Equity Test (§A.R.S. 38-718.H)
    3. Max 60% Internally Managed Assets Test (§A.R.S. 38-718.J)
    4. Max 5% Issuer Test (§A.R.S. 38-718.K)
    5. Max 10% Debt of Multinational Development Banks Test (§A.R.S. 38-718.L)

  - Arizona Restricted Country Test.
    • The test is setup to look at the Fund’s investment’s country of incorporation to identify companies that do business in or with countries currently designated by the United States Department of State as State Sponsors of Terrorism, pursuant to §35-392, Arizona Revised Statues, as added by Laws 2007, Chapter 201.

- Per statute requirements, the results are measured using market value.
Custody Bank Investment Compliance Review

Custody Bank Public Markets Portfolios & Statutory Investment Limits

Compliance Review Summary:

- The ASRS Custody Bank’s Compliance Group performed compliance reviews on all public markets portfolios, and at the Total Fund level investments for the period April 2022–June 2022.

- Public Markets Investment Limits:
  - 4 public markets portfolios for the period April 2022 – June 2022 (equities, fixed income) were reviewed.
  - The ASRS Custody Bank’s review found a few findings resulting from index changes, corporate actions, and informational flags.
  - All findings were researched and resolved to both the custody bank and ASRS’s satisfaction, for all periods.

- Total Fund Monthly Statutory Investment Limits:
  - Total Fund investments passed the five mandated statutes on investment limits, as well as the Arizona Restricted Country Test for all periods.
Investment Compliance Reporting

Private Markets Investment Compliance Program

RCLCO - Real Estate Separate Account Investment Compliance Review

- Review audited financial statements at a high level for significant issues.
- Review and note if financial statements are prepared on a fair value basis noting whether liabilities are marked to market or not.
- Review the calculation of ASRS Net Asset Value (i.e. the waterfall calculation) and comment to the manager and ASRS if any errors are noted.
- Review the management fee calculation and other fees paid to the manager, including review of the NOI calculation to determine if it has been calculated correctly and it appropriate reserves have been deducted, and comment to the manager and ASRS if any errors are noted.
- Review valuation policies for consistency with ASRS policies, operating agreements and standards.
- Review expense policies for consistency with ASRS policies, operating agreements, and standards.
- Work with the manager and ASRS as necessary to address concerns and questions.
Private Markets Investment Compliance Program

**RCLCO - Real Estate Separate Account Compliance Review Summary:**

- RCLCO completed 21 compliance reviews for the 2020 review period.

- RCLCO’s review found immaterial inconsistencies related to the management fee, NAV calculations, and equity positions, none of which had an impact to the percentage allocation of NAV between the ASRS and the Funds. All findings have been satisfactorily resolved.

- While each of the foregoing issues have been addressed by the respective managers, RFA will continue monitoring both the calculations and corrective actions during the 2021 compliance review process.

- The population of investments to be reviewed for 2021 has been identified and RCLCO is targeting to have compliance review completed by 4th quarter.
Private Markets Investment Compliance Program

Meketa Investment Group - Commingled Funds & Non-Real Estate Separate Accounts Investment Compliance Review

- Review managers’ calculations of:
  - Asset management fees
  - Partnership expenses
  - Carried interest
- Review investment valuation policy
- Ensure calculation and policy agree to investment documentation, agreements, and manager policies.
- If a deficiency is noted, the consultant will address with the sponsor and work to resolve deficiencies.
- All results are communicated to ASRS.
- A summary report will be presented to the ASRS to communicate findings on an annual basis.
Meketa Investment Group - Commingled Funds & Non-Real Estate Separate Accounts Investment Compliance Summary Review:

- Meketa has completed 9 compliance reviews for the 2020 period and no material issues were identified during the reviews of these funds.
- An additional 30 funds are under review.
Agenda Item #6
MEMORANDUM

TO: Mr. Michael Lofton, Chair, Arizona State Retirement System (ASRS) Investment Committee (IC)

FROM: Mr. Paul Matson, Director
       Mr. Michael Viteri, Chief Investment Officer

DATE: August 18, 2022

RE: Agenda Item 6: Presentation, Discussion, and Appropriate Action Regarding the Current Asset Liability Study

Purpose
To provide informational background on the Asset Liability Study and recommended portfolio mix, asset class ranges, and benchmarks for the ASRS Pension, Health, & LTD fund.

Recommendation:
Action item: To ensure compliance with open meeting law, staff will provide recommendations for Committee consideration during the presentation.

Background
Every three to five years, the ASRS works with its General Consultant, currently NEPC, to conduct Asset/Liability Modeling and a subsequent Asset Allocation Study.

The fundamental goal of the asset liability study is to develop an asset allocation (investment structure) that maximizes the expected long-term return on the fund while minimizing the expected risk. For the ASRS, “long-term return” is considered as the average return over several decades. For the ASRS, “risk” is considered in terms of the impact on the level and volatility of contribution rates for our employees and employers.

The ASRS definition of risk for this purpose is different than various other definitions of risk that typically focus on monthly portfolio volatility or other technical measures.

The combination of investment returns plus contributions are what fund the payment of current and future pensions, and as such any increase to long-term average investment returns will decrease the need for increased contribution rates to our employees and employers.

At a high-level, the following can be considered key expected outcomes of a successful asset allocation (investment structure) program that is designed to maximize average long-term rates of return, and, therefore long-term fund value:

NOTE: Each of the following should also be considered in combination with various actuarial methods, which can work synergistically with investment decisions.
1. Maximize the long-term (geometric) average investment rate of return in order to minimize the long-term average contribution rate, subject to prudent risk levels.
2. Mitigate contribution rate volatility
3. Achieve long-term full funding
4. Ensure liquidity

Supplemental outcomes include:

- Increase funded status based upon actuarial value of assets
- Increase funded status based upon the market value of assets
- Mitigate monthly downside portfolio volatility
- Mitigate Expenses

Other considerations include:

- Peer comparison critique
- Other

A key component of an Asset/Liability study is reviewing the actuarial requirements of the plan. These include both current and future liabilities and net external cash flow (cash received from contributions less benefit payments. A mature defined benefit plan such as the ASRS will typically have a negative cash flow as more participants retire.

The structuring of the fund is the process of determining the optimal allocation among broad asset classes, where an asset class is considered to a set of investments that have similar characteristics – such as “US Stocks”, “US Real Estate”, and “Foreign Bonds.”

Returns generated or earned by the fund should be considered in conjunction with the risk that the fund will support, where risk to the ASRS is essentially the possibility of a long-term decrease in the value of the fund relative to the current assumed 7% return assumption. These long-term changes in the value of the fund are typically caused by changes in economic conditions, interest rates, and many other economic and non-economic variables.

The impact of short-term investment volatility on contribution rates is significantly mitigated through the actuarial methods of smoothing and amortizing. Therefore, lowering expected short-term investment volatility at the expense of lowering expected returns is counter-productive.

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Target</th>
<th>Ranges</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Equity</td>
<td>44%</td>
<td>34% - 54%</td>
<td>MSCI ACWI IMI Net USA Gross</td>
</tr>
<tr>
<td>Private Equity</td>
<td>10%</td>
<td>7% - 13%</td>
<td>MSCI ACWI IMI Net USA Gross QTR Lagged</td>
</tr>
<tr>
<td>Credit</td>
<td>23%</td>
<td>17% - 26%</td>
<td>S&amp;P LSTA Leveraged Loan Index + 250 bps</td>
</tr>
<tr>
<td>Interest Rate Sensitive</td>
<td>6%</td>
<td>3% - 12%</td>
<td>Bloomberg Treasury Index</td>
</tr>
<tr>
<td>Private Real Estate</td>
<td>17%</td>
<td>13% - 21%</td>
<td>NCREIF ODCE Index</td>
</tr>
</tbody>
</table>

**Supplemental Information:**

Asset allocation is the primary determinant of investment return and asset volatility. As such, the study is a forward-looking exercise based upon assumptions of expected return, expected standard deviation of return, and correlations between and amongst asset classes. The return of an asset class in any given year is nearly impossible to forecast. Asset class returns vary day to
day as a function of various factors such as valuations, inflation, investor behavior, growth, yield, government rates, credit spreads, earnings growth, etc. The following table produced by Callan Consulting shows the variation in asset class returns on a calendar year basis ranked in order of performance.

### The Callan Periodic Table of Investment Returns

**Annual Returns for Key Indices Ranked in Order of Performance (2002–2021)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash</th>
<th>U.S. Fixed Income</th>
<th>Small Cap Equity</th>
<th>Large Cap Equity</th>
<th>Real Estate</th>
<th>Cash</th>
<th>U.S. Fixed Income</th>
<th>Small Cap Equity</th>
<th>Large Cap Equity</th>
<th>Real Estate</th>
</tr>
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<tbody>
<tr>
<td>2002</td>
<td>-5.30%</td>
<td>-12.54%</td>
<td>-4.58%</td>
<td>15.79%</td>
<td>4.94%</td>
<td>-33.78%</td>
<td>27.13%</td>
<td>15.25%</td>
<td>20.45%</td>
<td>21.89%</td>
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<tr>
<td>2003</td>
<td>2.67%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
</tr>
<tr>
<td>2004</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2005</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2006</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2007</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2008</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
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<tr>
<td>2009</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2010</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
</tr>
<tr>
<td>2011</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2012</td>
<td>5.30%</td>
<td>5.50%</td>
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<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2013</td>
<td>5.30%</td>
<td>5.50%</td>
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<td>-4.75%</td>
<td>3.96%</td>
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<td>2014</td>
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<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2015</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<td>2016</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
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<td>2017</td>
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<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2019</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
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<tr>
<td>2020</td>
<td>5.30%</td>
<td>5.50%</td>
<td>8.50%</td>
<td>8.90%</td>
<td>-18%</td>
<td>-4.75%</td>
<td>3.96%</td>
<td>-21.25%</td>
<td>11.5%</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

NEPC's forward-looking asset class models (typically referred to as capital market assumptions) incorporate current and forecasted market and economic data to inform expected returns, expected risk (standard deviation of returns), and intra-asset class correlations. Similar to most investment consultants, NEPC uses a building block methodology to systematically formulate expected returns within and across asset classes. For example, equity building blocks are established by factors such as real earnings growth, dividend yield, inflation, valuation, and an illiquidity premium. Fixed income building blocks are derived from factors such as government rates, credit spreads, spread price change, credit deterioration, government rates price change and an illiquidity premium.

NEPC’s building block approach is the baseline for return and risk characteristics and correlations among asset classes (i.e., this constitutes the baseline beta of each asset class). Consideration is also given to each plan’s sophistication and implementation expertise by taking into account demonstrated and historically consistent excess returns (alpha) or long-term differences in the volatility of each asset class. For example, an argument can be made that ASRS’ 12-year track record of implementing Private Credit has consistently provided higher returns and lower volatility than the benchmark, justifying changing the capital market assumptions of this asset class in the asset allocation study.
SUMMARY, ANALYSIS & RECOMMENDATION
EXECUTIVE SUMMARY: GOALS & PROCESS

Goals:

Establish policy asset allocation targets, including asset allocation ranges and benchmarks, in order to:

1. Maximize the long-term (geometric) average investment rate of return to minimize the long-term average contribution rate, subject to prudent risk levels.
2. Mitigate contribution rate volatility
3. Achieve long-term full funding
4. Ensure liquidity

Process:

- Correctly identify the appropriate risk metrics
- Determine current capital market assumptions (expected returns and volatilities)
- Project the size of liabilities and the timing of payments
- Conduct various deterministic and stochastic simulations
- Evaluate alternative asset allocations
- Measure the various relevant risk metrics including:
  - Future contribution rate levels
  - Future contribution rate volatility
  - Smoothed Asset Funded status
  - Unsmoothed Asset Funded status
  - Other
# PROCESS

## ASSET LIABILITY STUDY

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Obtain Actuarial Valuation from GRS (basis for Liability Projection)</td>
</tr>
<tr>
<td>2.</td>
<td>Release 2022 standard NEPC Capital Market Assumptions Themes, Inflation, 10 year, 30 year returns</td>
</tr>
<tr>
<td>3.</td>
<td>Customize Asset Class Forecasts for the asset classes</td>
</tr>
<tr>
<td>4.</td>
<td>Investment Committee Meeting Provide background on Asset Liability Modeling and Asset Allocation Study, Review Capital Market Assumptions, 10 and 20 year outlook for current allocation and policy targets. Solicit Feedback on changes/concerns</td>
</tr>
<tr>
<td>5.</td>
<td>Review efficient frontiers (including constraints). Propose and evaluate alternate mixes based on return/risk/liquidity</td>
</tr>
<tr>
<td>6.</td>
<td>Evaluate study and stochastic results using current actual and policy target allocation. Present alternate mixes (asset only analysis) for discussion. Choose Revised Policy Targets. Evaluate benchmarks and ranges</td>
</tr>
<tr>
<td>7.</td>
<td>Present Full study including alternate mixes and stochastic results. Approve Revised Investment Policy including Revised Targets, Ranges, and Benchmarks</td>
</tr>
</tbody>
</table>
# RECOMMENDATION

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Policy Target</th>
<th>Range</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>50.0%</td>
<td>35%-65%</td>
<td>Asset Weighted: MSCI ACWI IMI Net USA Gross + MSCI ACWI IMI Net USA Gross 1 QTR Lagged</td>
</tr>
<tr>
<td>Public Equity</td>
<td></td>
<td></td>
<td>MSCI ACWI IMI Net USA Gross</td>
</tr>
<tr>
<td>Private Equity</td>
<td></td>
<td></td>
<td>MSCI ACWI IMI Net USA Gross 1 QTR Lagged</td>
</tr>
<tr>
<td>Credit</td>
<td>20.0%</td>
<td>10%-30%</td>
<td>S&amp;P LSTA Index 1 QTR Lagged + 2.5%</td>
</tr>
<tr>
<td>Interest Rate Sensitive</td>
<td>10.0%</td>
<td>0%-20%</td>
<td>Bloomberg US Aggregate Bond Index</td>
</tr>
<tr>
<td>Real Estate</td>
<td>20.0%</td>
<td>10%-30%</td>
<td>NCREIF ODCE NET 1 QTR Lagged</td>
</tr>
</tbody>
</table>

## Recommended (Mix 12)

<table>
<thead>
<tr>
<th>Policy Target</th>
<th>Range</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.0%</td>
<td>34%-54%</td>
<td>MSCI ACWI IMI Net USA Gross</td>
</tr>
<tr>
<td>10.0%</td>
<td>7%-13%</td>
<td>MSCI ACWI IMI Net USA Gross 1 QTR Lagged</td>
</tr>
<tr>
<td>23.0%</td>
<td>17%-26%</td>
<td>S&amp;P LSTA Index 1 QTR Lagged + 2.5%</td>
</tr>
<tr>
<td>6.0%</td>
<td>3%-12%</td>
<td>Bloomberg US Treasury Index</td>
</tr>
<tr>
<td>17.0%</td>
<td>13%-21%</td>
<td>NCREIF ODCE NET 1 QTR Lagged</td>
</tr>
</tbody>
</table>

The recommended asset allocation is Mix 12 and includes the following changes:

- Increase Public Equity by 4% to: 44% of Total Fund
- Maintain Private Equity at: 10% of Total Fund
- Increase Credit by 3% to: 23% of Total Fund
- Decrease Interest Rate Sensitive by 4% to: 6% of Total Fund
  - Change benchmark to Bloomberg US Treasuries Index
- Reduce Real Estate by 3% to: 17% of Total Fund
- Asset class Ranges as presented
The Arizona State Retirement System administers two main defined benefit plans:
- Pension Plan: traditional final average salary pension benefits
- 401(h) Plan: supplemental health premium benefits

Pension Plan is by far the main cost driver within the system:
- Consists of 96% of system assets and 98% of system liabilities

As of June 30, 2021 ASRS is 71.5% funded based on a smoothed asset value:
- 80.0% funded on a market value basis

Among other assumption and method changes, the discount rate was decreased from 7.50% to 7.00%:
- Impact from these changes is being phased-in over 3 years to minimize contribution volatility

Strong investment performance in FY21 and smoothed asset methodology will help to balance impact from recent assumption changes

Source: GRS
ARIZONA STATE RETIREMENT SYSTEM

PLAN RISK PROFILE

**Funded Status**

- Liability Discount Rate: 7.0%
- Funded Status: 71.5%
- Contribution Rate: 24.1%

**Asset Allocation**

- Public Equity: 40%
- Private Equity: 10%
- Credit: 20%
- Private Real Estate: 20%
- Interest Rate Sensitive: 10%

**Performance**

- 10-Yr Expected Return: 6.8% (NEPC) vs. 7.2% (ASRS)
- 20-Yr Expected Return: 7.3% (NEPC) vs. 7.4% (ASRS)
- Asset Volatility: 9.8% (NEPC) vs. 9.3% (ASRS)

Notes: 1 Current Policy targets
CURRENT POLICY
DETERMINISTIC PROJECTIONS
Notes: As of June 30; Assumes Current Policy allocation NEPC Beta 10-yr expected return of 6.8% per annum
ARIZONA STATE RETIREMENT SYSTEM
10-YR FUNDED STATUS PROJECTION – PENSION & BENEFIT
ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes Current Policy allocation ASRS Alpha 10-yr expected return of 7.2% per annum
ARIZONA STATE RETIREMENT SYSTEM
10-YR FUNDED STATUS PROJECTION – PENSION
NEPC BETA RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes Current Policy allocation NEPC Beta 10-yr expected return of 6.8% per annum
ARIZONA STATE RETIREMENT SYSTEM

10-YR FUNDED STATUS PROJECTION – PENSION

ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes Current Policy allocation ASRS Alpha 10-yr expected return of 7.2% per annum
ARIZONA STATE RETIREMENT SYSTEM
10-YR CONTRIBUTION PROJECTION – PENSION & BENEFIT
NEPC BETA RETURN ASSUMPTIONS

Contributions

<table>
<thead>
<tr>
<th>Year</th>
<th>Employer Contribution</th>
<th>Member Contribution</th>
<th>Contribution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.4%</td>
</tr>
<tr>
<td>2023</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.1%</td>
</tr>
<tr>
<td>2024</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.1%</td>
</tr>
<tr>
<td>2025</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.5%</td>
</tr>
<tr>
<td>2026</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.1%</td>
</tr>
<tr>
<td>2027</td>
<td>$1,600</td>
<td>$2,000</td>
<td>24.0%</td>
</tr>
<tr>
<td>2028</td>
<td>$1,600</td>
<td>$2,000</td>
<td>23.7%</td>
</tr>
<tr>
<td>2029</td>
<td>$1,600</td>
<td>$2,000</td>
<td>23.2%</td>
</tr>
<tr>
<td>2030</td>
<td>$1,600</td>
<td>$2,000</td>
<td>23.2%</td>
</tr>
<tr>
<td>2031</td>
<td>$1,600</td>
<td>$2,000</td>
<td>22.9%</td>
</tr>
</tbody>
</table>

Notes: For the fiscal year ending June 30; Assumes Current Policy allocation NEPC Beta 10-yr expected return of 6.8% per annum
ARIZONA STATE RETIREMENT SYSTEM
10-YR CONTRIBUTION PROJECTION – PENSION & BENEFIT
ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Contributions

<table>
<thead>
<tr>
<th>Year</th>
<th>Employer Contribution</th>
<th>Member Contribution</th>
<th>Contribution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>$1,200</td>
<td>$400</td>
<td>24.4%</td>
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<tr>
<td>2023</td>
<td>$1,220</td>
<td>$400</td>
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<td>2024</td>
<td>$1,240</td>
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<td>2025</td>
<td>$1,250</td>
<td>$400</td>
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<tr>
<td>2026</td>
<td>$1,260</td>
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<td>24.2%</td>
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<td>$1,270</td>
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<td>$1,290</td>
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<td>$1,300</td>
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<tr>
<td>2031</td>
<td>$1,310</td>
<td>$400</td>
<td>22.7%</td>
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</table>

Notes: For the fiscal year ending June 30; Assumes Current Policy allocation ASRS Alpha 10-yr expected return of 7.2% per annum
ARIZONA STATE RETIREMENT SYSTEM
10-YR NET CASH FLOW – PENSION & BENEFIT
NEPC BETA RETURN ASSUMPTIONS

Notes: For the fiscal year ending June 30; Assumes Current Policy allocation NEPC Beta 10-yr expected return of 6.8% per annum.
ARIZONA STATE RETIREMENT SYSTEM
30-YR FUNDED STATUS PROJECTION – PENSION & BENEFIT
NEPC BETA RETURN ASSUMPTIONS

Funded Ratio

Billions

Notes: As of June 30; Assumes Current Policy allocation NEPC Beta 20-yr expected return of 7.3% per annum
ARIZONA STATE RETIREMENT SYSTEM
30-YR FUNDED STATUS PROJECTION – PENSION & BENEFIT
ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes Current Policy allocation ASRS Alpha 20-yr expected return of 7.4% per annum
ARIZONA STATE RETIREMENT SYSTEM
30-YR FUNDED STATUS PROJECTION – PENSION
NEPC BETA RETURN ASSUMPTIONS

Notes: As of June 30; Assumes Current Policy allocation NEPC Beta 20-yr expected return of 7.3% per annum

Funded Ratio

Dates: 2021 to 2051
Values:
- Pension
- Pension Market Value
- Health
- Health Market Value

% Values:
- 0% to 160%

Years:
- 2021
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028
- 2029
- 2030
- 2031
- 2032
- 2033
- 2034
- 2035
- 2036
- 2037
- 2038
- 2039
- 2040
- 2041
- 2042
- 2043
- 2044
- 2045
- 2046
- 2047
- 2048
- 2049
- 2050
- 2051

Values shown in the graph:
- 148.9%
- 142.6%
- 133.3%
- 123.1%
- 119.9%
- 120.5%
- 122.0%
- 78%
- 83%
- 87%
- 93%
- 100%
- 104%
- 70%
- 79%
- 86%
- 93%
- 100%
- 104%

Notes: As of June 30; Assumes Current Policy allocation NEPC Beta 20-yr expected return of 7.3% per annum
Notes: As of June 30; Assumes Current Policy allocation ASRS Alpha 20-yr expected return of 7.4% per annum
ARIZONA STATE RETIREMENT SYSTEM
30-YR CONTRIBUTION PROJECTION – PENSION & BENEFIT
NEPC BETA RETURN ASSUMPTIONS

Notes: For the fiscal year ending June 30; Assumes Current Policy allocation NEPC Beta 30-yr expected return of 7.3% per annum

<table>
<thead>
<tr>
<th>Year</th>
<th>Contributions</th>
<th>% of Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>$2,500</td>
<td>24.4%</td>
</tr>
<tr>
<td>2023</td>
<td>$2,200</td>
<td>23.7%</td>
</tr>
<tr>
<td>2024</td>
<td>$2,000</td>
<td>22.1%</td>
</tr>
<tr>
<td>2025</td>
<td>$1,800</td>
<td>22.1%</td>
</tr>
<tr>
<td>2026</td>
<td>$1,600</td>
<td>22.1%</td>
</tr>
<tr>
<td>2027</td>
<td>$1,400</td>
<td>22.1%</td>
</tr>
<tr>
<td>2028</td>
<td>$1,200</td>
<td>22.1%</td>
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<td>2049</td>
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<tr>
<td>2050</td>
<td>$8,000</td>
<td>22.3%</td>
</tr>
<tr>
<td>2051</td>
<td>$8,500</td>
<td>22.3%</td>
</tr>
</tbody>
</table>

*Employer Contribution* | *Member Contribution* | *Contribution Rate*
Notes: For the fiscal year ending June 30; Assumes Current Policy allocation ASRS Alpha 30-yr expected return of 7.4% per annum
ARIZONA STATE RETIREMENT SYSTEM

30-YR NET CASH FLOW – PENSION & BENEFIT

NEPC BETA RETURN ASSUMPTIONS

Net Cash Flow

Notes: For the fiscal year ending June 30; Assumes Current Policy allocation NEPC Beta 30-yr expected return of 7.3% per annum
ARIZONA STATE RETIREMENT SYSTEM

STOCHASTIC FUNDED RATIO – SMOOTHED ASSET VALUES

ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes mean expected return equal to the ASRS Alpha 20-year expected return of 7.4% with 9.3% volatility per annum.
ARIZONA STATE RETIREMENT SYSTEM
STOCHASTIC CONTRIBUTION RATE (PENSION, HEALTH, LTD)
ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Contribution Rate

% of Salary

25th-50th
50th-75th
75th-95th
Above 95th
Median

Notes: For the fiscal year ending June 30; Assumes mean expected return equal to the ASRS Alpha 20-year expected return of 7.4% with 9.3% volatility per annum.
ALTERNATIVE ASSET ALLOCATIONS
# ARIZONA STATE RETIREMENT SYSTEM

## ALTERNATIVE ASSET ALLOCATIONS

### NEPC BETA RETURN ASSUMPTIONS

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Policy Target</th>
<th>Mix 2</th>
<th>Mix 7</th>
<th>Mix 10</th>
<th>Mix 12</th>
<th>Public Funds &gt;$1B</th>
<th>10 Yr Return</th>
<th>20 Yr Return</th>
<th>Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Equity</td>
<td>40.0%</td>
<td>40.0%</td>
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<td>44.0%</td>
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## ARIZONA STATE RETIREMENT SYSTEM

### ALTERNATIVE ASSET ALLOCATIONS

### ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

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## ARIZONA STATE RETIREMENT SYSTEM

### RETURN ASSUMPTION SUMMARY

#### NEPC Beta

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#### ASRS Portfolio Construction

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<td>0.60</td>
<td>0.58</td>
<td>0.56</td>
<td>0.57</td>
<td>0.41</td>
</tr>
<tr>
<td>Probability of 1-Year Return</td>
<td>22.0%</td>
<td>21.8%</td>
<td>22.6%</td>
<td>23.4%</td>
<td>23.0%</td>
<td>28.9%</td>
</tr>
<tr>
<td>Probability of 10-Year Return</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.9%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Probability of 10-Year Return</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability of 10-Year Return</td>
<td>47.3%</td>
<td>45.2%</td>
<td>54.2%</td>
<td>45.8%</td>
<td>45.8%</td>
<td>63.6%</td>
</tr>
<tr>
<td>Probability of 20-Year Return</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Probability of 20-Year Return</td>
<td>41.6%</td>
<td>39.0%</td>
<td>48.1%</td>
<td>39.7%</td>
<td>39.5%</td>
<td>62.0%</td>
</tr>
</tbody>
</table>

**Notes:** Illiquid Assets includes Private Equity, Credit, Real Estate, Hedge Funds
ARIZONA STATE RETIREMENT SYSTEM

MEDIAN FUNDED STATUS – UNSMOOTHED ASSET VALUES

ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes mean expected return equal to the ASRS Alpha 20-year expected return and volatility per annum for each mix.
ARIZONA STATE RETIREMENT SYSTEM

MEDIAN FUNDED STATUS – SMOOTHED ASSET VALUES

ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Funded Ratio

Notes: As of June 30; Assumes mean expected return equal to the ASRS Alpha 20-year expected return and volatility per annum for each mix.
ARIZONA STATE RETIREMENT SYSTEM

MEDIAN CONTRIBUTION RATE (PENSION, HEALTH, LTD)

ASRS PORTFOLIO CONSTRUCTION RETURN ASSUMPTIONS

Contribution Rate

% of Salary

Notes: For the fiscal year ending June 30; Assumes mean expected return equal to the ASRS Alpha 20-year expected return and volatility per annum for each mix.
## ARIZONA STATE RETIREMENT SYSTEM

**CONTRIBUTION RATE STATISTICS**

**NEPC BETA RETURN ASSUMPTIONS**

<table>
<thead>
<tr>
<th>Mix</th>
<th>30-Yr Avg Contribution Rate</th>
<th>30-Yr Std Dev Contribution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Policy</td>
<td>20.6%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Mix 2</td>
<td>20.2%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Mix 7</td>
<td>21.7%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Mix 10</td>
<td>20.3%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Mix 12</td>
<td>20.4%</td>
<td>5.7%</td>
</tr>
<tr>
<td>PF&gt;$1B</td>
<td>24.3%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

*Notes: Data represents median outcomes*
ARIZONA STATE RETIREMENT SYSTEM

SCENARIO ANALYSIS

Notes: Scenarios reflect a 5-year market cycle. Change in Funded Ratio is relative to 71.5%, change in Funded Ratio – Market Value is relative to 80.0% as of June 30, 2021. Change in Contribution is relative to $2.720 million, change in Contribution Rate is relative to 24.4% for the fiscal year ending June 30, 2022.
ARIZONA STATE RETIREMENT SYSTEM
ASSUMPTIONS AND METHODS

- Deterministic and stochastic return projections are based on NEPC’s 12/31/2021 capital market assumptions
  - FYTD return of 5.5% thru 3/31/2022, thereafter NEPC’s expected returns assumed

- Asset-liability projections follow a roll-forward methodology based on the June 30, 2021 Actuarial Valuation Report
  - Benefit payment projections provided by GRS
  - Other than those described herein, all assumptions remain unchanged from the valuation
  - No gains or losses are assumed other than those attributed to investment experience and Permanent Benefit Increases (PBI)

- Assets, liabilities and cash flows were modeled for each individual plan and aggregated in the results noted “Pension/System Level”
  - Individual plan results also provided for select outputs

- Contributions based on gross normal cost-plus layered amortizations of unfunded liability
  - Employers and Members pay an equal share of the contribution requirement
INTERPRETING STOCHASTIC RESULTS

Model ranks 10,000 forecasts each year

- **95th percentile**
  - Exceeds 95% of all forecasts
  - Overly optimistic outcome

- **75th percentile**
  - Exceeds 75% of all forecasts
  - Optimistic outcome

- **50th percentile**
  - Exceeds 50% of all forecasts
  - Median outcome

- **25th percentile**
  - Exceeds 25% of all forecasts
  - Pessimistic outcome

- **5th percentile**
  - Exceeds 5% of all forecasts
  - Overly pessimistic outcome
# 12/31/2021 CAPITAL MARKET ASSUMPTIONS

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>10-Year Return</th>
<th>30-Year Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MACRO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>2.4%</td>
<td>2.6%</td>
<td>—</td>
</tr>
<tr>
<td>Cash</td>
<td>1.5%</td>
<td>2.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>US Leverage Cost</td>
<td>1.9%</td>
<td>2.7%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Non-US Cash</td>
<td>0.4%</td>
<td>1.4%</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>EQUITY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Large-Cap Equity</td>
<td>4.3%</td>
<td>6.1%</td>
<td>16.6%</td>
</tr>
<tr>
<td>US Small/Mid-Cap Equity</td>
<td>5.6%</td>
<td>6.6%</td>
<td>20.7%</td>
</tr>
<tr>
<td>Non-US Developed Equity</td>
<td>5.2%</td>
<td>6.2%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Non-US Developed Equity (USD Hedge)</td>
<td>5.4%</td>
<td>6.4%</td>
<td>17.6%</td>
</tr>
<tr>
<td>Non-US Developed Small-Cap Equity</td>
<td>5.9%</td>
<td>6.8%</td>
<td>24.2%</td>
</tr>
<tr>
<td>Emerging Market Equity</td>
<td>8.3%</td>
<td>8.7%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Emerging Market Small-Cap Equity</td>
<td>7.6%</td>
<td>8.7%</td>
<td>34.4%</td>
</tr>
<tr>
<td>Global Equity*</td>
<td>5.4%</td>
<td>6.8%</td>
<td>17.9%</td>
</tr>
<tr>
<td>Hedge Fund – Equity</td>
<td>4.1%</td>
<td>5.2%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Private Equity – Buyout</td>
<td>7.3%</td>
<td>8.5%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Private Equity – Growth</td>
<td>8.6%</td>
<td>9.7%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Private Equity – Venture</td>
<td>10.0%</td>
<td>10.7%</td>
<td>45.0%</td>
</tr>
<tr>
<td>Private Equity – Secondary</td>
<td>6.8%</td>
<td>7.9%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Non-US Private Equity</td>
<td>10.3%</td>
<td>10.7%</td>
<td>32.0%</td>
</tr>
<tr>
<td>Private Equity*</td>
<td>9.0%</td>
<td>10.0%</td>
<td>25.2%</td>
</tr>
<tr>
<td>China Equity</td>
<td>8.8%</td>
<td>8.8%</td>
<td>28.6%</td>
</tr>
<tr>
<td>US Microcap Equity</td>
<td>6.5%</td>
<td>7.5%</td>
<td>25.8%</td>
</tr>
</tbody>
</table>
## 12/31/2021 CAPITAL MARKET ASSUMPTIONS

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>10-Year Return</th>
<th>30-Year Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>US TIPS</td>
<td>1.4%</td>
<td>2.6%</td>
<td>5.8%</td>
</tr>
<tr>
<td>US Treasury Bond</td>
<td>1.5%</td>
<td>2.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>US Corporate Bond</td>
<td>2.8%</td>
<td>4.2%</td>
<td>7.3%</td>
</tr>
<tr>
<td>US Mortgage-Backed Securities</td>
<td>1.8%</td>
<td>2.8%</td>
<td>6.5%</td>
</tr>
<tr>
<td><strong>US Aggregate Bond</strong>*</td>
<td><strong>2.0%</strong></td>
<td><strong>3.1%</strong></td>
<td><strong>5.6%</strong></td>
</tr>
<tr>
<td>US High Yield Corporate Bond</td>
<td>3.2%</td>
<td>5.4%</td>
<td>11.2%</td>
</tr>
<tr>
<td>US Leveraged Loan</td>
<td>4.7%</td>
<td>5.6%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Emerging Market External Debt</td>
<td>4.1%</td>
<td>5.1%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Emerging Market Local Currency Debt</td>
<td>5.7%</td>
<td>5.3%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Non-US Government Bond</td>
<td>1.1%</td>
<td>1.9%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Non-US Government Bond (USD Hedge)</td>
<td>1.3%</td>
<td>2.2%</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>Global Government Bond</strong>*</td>
<td><strong>1.2%</strong></td>
<td><strong>2.2%</strong></td>
<td><strong>7.6%</strong></td>
</tr>
<tr>
<td><strong>Global Government Bond (USD Hedge)</strong></td>
<td><strong>1.3%</strong></td>
<td><strong>2.3%</strong></td>
<td><strong>4.0%</strong></td>
</tr>
<tr>
<td>Non-US Inflation-Linked Bond (USD Hedge)</td>
<td>0.7%</td>
<td>1.4%</td>
<td>5.9%</td>
</tr>
<tr>
<td><strong>Global Multi-Sector Fixed Income</strong>*</td>
<td><strong>3.6%</strong></td>
<td><strong>4.8%</strong></td>
<td><strong>7.8%</strong></td>
</tr>
<tr>
<td><strong>Absolute Return Fixed Income</strong>*</td>
<td><strong>2.9%</strong></td>
<td><strong>4.3%</strong></td>
<td><strong>5.8%</strong></td>
</tr>
<tr>
<td>US Municipal Bond</td>
<td>1.6%</td>
<td>2.5%</td>
<td>6.0%</td>
</tr>
<tr>
<td>US Municipal Bond (1-10 Year)</td>
<td>1.2%</td>
<td>2.3%</td>
<td>4.5%</td>
</tr>
<tr>
<td>US High Yield Municipal Bond</td>
<td>2.1%</td>
<td>3.9%</td>
<td>12.0%</td>
</tr>
<tr>
<td>Hedge Fund - Credit</td>
<td>4.2%</td>
<td>5.7%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Private Debt - Credit Opportunities</td>
<td>6.5%</td>
<td>7.4%</td>
<td>14.4%</td>
</tr>
<tr>
<td>Private Debt – Distressed</td>
<td>7.2%</td>
<td>8.2%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Private Debt - Direct Lending</td>
<td>6.2%</td>
<td>7.8%</td>
<td>10.5%</td>
</tr>
<tr>
<td><strong>Private Debt</strong>*</td>
<td><strong>6.6%</strong></td>
<td><strong>7.9%</strong></td>
<td><strong>11.6%</strong></td>
</tr>
<tr>
<td>Asset Class</td>
<td>10-Year Return</td>
<td>30-Year Return</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>US Short-Term TIPS (1-3 Year)</td>
<td>1.2%</td>
<td>2.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>US Short-Term Treasury Bond (1-3 Year)</td>
<td>1.4%</td>
<td>2.4%</td>
<td>2.1%</td>
</tr>
<tr>
<td>US Short-Term Corporate Bond (1-3 Year)</td>
<td>2.3%</td>
<td>3.4%</td>
<td>3.0%</td>
</tr>
<tr>
<td>US Short-Term High Yield Corporate Bond (1-3 Year)</td>
<td>2.3%</td>
<td>3.7%</td>
<td>8.5%</td>
</tr>
<tr>
<td>US Intermediate-Term TIPS (3-10 Year)</td>
<td>1.5%</td>
<td>2.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>US Intermediate-Term Treasury Bond (3-10 Year)</td>
<td>1.6%</td>
<td>2.7%</td>
<td>5.5%</td>
</tr>
<tr>
<td>US Intermediate-Term Corporate Bond (3-10 Year)</td>
<td>3.0%</td>
<td>4.4%</td>
<td>6.5%</td>
</tr>
<tr>
<td>US Long-Term Treasury Bond (10-30 Year)</td>
<td>1.3%</td>
<td>2.3%</td>
<td>10.9%</td>
</tr>
<tr>
<td>US Long-Term TIPS (10-30 Year)</td>
<td>1.4%</td>
<td>2.4%</td>
<td>11.6%</td>
</tr>
<tr>
<td>US Long-Term Corporate Bond (10-30 Year)</td>
<td>2.8%</td>
<td>4.2%</td>
<td>10.7%</td>
</tr>
<tr>
<td>20+ Year US Treasury STRIPS</td>
<td>1.0%</td>
<td>2.1%</td>
<td>20.9%</td>
</tr>
<tr>
<td>US Long-Term Government/Credit*</td>
<td>2.2%</td>
<td>3.4%</td>
<td>10.2%</td>
</tr>
<tr>
<td>US Corporate Bond - AAA</td>
<td>2.2%</td>
<td>3.3%</td>
<td>6.0%</td>
</tr>
<tr>
<td>US Corporate Bond – AA</td>
<td>2.2%</td>
<td>3.4%</td>
<td>5.9%</td>
</tr>
<tr>
<td>US Corporate Bond – A</td>
<td>2.6%</td>
<td>3.8%</td>
<td>7.2%</td>
</tr>
<tr>
<td>US Corporate Bond – BBB</td>
<td>3.1%</td>
<td>4.4%</td>
<td>8.0%</td>
</tr>
<tr>
<td>US Corporate Bond – BB</td>
<td>4.0%</td>
<td>6.0%</td>
<td>9.8%</td>
</tr>
<tr>
<td>US Corporate Bond – B</td>
<td>3.6%</td>
<td>5.4%</td>
<td>11.7%</td>
</tr>
<tr>
<td>US Corporate Bond - CCC/Below</td>
<td>-3.8%</td>
<td>-0.6%</td>
<td>20.6%</td>
</tr>
<tr>
<td>US Securitized Bond</td>
<td>2.3%</td>
<td>3.6%</td>
<td>8.4%</td>
</tr>
<tr>
<td>US Collateralized Loan Obligation</td>
<td>3.1%</td>
<td>4.0%</td>
<td>7.3%</td>
</tr>
<tr>
<td>US High Yield Securitized Bond</td>
<td>3.4%</td>
<td>5.4%</td>
<td>11.2%</td>
</tr>
<tr>
<td>US High Yield Collateralized Loan Obligation</td>
<td>5.5%</td>
<td>6.4%</td>
<td>10.8%</td>
</tr>
<tr>
<td>US Taxable Municipal Bond</td>
<td>2.7%</td>
<td>4.3%</td>
<td>7.5%</td>
</tr>
<tr>
<td>10 Year US Treasury Bond</td>
<td>1.8%</td>
<td>3.0%</td>
<td>7.4%</td>
</tr>
<tr>
<td>10 Year Non-US Government Bond (USD Hedge)</td>
<td>0.3%</td>
<td>1.4%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Asset Class</td>
<td>10-Year Return</td>
<td>30-Year Return</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>REAL ASSETS</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Commodity Futures</td>
<td>0.4%</td>
<td>3.3%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Midstream Energy</td>
<td>6.7%</td>
<td>6.7%</td>
<td>28.6%</td>
</tr>
<tr>
<td><em>Public Real Assets (Multi-Asset)</em></td>
<td>3.9%</td>
<td>5.6%</td>
<td>14.1%</td>
</tr>
<tr>
<td>US REIT</td>
<td>4.5%</td>
<td>6.3%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Global Infrastructure Equity</td>
<td>5.6%</td>
<td>6.3%</td>
<td>20.3%</td>
</tr>
<tr>
<td>Global Natural Resources Equity</td>
<td>5.5%</td>
<td>6.7%</td>
<td>23.2%</td>
</tr>
<tr>
<td>Gold</td>
<td>3.3%</td>
<td>4.0%</td>
<td>16.3%</td>
</tr>
<tr>
<td>Core Real Estate</td>
<td>4.7%</td>
<td>5.6%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Non-Core Real Estate</td>
<td>5.9%</td>
<td>6.9%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Private Debt - Real Estate</td>
<td>4.6%</td>
<td>5.4%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Private Real Assets - Natural Resources</td>
<td>7.1%</td>
<td>8.2%</td>
<td>32.5%</td>
</tr>
<tr>
<td>Private Real Assets – Infrastructure</td>
<td>5.3%</td>
<td>6.6%</td>
<td>12.6%</td>
</tr>
<tr>
<td><strong>MULTI-ASSET</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedge Fund – Macro</td>
<td>3.7%</td>
<td>4.9%</td>
<td>9.2%</td>
</tr>
<tr>
<td><em>Hedge Fund</em></td>
<td>4.2%</td>
<td>5.5%</td>
<td>8.6%</td>
</tr>
<tr>
<td><em>60% S&amp;P 500 &amp; 40% US Aggregate Bond</em></td>
<td>3.7%</td>
<td>5.2%</td>
<td>10.3%</td>
</tr>
<tr>
<td><em>60% MSCI ACWI &amp; 40% US Aggregate Bond</em></td>
<td>4.4%</td>
<td>5.7%</td>
<td>11.0%</td>
</tr>
</tbody>
</table>
PRIVATE MARKET COMPOSITES

Assumed public market beta composites for private market return assumptions:

**Private Equity:**
Private Equity – Buyout: 25% US Large Cap, 75% US Small/Mid Cap
Private Equity – Secondary: 25% US Large Cap, 75% US Small/Mid Cap
Private Equity – Growth: 50% US Small/Mid Cap, 50% US Microcap
Private Equity – Venture: 25% US Small/Mid Cap, 75% US Microcap
Private Equity – Non-US: 70% International Small Cap, 30% Emerging Small Cap
PE Composite: 34% Buyout, 34% Growth, 15% Non-US, 8.5% Secondary, 8.5% Venture

**Private Debt:**
Private Debt – Direct Lending: 100% Bank Loans
Private Debt – Distressed: 20% US Small/Mid Cap, 60% US High Yield, 20% Bank Loans
Private Debt – Credit Opportunities: 24% US SMID Cap, 33% US High Yield, 33% Bank Loans
Private Debt Composite: 50% Direct Lending, 25% Credit Opportunities, 25% Distressed

**Private Real Assets:**
Private Real Assets – Energy: 30% Comm., 35% Midstream, 35% Public Resource Equity
Private Real Assets - Infra/Land: 30% Commodities, 70% Public Infrastructure
Private Real Estate Debt: 50% CMBS, 50% Core Real Estate
NEPC DISCLOSURES

Past performance is no guarantee of future results.

NEPC, LLC is an investment consulting firm. We provide asset-liability studies for certain clients but we do not provide actuarial services. Any projections of funded ratio or contributions contained in this report should not be used for budgeting purposes. We recommend contacting the plan’s actuary to obtain budgeting estimates.

The goal of this report is to provide a basis for substantiating asset allocation recommendations. The opinions presented herein represent the good faith views of NEPC as of the date of this report and are subject to change at any time.

Information on market indices was provided by sources external to NEPC. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.

The projection of liabilities in this report uses standard actuarial projection methods and does not rely on actual participant data. Asset and liability information was received from the plan’s actuary, and other projection assumptions are stated in the report.

All investments carry some level of risk. Diversification and other asset allocation techniques do not ensure profit or protect against losses.

This report is provided as a management aid for the client’s internal use only. This report may contain confidential or proprietary information and may not be copied or redistributed to any party not legally entitled to receive it.
Agenda Item #7
MEMORANDUM

TO: Mr. Michael Lofton, Chair, Arizona State Retirement System (ASRS) Investment Committee (IC)

FROM: Mr. Paul Matson, Director
       Mr. Michael Viteri, Chief Investment Officer

DATE: August 18, 2022

RE: Agenda Item 7: Presentation, Discussion, and Appropriate Action Regarding Updates to the Strategic Investment Policies

Purpose
To inform and seek approval on updated Strategic Policies, formerly known as Strategic Investment Policies (SIP002, SIP006).

Recommendation:
Action item: To ensure compliance with open meeting law, staff will provide recommendations for Committee consideration during the presentation.

Background SIP002
The Arizona State Retirement System Board last approved a revision to SIP002 – Tactical Positioning, Leverage, and Rebalancing: Pension, Health Benefit Supplement, System, & Long-Term Disability on April 28, 2017. In addition to minor grammatical and stylistic changes in this document, the updated SIP002, now titled SIP002 – Tactical Positioning, Rebalancing and Leverage: Pension, Health Benefit Supplement, System, & Long-Term Disability codifies the use of leverage previously approved by the Board on Tuesday, May 22, 2018, and contained on page 37 of the Investment Strategy Presentation dated May 9, 2018 (see Exhibit 1).

Exhibit 1

**Leverage Constraints**

- Real estate and credit is targeted for leverage up to 60% on a portfolio basis
- Interest rate sensitive bonds will not be levered
- Fund level leverage is targeted for 1% with a low of 0% and maximum of 5%
- Should any of these leverage targets be exceeded a report will be delivered to the investment committee outlining the circumstances and stating a plan to prudently return the portfolio to compliance without requiring sale of assets in distressed circumstances
- The forgoing plans do not require the approval of the investment committee

Your money. Your future. Secure for your lifetime.
Staff believes that the authority to use leverage is better suited to a Strategic Policy document versus a standalone PowerPoint presentation with no direct reference to ASRS governance documents. In addition, the total fund leverage will no longer have a ‘target’ of 1% but rather maintain the range of 0%-5%.

The following is a summary of the rationale for the usage of total fund leverage:

- Simplifies cash management
- Reduce transaction costs (market movement and commissions) for cash raises (i.e., ASRS has to sell assets in order to buy assets) and implementation.
- Allows for more effective rebalancing
- Allows tactically overweighting of potentially distressed priced assets
- Can enhance returns when borrowing costs are low

It should also be noted that leverage is embedded in most public equity investments, as well as the following private market investments:

- Public Equity & Private Equity are leveraged at an average of 60% loan to value
- Real Estate & Credit are leveraged up to 60% loan to value

**Background SIP006**
The Arizona State Retirement System Board last approved a revision to SIP006 – *Investment Manager, Partner, and Co-Investment Selection and Oversight* on November 16, 2012. Edits have been made for the purposes of clarity, grammatical changes, updating of IMD Staff titles and responsibilities, and also to reflect changes that better reflect current evolved processes.
Purpose:
To codify the policy and guidelines for determining and managing the tactical positioning, leverage, and rebalancing process for the Pension, Health Benefit Supplement (HBS), System, & Long-Term Disability (LTD), (collectively the “Plans”) relative to the Arizona State Retirement System (ASRS) Strategic Asset Allocation Policy (SAAP).

Policy:
The ASRS will establish and maintain this tactical positioning, leverage, and rebalancing policy for the Plans which will assist in the investment management of the Plans’ assets. This policy will reflect the process for identifying and determining potential courses of action associated with the Plans’ asset class over-/under-weight deviations relative to the Plans’ broad SAAP and for repositioning based on market valuations and expectations.

A Tactical Fund Positioning Committee (TFPC or Committee, the “Committee”) is established to fulfill the purposes of this policy. The members of the Committee will include the Executive Director, Chief Investment Officer (CIO), Assistant–Deputy CIO(s) Investment Risk & Compliance Officer, Manager of Operations, and other investment management staff at the discretion of the CIO Senior Portfolio Managers. Voting members of the TFPC Committee are the Executive Director, Chief Investment Officer, and Deputy CIO(s). The TFPC Committee will meet periodically in its discretion, but not less than quarterly. The Committee will engage in asset class relative value discussions of the fundamental, technical and market sentiment metrics used to develop the Investment Management Division’s (IMD) Investment House Views. The TFPC Committee may also utilize the research and perspectives of the ASRS investment consultants and/or select ASRS external investment managers. The Committee will review the actual allocation of assets of the Plans based on valuations from the custodial bank. The Committee will review the degree to which the actual asset allocation differs from the SAAP and whether any asset allocations are outside the bands permitted under the SAAP. The Committee will consider transaction costs of any proposed change in portfolio allocation. Consistent with IMD Investment House Views, and the SAAP, the Committee may direct rebalance or tactical position initiatives.

When the Committee directs a tactical, rebalance, leverage or tactical or leverage positioning initiative, the CIO will designate the investment portfolios or vehicles to be used taking into account factors such as the asset class active/passive policy targets, timing and execution costs and the Plan’s cash-flow management considerations. Active and passive managers’ portfolios may be utilized for the rebalancing and repositioning purpose and, as such, may be selected for additional portfolio funding or be defunded by decrements which may result in zero portfolio balances. Defunded investment managers will remain as contracted ASRS investment managers unless termination is warranted determined as determined by the an Asset Class Committee.

The Committee may utilize cash market securities, derivatives, synthetic rebalancing, leverage, or other repositioning methodologies that more effectively implement this policy.
Rebalancing or Repositioning Rules:

1. Depending on IMD Investment House Views and consistent with valuation metrics, asset class position movements away from policy targets but within the target’s bands may and are expected to occur.

2. If the magnitude of the difference between actual and interim target allocations is outside the adjusted policy* target bands, rebalancing or repositioning back into policy bands will occur.

3. If the magnitude of the difference between actual and interim target allocations is within the adjusted policy target bands, rebalancing or repositioning may occur toward or away from the targets but not beyond the bands.

Leverage Rules:

1. Private Real Estate and Private Credit asset classes are targeted for leverage up to 60% on an aggregate Private Real Estate and aggregate Private Credit portfolio basis.

2. Interest Rate Sensitive asset class will not be levered.

3. Fund level leverage (when implemented) is targeted for range from -0% to a maximum of 5% of Total Fund.

4. Should any of these leverage targets be exceeded, a report will be delivered to the investment committee outlining the circumstances and stating a plan will be developed and implemented to prudently return the portfolio to compliance without requiring sale of assets in distressed circumstances.

The Committee will maintain records regarding its decisions. Performance contributions resulting from over-/under-weights relative to Plans’ broad SAAP will be captured in the quarterly ASRS Total Fund Performance Attribution Analysis Report which is presented to the Board.

If Total Fund leverage is utilized, the CIO will report to the Investment Committee regarding the Total Fund leverage activities and positions of the Tactical Fund Positioning Committee.

*Private market, opportunistic investments and commodities pro-rated.
Arizona State Retirement System
Strategic Investment Policy (SIP002)

Tactical Positioning, Rebalancing, Leverage: Pension, Health Benefit Supplement (HBS), System, & Long-Term Disability (LTD)

Purpose:
To codify the policy and guidelines for determining and managing the tactical positioning, rebalancing, or leverage process for the Pension, Health Benefit Supplement (HBS), System, & Long-Term Disability (LTD), (collectively the “Plans”) relative to the Arizona State Retirement System (ASRS) Strategic Asset Allocation Policy (SAAP).

Policy:
The ASRS will establish and maintain this tactical positioning, rebalancing, and leverage policy for the Plans which will assist in the investment management of the Plans’ assets. This policy will reflect the process for identifying and determining potential courses of action associated with the Plans’ asset class over-/under-weight deviations relative to the Plans’ broad SAAP and for repositioning based on market valuations and expectations.

A Tactical Fund Positioning Committee (TFPC or Committee) is established to fulfill the purposes of this policy. The members of the Committee will include the Executive Director, Chief Investment Officer (CIO), Deputy CIO(s) Investment Risk & Compliance Officer, Manager of Operations, and other investment management staff at the discretion of the CIO. Voting members of the TFPD are the Executive Director, Chief Investment Officer, and Deputy CIO(s). The TFPC will meet periodically in its discretion, but not less than quarterly. The Committee will engage in asset class relative value discussions of the fundamental, technical and market sentiment metrics used to develop the Investment Management Division’s (IMD) Investment House Views. The TFPC may also utilize the research and perspectives of the ASRS investment consultants and/or select investment managers. The Committee will review the actual allocation of assets of the Plans based on valuations from the custodial bank. The Committee will review the degree to which the actual asset allocation differs from the SAAP and whether any asset allocations are outside the bands permitted under the SAAP. The Committee will consider transaction costs of any proposed change in portfolio allocation. Consistent with IMD Investment House Views, and the SAAP, the Committee may direct rebalance or tactical position initiatives.

When the Committee directs a tactical, rebalance, or leverage positioning initiative, the CIO will designate the investment portfolios or vehicles to be used taking into account factors such as the asset class active/passive policy targets, timing and execution costs and the Plan’s cash-flow management considerations. Active and passive managers’ portfolios may be utilized for the rebalancing and repositioning purpose and, as such, may be selected for additional portfolio funding or be defunded by decrements which may result in zero portfolio balances. Defunded investment managers will remain as contracted ASRS investment managers unless termination is warranted as determined by the Committee.

The Committee may utilize cash market securities, derivatives, leverage, or other repositioning methodologies that more effectively implement this policy.

Rebalancing or Repositioning Rules:
1. Depending on IMD Investment House Views and consistent with valuation metrics, asset class position movements away from policy targets but within the target’s bands may and are expected to occur.

2. If the magnitude of the difference between actual and interim target allocations is **outside** the adjusted policy* target bands, rebalancing or repositioning back into policy bands will occur.

3. If the magnitude of the difference between actual and interim target allocations is **within** the adjusted policy target bands, rebalancing or repositioning may occur toward or away from the targets but not beyond the bands.

**Leverage Rules:**

1. Private Real Estate and Private Credit asset classes are targeted for leverage up to 60% on an aggregate Private Real Estate and aggregate Private Credit portfolio basis.
2. Interest Rate Sensitive asset class will not be levered.
3. Fund level leverage (when implemented) may range from 0% to a maximum of 5% of Total Fund.
4. Should any of these leverage targets be exceeded, a plan will be develop and implemented to prudently return the portfolio to compliance.

The Committee will maintain records regarding its decisions. Performance contributions resulting from over-/under-weights relative to Plans’ broad SAAP will be captured in the quarterly ASRS Total Fund Performance Attribution Analysis Report which is presented to the Board.

If Total Fund leverage is utilized, the CIO will report to the Investment Committee regarding the Total Fund leverage activities and positions.

*Private market, opportunistic investments and commodities pro-rated.
Purpose:
To codify the policy to be utilized for the selection of public market and private market investment managers and partners. Throughout the remainder of this policy the term investment manager will refer to both public and private market investment managers and partners.

Policy:
The ASRS will establish and follow an Investment Manager, Partner, and Co-investment Selection Policy that will govern the process and activities regarding the selection of ASRS investment managers.

The process is outlined as follows:

1. **Opportunity Set - Sourcing**
   The primary responsibility for sourcing investment managers and co-investments resides with the Investment Management Division (IMD). In addition, any other party, specifically including the Director, ASRS investment consultants (both staff-extension consultants as well as the general consultant), and ASRS trustees may communicate investment manager recommendations or opportunities to either the Director or Chief Investment Officer (CIO).

2. **Opportunity Set - Screening**
   The CIO or designee will determine if the investment manager recommendations or co-investment opportunities deserve further internal or external due diligence resource allocation. This determination will be based upon the merits of the opportunity under consideration, within the context of:
   - ASRS strategic asset allocation;
   - IMD Investment House Views;
   - Investment manager organization structure;
   - Investment manager investment strategy, terms and structure; and
   - ASRS investment priorities.

3. **Analysis and Due Diligence**
   IMD staff will provide expertise in, and project-manage, the investment manager analysis and due diligence process. This process will include the development of a comprehensive due diligence packet which will be developed by staff extension consultants, IMD staff, or a combination of both. The CIO will determine which staff-extension consultants will be utilized and the related scope-of-work and product deliverables.

   The due diligence packet will include sufficient information to ensure the manager has been properly vetted and enable the Combined Asset Class eCommittee (CACC) to make an informed decision, and will include but not be limited to the following information, when relevant to the manager:
1. Organization
2. Staff
3. Strategy
4. Terms
5. Performance
6. Risk
   a. Investment Risk Management
   b. Operational Risk Management
7. Disclosures
8. Miscellaneous

As applicable, public markets managers and private markets managers may have additional factors included.

The full list of due diligence packet contents can be found in Appendix I.

Decision to hire an investment manager should primarily be evidence-based and based on a reasonable expectation of their ability to add value to ASRS investment goals and objectives. Evidence typically includes empirical data, historical statistical analysis, risk-adjusted return metrics, and risk measures (ex., alpha, beta, r-squared, standard deviation, and Sharpe ratio) in combination with a forward-looking confidence in the strategy and its theoretical logic.

The analysis and due diligence of co-investments, whereby ASRS has the opportunity to participate in a pending investment to be made by a manager of a fund or account, will be evaluated through a process as described in Appendix II.

4. Combined Asset Class Committee (CACC) Meetings – Decision Making

The CIO will determine which Asset Class Committee (Public Markets or Private Markets) is the appropriate forum to discuss the investment manager under consideration and work with IMD staff regarding the meeting dates for respective Committees.

The due diligence packet will be disseminated to the relevant Committee membership prior to the meeting in order to allow members sufficient time to review and prepare for the meeting.

The ASRS general investment consultant and Internal Audit (IA) will be notified of each Public Market Committee and Private Market Combined Asset Investment Committee (CACC) meeting and will be provided an agenda and due diligence packet in advance for each meeting in order to allow them sufficient time should they wish to attend or ask questions. The ASRS general investment consultant and IA may attend any Public Market Committee or Private Market Combined Asset Investment Committee (CACC) meeting.

Asset Class CommitteesThe CACC will be comprised of the Director, CIO, Deputy CIO(s), Investment Operations Manager, and one or more IMD portfolio managers as determined by the CIO based upon related skills and knowledge and, as applicable, staff-extension consultants.

Voting members of the Committee-CACC include the Director, CIO, and Deputy CIO(s), one or more IMD portfolio managers, and the Investment Operations Manager. Investment manager selection decisions require the consensus of both the Director and CIO.

As applicable, the ASRS Procurement Officer will distribute Confidentiality and Disclosure forms to IMD staff, which will be completed and returned prior to commencing the
5. Post-Committee Meeting Documentation and Dissemination

Asset Class Committee meeting minutes will be prepared by IMD staff, which will include the agenda and motions or directives and decisions made by the Committee. The meeting minutes will be disseminated to voting Committee members for review and approval. Once approved, the minutes (which may be marked as confidential and non-public) will be disseminated to the Investment Committee (IC) Trustees, ASRS general investment consultant, and IA, and available to the Investment Committee (IC) Trustees.

6. Governance Oversight

The ASRS general consultant will conduct an independent review, at least annually, of the process to determine compliance with the Policy and Appendix A, and that the investment recommendation is consistent with ASRS Strategic Asset Allocation Policy targets/ranges, House Views and, as applicable, investment programs’ pacing and implementation plans. The general consultant will use the following information and resources to help make their determination: investment due diligence packet; Committee meeting minutes and motions and other presentation materials; general and specific market knowledge of the investment, and discussions with the Director, CIO, or Portfolio Managers.

If the general consultant does not believe that the Policy and Appendix are being followed, or that a prudent decision is being made, they shall contact any or all of the following parties: Board Chair; Investment Committee Chair; Chief Internal Auditor; Investment Risk and Compliance Officer, Director.

As standard operating procedure, the CIO will keep the IC informed of the selection and termination decisions made regarding investment managers.

During each external audit, the internal financial auditor will periodically review this policy and conduct a sample process review or audit to determine possible omissions or violations, and report such omissions or violations to any or all of the following parties: Board Chair; Investment Committee Chair; Chief Internal Auditor; Director, and may include such findings in their monthly investment compliance report which resides in the Director’s section of the Board packet.

7. Post-Investment Manager and Co-Investment Selection Monitoring

Public and private investment managers and co-investments are monitored by various functions performed by the CIO, IMD staff, ASRS custody bank, general consultant, staff extension consultants and other service providers and reported to the Combined Asset Class Committees, IC and Board.

ASRS custody bank provides look-through Committee on Uniform Security Identification Procedures (CUSIP)-level capabilities for separate account public manager portfolios and generates various customizable reports on holdings, risk, and returns. IMD staff utilize a combination of internal, manager, and consultant data and information from a third-party research providers as the basis for staff’s quarterly conference calls with the managers to review performance, attribution, and consistency of process and decision-making, and other matters related to firm personnel, Assets Under Management (AUM), and operations.

For private investments, ASRS independent external back-office third party custody bank will provide performance measurements as well as other services such as: document warehousing, administers ASRS approval capital calls and distributions, and various aggregate
program and individual fund level reports. IMD staff may use this information in their calls, meetings, and correspondence with managers and their participation at limited partner advisory committees of which we are members. IMD staff also provides timely private market program information such as portfolio performance, portfolio news, detail fund activity and pacing activity to the Private Markets Combined Asset Class Committee.

With respect to the ASRS Real Estate Strategic Manager program, staff—extension consultants provide operational and investment oversight functions that ensures that each proposed investment is in compliance with contracted investment criteria, i.e., investment type, underwriting, leverage, etc. and that, subsequent to purchase, investments are monitored on an ongoing basis.

On a quarterly basis, the ASRS general consultant generates an investment performance reports containing information about both public and private managers. IMD staff and the general consultant provides asset class presentations to the Investment Committee which includes performance measurement relative to the mandate’s benchmarks as well as select risk and return metrics relative to peers, and a qualitative review of the manager.
The due diligence packet will include sufficient information to ensure the manager has been properly vetted and enable the asset class committee to make an informed decision and include, but not be limited to the following information when relevant to the manager:

1. **Organization**
   - a. History of the firm
   - b. Firm ownership
   - c. Office location(s)
   - d. Strategy offerings and capabilities
   - e. Staff allocated across and/or between strategies
   - f. Assets Under Management for the firm

2. **Staff**
   - a. Team background/biographies
   - b. Organizational responsibilities
   - c. Operational capabilities
   - d. Technical resources
   - e. Key additions/subtractions to team

3. **Strategy**
   - a. Description of investment strategy and/or philosophy
   - b. Idea sourcing resources
   - c. Research sources: in-house and external
   - d. Decision-making process
   - e. Staff allocated to the strategy
   - f. Asset under Management (AUM) for the strategy
   - g. Comparison with other strategies

4. **Terms**
   - a. Fees
   - b. Fee structure
   - c. Vehicle structure
   - d. Benchmark definition

5. **Performance**
   - a. Historical rates of return (public markets)
   - b. Multiples of invested capital return (private markets)
   - c. Internal rates of return (private markets)
   - d. Peer manager universe criteria
   - e. Comparative returns versus peers and/or prior funds
   - f. Historical quartile ranking analysis

6. **Risk**
   - a. Investment Risk Management
     - i. Risk metrics
     - ii. Portfolio limitations
iii. Portfolio characteristics
iv. Portfolio diversification
b. Operational Risk Management
   i. Personnel turnover
   ii. Information security
   iii. Internal controls
   iv. Regulatory oversight
   v. Legal inquiries/investigations

7. Disclosures
   a. Placement agents
   b. Conflict of interest

8. Miscellaneous
   a. Integration of strategy with other ASRS mandates
   b. Strategic relationship role of manager with ASRS
   c. Composition of current investors in the strategy
   d. Analysis of competing managers and firms

As applicable, also assess public markets managers and public markets managers for:

Public Markets

1. Terms
   e. alpha and tracking error targets
   b. Most-favored nations clauses

2. Investment Risk
   a. Portfolio turnover
   b. Correlation to benchmark
   c. Correlation to peers
   d. Volatility of returns
   e. Risk adjusted return metrics

Private Markets

1. Terms:
   a. Investment time horizon and total fund term
   b. GP commitment
   c. Co-investment policy
   d. Key man provision
   e. No-fault termination
   f. Recall/recycle provisions

2. Operational risk:
   a. Legal structure
   b. Placement agent disclosures
   c. GP reference checks

3. Investment risk:
a. Fund leverage
b. Portfolio company references
c. Fund Opportunity SWOT Analysis
Appendix II

At a high level co-investment is used loosely to describe any two parties that invest alongside one another in the same company, by having co-investment rights, a limited partner can invest directly in a company that is simultaneously backed by the fund’s general partner at terms and conditions more favorable than the fund investment. For co-investments, whereby the ASRS has the opportunity to participate in a pending investment to be made by the manager of a fund or account, the analysis and due diligence process will be as follows:

**Debt Co-Investment Opportunities:**

When evaluating debt co-investment opportunities, IMD staff and the Combined Asset Class Committee will focus on portfolio and the ASRS Total Fund construction considerations, while the merits of a particular investment will be determined by the investment manager of the fund. IMD staff will review a due diligence packet for the co-investment opportunity provided by the investment manager to determine its suitability with respect to portfolio and Total Fund considerations including but not limited to the following:

- The size of ASRS’ commitment to the fund,
- The overall portfolio concentration (ex. industry, geographic etc.) of the fund,
- The fund’s investment guidelines, and
- ASRS Total Fund considerations.

For suitable co-investment opportunities, IMD staff will prepare a memo summarizing its conclusions and submit it to the appropriate Combined Asset Class Committee, along with the due diligence packet provided by the manager, to obtain approval.

**Equity Co-Investment Opportunities:**

Due to the higher risk associated with equity investments, equity co-investment opportunities require confirmatory due diligence by IMD staff and/or staff-extension consultants. The primary due diligence will be performed by the financial sponsor. Staff or the extension consultant will perform additional diligence to confirm that appropriate diligence has been done by the sponsor and to confirm that the major results of the diligence reasonably support the investment thesis and metrics. The scope of such confirmatory diligence will be determined on a case by case basis by the CIO in consultation with the portfolio manager for the project.
Purpose:
To codify the policy to be utilized for the selection of public market and private market investment managers and partners. Throughout the remainder of this policy the term investment manager will refer to both public and private market investment managers and partners.

Policy:
The ASRS will establish and follow an Investment Manager, Partner, and Co-investment Selection Policy that will govern the process and activities regarding the selection of ASRS investment managers.

The process is outlined as follows:

1. Opportunity Set - Sourcing
   The primary responsibility for sourcing investment managers and co-investments resides with the Investment Management Division (IMD). In addition, any other party, specifically including the Director, ASRS investment consultants (both staff-extension consultants as well as the general consultant), and ASRS trustees may communicate investment manager recommendations or opportunities to either the Director or Chief Investment Officer (CIO).

2. Opportunity Set - Screening
   The CIO or designee will determine if the investment manager recommendations or co-investment opportunities deserve further internal or external due diligence resource allocation. This determination will be based upon the merits of the opportunity under consideration, within the context of:
   - ASRS strategic asset allocation;
   - IMD Investment House Views;
   - Investment manager organization structure;
   - Investment manager investment strategy, terms and structure; and
   - ASRS investment priorities.

3. Analysis and Due Diligence
   IMD staff will provide expertise in, and project-manage, the investment manager analysis and due diligence process. This process will include the development of a comprehensive due diligence packet which will be developed by staff extension consultants, IMD staff, or a combination of both. The CIO will determine which staff-extension consultants will be utilized and the related scope-of-work and product deliverables.
   The due diligence packet will include sufficient information to ensure the manager has been properly vetted and enable the Combined Asset Class Committee (CACC) to make an informed decision, and will include but not be limited to the following information, when relevant to the manager:
1. Organization
2. Staff
3. Strategy
4. Terms
5. Performance
6. Risk
   a. Investment Risk Management
   b. Operational Risk Management
7. Disclosures
8. Miscellaneous

As applicable, public markets managers and private markets managers may have additional factors included.

The full list of due diligence packet contents can be found in Appendix I.

Decision to hire an investment manager should primarily be evidence-based and based on a reasonable expectation of their ability to add value to ASRS investment goals and objectives. Evidence typically includes empirical data, historical statistical analysis, risk-adjusted return metrics, and risk measures (e.g., alpha, beta, r-squared, standard deviation, and Sharpe ratio) in combination with a forward-looking confidence in the strategy and its theoretical logic.

The analysis and due diligence of co-investments, whereby ASRS has the opportunity to participate in a pending investment to be made by a manager of a fund or account, will be evaluated through a process as described in Appendix II.

4. Combined Asset Class Committee (CACC) Meetings – Decision Making

The CIO will work with IMD staff regarding the meeting dates.

The due diligence packet will be disseminated to the Committee membership prior to the meeting in order to allow members sufficient time to review and prepare for the meeting.

The ASRS general investment consultant and Internal Audit (IA) will be notified of each CACC meeting and will be provided an agenda and due diligence packet in advance for each meeting in order to allow them sufficient time should they wish to attend or ask questions. The ASRS general investment consultant and IA may attend any CACC meeting.

The CACC will be comprised of the Director, CIO, Deputy CIO(s), Investment Operations Manager, and one or more IMD portfolio managers as determined by the CIO based upon related skills and knowledge and, as applicable, staff-extension consultants.

Voting members of the CACC include the Director, CIO, Deputy CIO(s), and the Investment Operations Manager. Investment manager selection decisions require the consensus of both the Director and CIO.

IMD staff will provide Confidentiality and Disclosure notifications to the ASRS Procurement Officer.

5. Post-Committee Meeting Documentation and Dissemination

Asset Class Committee meeting minutes will be prepared by IMD staff, which will include the agenda and motions or directives and decisions made by the Committee. The meeting minutes will be disseminated to voting Committee members for review and approval. Once approved,
the minutes (which may be marked as confidential and non-public) will be disseminated to the ASRS general investment consultant and IA, and available to the Investment Committee (IC) Trustees.

6. **Governance Oversight**

The ASRS general consultant will conduct an independent review, at least annually, of the process to determine compliance with the Policy and Appendix A, and that the investment recommendation is consistent with ASRS Strategic Asset Allocation Policy targets/ranges, House Views and, as applicable, investment programs’ pacing and implementation plans. The general consultant will use the following information and resources to help make their determination: investment due diligence packet; Committee meeting minutes and motions and other presentation materials; general and specific market knowledge of the investment, and discussions with the Director, CIO, or Portfolio Managers.

If the general consultant does not believe that the Policy and Appendix are being followed, or that a prudent decision is being made, they shall contact any or all of the following parties: Board Chair; Investment Committee Chair; Chief Internal Auditor; Investment Risk and Compliance Officer, Director.

The intern auditor will periodically review this policy and conduct a sample process review or audit to determine possible omissions or violations, and report such omissions or violations to any or all of the following parties: Board Chair; Investment Committee Chair; Chief Internal Auditor; Director, and may include such findings in their monthly investment compliance report which resides in the Director’s section of the Board packet.

7. **Post-Investment Manager and Co-Investment Selection Monitoring**

Public and private investment managers and co-investments are monitored by various functions performed by the CIO, IMD staff, ASRS custody bank, general consultant, staff-extension consultants and other service providers and reported to the Combined Asset Class Committee, IC and Board.

IMD staff will utilize a combination of internal, manager, and consultant data and information as the basis for staff’s conference calls with the managers to review performance, attribution, and consistency of process and decision-making, and other matters related to firm personnel, Assets Under Management (AUM), and operations.

For private investments, ASRS independent third parties will provide performance measurements as well as other services such as: document warehousing, administers ASRS approval capital calls and distributions, and various aggregate program and individual fund level reports. IMD staff may use this information in their calls, meetings, and correspondence with managers and their participation at limited partner advisory committees of which we are members. IMD staff also provides timely private market program information such as portfolio performance, portfolio news, detail fund activity and pacing activity to the Combined Asset Class Committee.

With respect to the ASRS Real Estate Strategic Manager program, staff-extension consultants provide operational and an investment oversight functions that ensures that each proposed investment is in compliance with contracted investment criteria, i.e., investment type, underwriting, leverage, etc. and that, subsequent to purchase, investments are monitored on an ongoing basis.

On a quarterly basis, the ASRS general consultant generates investment performance reports containing information about both public and private managers. IMD staff and the general consultant provides asset class presentations to the Investment Committee which includes
performance measurement relative to the mandate’s benchmarks as well as select risk and return metrics relative to peers, and a qualitative review of the manager.
Appendix I

The due diligence packet will include sufficient information to ensure the manager has been properly vetted and enable the asset class committee to make an informed decision and include, but not be limited to the following information when relevant to the manager:

1. **Organization**
   a. History of the firm
   b. Firm ownership
   c. Office location(s)
   d. Strategy offerings and capabilities
   e. Staff allocated across and/or between strategies
   f. Assets Under Management for the firm

2. **Staff**
   a. Team background/biographies
   b. Organizational responsibilities
   c. Operational capabilities
   d. Technical resources
   e. Key additions/subtractions to team

3. **Strategy**
   a. Description of investment strategy and/or philosophy
   b. Idea sourcing resources
   c. Research sources: in-house and external
   d. Decision-making process
   e. Staff allocated to the strategy
   f. Asset under Management (AUM) for the strategy
   g. Comparison with other strategies

4. **Terms**
   a. Fees
   b. Fee structure
   c. Vehicle structure
   d. Benchmark definition

5. **Performance**
   a. Historical rates of return (public markets)
   b. Multiples of invested capital return (private markets)
   c. Internal rates of return (private markets)
   d. Peer manager universe criteria
   e. Comparative returns versus peers and/or prior funds
   f. Historical quartile ranking analysis

6. **Risk**
   a. Investment Risk Management
      i. Risk metrics
      ii. Portfolio limitations
iii. Portfolio characteristics
iv. Portfolio diversification

b. Operational Risk Management
   i. Personnel turnover
   ii. Information security
   iii. Internal controls
   iv. Regulatory oversight
   v. Legal inquiries/investigations

7. Disclosures
   a. Placement agents
   b. Conflict of interest

8. Miscellaneous
   a. Integration of strategy with other ASRS mandates
   b. Strategic relationship role of manager with ASRS
   c. Composition of current investors in the strategy
   d. Analysis of competing managers and firms

As applicable, also assess public markets managers and public markets managers for:

**Public Markets**

1. Terms
   - alpha and tracking error targets
   - Most-favored nations clauses

2. Investment Risk
   a. Portfolio turnover
   b. Correlation to benchmark
   c. Correlation to peers
   d. Volatility of returns
   e. Risk adjusted return metrics

**Private Markets**

1. Terms:
   a. Investment time horizon and total fund term
   b. GP commitment
   c. Co-investment policy
   d. Key man provision
   e. No-fault termination
   f. Recall/recycle provisions

2. Operational risk:
   a. Legal structure
   b. Placement agent disclosures
   c. GP reference checks

3. Investment risk:
a. Fund leverage
b. Portfolio company references
c. Fund Opportunity SWOT Analysis
At a high level co-investment is used loosely to describe any two parties that invest alongside one another in the same company, by having co-investment rights, a limited partner can invest directly in a company that is simultaneously backed by the fund’s general partner at terms and conditions more favorable than the fund investment. For co-investments, whereby the ASRS has the opportunity to participate in a pending investment to be made by the manager of a fund or account, the analysis and due diligence process will be as follows:

**Debt Co-Investment Opportunities:**

When evaluating debt co-investment opportunities, IMD staff and the Combined Asset Class Committee will focus on portfolio and the ASRS Total Fund construction considerations, while the merits of a particular investment will be determined by the investment manager of the fund. IMD staff will review a due diligence packet for the co-investment opportunity provided by the investment manager to determine its suitability with respect to portfolio and Total Fund considerations including but not limited to the following:

- The size of ASRS’ commitment to the fund,
- The overall portfolio concentration (ex. industry, geographic etc.) of the fund,
- The fund’s investment guidelines, and
- ASRS Total Fund considerations.

For suitable co-investment opportunities, IMD staff will prepare a memo summarizing its conclusions and submit it to the Combined Asset Class Committee, along with the due diligence packet provided by the manager, to obtain approval.

**Equity Co-Investment Opportunities:**

Due to the higher risk associated with equity investments, equity co-investment opportunities require confirmatory due diligence by IMD staff and/or staff-extension consultants. The primary due diligence will be performed by the financial sponsor. Staff or the extension consultant will perform additional diligence to confirm that appropriate diligence has been done by the sponsor and to confirm that the major results of the diligence reasonably support the investment thesis and metrics. The scope of such confirmatory diligence will be determined on a case by case basis by the CIO in consultation with the portfolio manager for the project.
Agenda Item #8
MEMORANDUM

TO: Mr. Michael Lofton, Chair, Arizona State Retirement System (ASRS) Investment Committee (IC)

FROM: Mr. Paul Matson, Director
       Mr. Michael Viteri, Chief Investment Officer

DATE: August 18, 2022

RE: Agenda Item 8: Presentation, Discussion, and Appropriate Action Regarding the Incentive Compensation Plan (ICP) for Internal Investment Professionals

Purpose
To present, discuss, and take appropriate action regarding the Incentive Compensation Plan for Internal Investment Professionals.

Recommendation:
Action item: To ensure compliance with open meeting law, staff will provide recommendations for Committee consideration during the presentation.

Background
The ASRS Board of Trustees approved the Incentive Compensation Plan (ICP) for Internal Investment Professionals at the November 15, 2013 Board meeting. Since then, changes to the staffing, operations, the competitive investment marketplace, and strategies of the investment management division, combined with a desire to clarify various sections, suggest that a review and update occur.

ASRS investment professionals execute and support the fiduciary responsibilities of the Board of Trustees by investing fund assets to maximize risk-adjusted returns in order to lower long-term average contribution rates and meet long-term retirement liabilities.

As such, the ASRS ICP was designed to contribute to the ASRS’ ability to achieve the following objectives:

1. Retain high-caliber investment professionals
2. Attract high-caliber investment professionals
3. Incentivize investment performance

The ICP was developed to have the following characteristics:

- Result in enhanced investment performance
- Controlled or influenced by participants
In addition to minor grammatical and stylistic changes to improve readability, the following are highlights of the most relevant amendments to the ICP:

- Maximum incentive compensation range increased from 25% to 30%,
- Remove the ability to obtain excess outperformance credit in any area,
- Investment Operations Manager position added to ICP,
- Payment moved from September 30th to November 30th or the first practicable date following the close of the Performance Period (fiscal year ended June 30),
- Removed the requirement that total fund absolute returns/performance must be greater than 0% in order for any incentive compensation to be earned.
INCENTIVE COMPENSATION PLAN
For
Internal Investment Professionals

Arizona State Retirement System

Amended July 2022
Arizona State Retirement System
Incentive Compensation Plan for Internal Investment Professionals

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Arizona State Retirement System
Incentive Compensation Plan for Internal Investment Professionals

Authority
A.R.S. § 38-611.01 provides that the ASRS, in consultation with the Director of the Arizona Department of Administration (ADOA), may establish and administer an incentive compensation plan (hereafter the “ICP”) for investment-related personnel. This document describes the ICP and specifies the methods and procedures related to the administration of the ICP.

Nothing in this document is intended to alter the nature of ASRS employment or to create or be construed as creating an expressed or implied contract of employment, or to define conditions of employment. This document does not provide a contract, guarantee of payment, guarantee of participation in the incentive plan in subsequent years, or guarantee of employment with the ASRS. The ICP and the payments that result from the ICP are public information and will be disclosed upon request.

In addition, upon consultation with the Director of ADOA, the ASRS reserves the right to alter, amend, modify, rescind, or otherwise change the content of the ICP at any time for any reason as permitted by law, in its sole discretion, and without advance notice to any employee affected by the provisions of the ICP.

Purpose and Objectives
The purpose of the ICP is to further enhance the investment management and performance of the ASRS Trust Fund.

In order to achieve this purpose, the ICP has been designed to contribute to the ASRS’s ability to meet the following objectives:

1. Retain high-caliber investment professionals
   (By providing performance-based compensation.)

2. Attract high-caliber investment professionals
   (By providing performance-based compensation.)

3. Incentivize investment performance
   (By aligning investment personnel compensation with investment results.)
Eligibility for Participation

To be eligible to participate (a “Participant”) in the ICP, an ASRS employee must be in a position that:

- Is allocated to Investment Management as determined by the ASRS Director and
- Has a classification directly involved with investment portfolio management or analysis of investments or holds the position of Investment Operations Manager
  - Other staff responsible for investment portfolio administration and support, compliance, risk and reporting are not eligible

If an employee begins employment in an eligible position after July 1 of any year, the employee may become a Participant on the first date of employment, and participation will be pro-rated based on the total number of days employed during the Performance Period. An eligible employee will be asked to opt to participate in the ICP at the start of each fiscal year or at the beginning of their employment. Any eligible employee may opt not to participate in the ICP at any time. Once an employee opts not to participate in the ICP, that decision will be valid and binding on the employee for the fiscal year during which the employee opted out. An employee will not be eligible for any ICP payments for the full fiscal year during which they opted out. No partial ICP payments will be made for partial fiscal years during which an employee opted out. The performance of an employee who opts out will be documented and measured utilizing the same metrics.

Participant Eligibility for Other Approved Compensation Strategies

Participants in the ICP remain eligible to participate in compensation strategies such as merit adjustments, criteria-based adjustments, market or other base pay adjustments that are employed by the State of Arizona or the ASRS with the following exception:

- Any strategy or combination of strategies whose express purpose is to provide incentive to achieve performance-based goals and the opportunity to receive variable pay (i.e., pay that is not considered part of base salary).

Performance Period

For purposes of the ICP, the Performance Period is the state fiscal year, which begins on July 1 of each year and ends on June 30 of the following year. Due to lagged valuations, Private Market returns will be for the year ending March 31.

Maximum Incentive Compensation Opportunity

A Participant has the opportunity to earn incentive compensation up to 30% of the base salary in effect on July 1 of the Performance Period.

Performance Categories

Incentive compensation categories were developed to have the following characteristics:

- Incentivize positive results
- Ascribe positive results to personnel responsible for decision making
- Fair
- Achievable
- Measurable
Applicability of Performance Categories

All performance categories apply to the Chief Investment Officer (CIO) and the Investment Operations Manager. For the CIO and the Investment Operations Manager, the method used to calculate private asset class performance will be consistent with the approach used to measure the private markets asset classes.

Performance categories apply to all eligible ASRS Investment Professionals listed below and are applicable based on whether their asset coverage is within public markets, private markets or both:

- Chief Investment Officer (CIO)
- Deputy Chief Investment Officer
- Senior Portfolio Manager
- Portfolio Manager
- Assistant Portfolio Manager
- Senior Portfolio Analyst
- Senior Investment Analyst
- Portfolio Analyst
- Investment Analyst
- Investment Operations Manager
- Other – as determined by the ASRS Director

(Note: Working titles vary depending on portfolio/investment focus but will fall within the broader professional classifications above.)

Performance Categories:

1. **Internal Portfolio Performance:**
   Portfolio performance is measured on 1- and 3-year historical net returns {time-weighted rate of return ('TWR')}, as of June 30, relative to established benchmarks (see Appendix B), in each period, weighted equally at 50%. Each portfolio will be dollar weighted to determine the overall excess performance. Any new internally managed portfolios will be included during the first available full month of performance utilizing relevant benchmarks.

2. **Asset Class Performance:**
   Refer to the Strategic Asset Allocation Policy (SAAP) for definitions of ASRS asset classes. Asset class performance in public asset classes is measured using 1- and 3-year time-weighted historical net of fee rates of return, as of June 30, relative to established benchmarks (see Appendix B) using time-weighted returns. Each period is weighted equally at 50%. Private market asset class performance is measured using long-term Internal Rate of Return ('IRR') where applicable as defined by their asset class benchmark defined herein.

3. **Real Estate:**
Portfolio performance is measured using the 10-year internal rate of return (IRR), as of March 31, relative to an absolute rate of return tied to the underwriting standard of the asset class (see Appendix B). The 10-year IRR is calculated using the combined cash flows and terminal values of all investments. The real estate asset class may invest across publicly-traded and private investments. To measure the combined performance, ASRS measures real estate performance based on IRR. In recognition of the flexibility within the asset class to invest across asset types, ASRS may measure public assets using a time-weighted rate of return calculation based on industry prevailing practice.

4. **Credit Performance:**
Portfolio performance is measured using the 7-year IRR as of March 31, relative to an absolute rate of return tied to the underwriting standard of the asset class (see Appendix B). The 7-year IRR is calculated using the combined cash flows and terminal values of all investments. The Credit asset class may invest across publicly-traded and private investments. To measure the combined performance, ASRS measures Credit performance based on the TWR until such time that the historical public markets investments roll out of the time period measured. In recognition of the flexibility within the asset class to invest across asset types, ASRS may measure Credit using a time-weighted rate of return calculation based on industry prevailing practice.

5. **Interest Rate Sensitive:**
Portfolio performance is measured on 1- and 3-year historical net rates of return, as of June 30, relative to established benchmarks (see Appendix B), with each period weighted equally at 50%.

6. **Private Equity:**
Portfolio performance is measured using the 10-year IRR, as of March 31, relative to an absolute rate of return tied to the underwriting standard of the asset class (see Appendix B). The 10-year IRR will be calculated using the combined cash flows and terminal values of all investments to determine the overall excess performance.

7. **Other:**
Portfolio performance is measured on 1- and 3-year historical net TWR, as of June 30, relative to established benchmarks (see Appendix B). Note, the inclusion of the Other asset class within the calculation is dependent on the long-term strategic nature of the investments held within the asset class and the ability to measure excess performance.

8. **Total Fund Performance:**
Total fund performance is measured on 1- and 3-year historical net TWR, as of June 30, relative to the ASRS Strategic Asset Allocation Policy benchmark (see Appendix B), with each period, including the implementation period, weighted equally at 50%. Total fund represents aggregate Plan, System, Health Benefit Supplement (HBS) and Long-Term Disability (LTD) assets.
9. **Qualitative Performance:**

Individual and team goals, objectives, and other contributions and attributes will be reviewed. Evaluation criteria may vary by Participant and will be designed to reflect desired organizational attributes such as leadership, organizational competence, interpersonal relationship skills, effective teamwork, accountability, training and mentoring, project participation, process improvement, and other factors. Each year, criteria will be developed and documented by the CIO and/or ASRS Director for each Participant as part of this program and an agency performance appraisal measurement will be utilized as a component of the final calculations for the ICP. Consideration will be given to compliance exceptions, investment risks, reputational risks, and ethics violations.

The points allocated to Participants for each category will be calculated based upon the proportionate Actual Outperformance as a ratio of the Excess Return Target. Achieving 80% of the Excess Return Target will result in receiving 80% of the points for that category. Achieving 20% of the Excess Return Target will result in receiving 20% of the points for that category.

*Outperformance in at least one of the first eight performance categories must occur for any incentive compensation to be earned. In other words, no incentive compensation will be paid if the only outperformance occurs in the qualitative category.*

All returns utilized will be calculated or reviewed by the ASRS external general investment consultant.

Any methodological or interpretational issues that may arise will be determined by either ASRS ASD staff or the ASRS Director, as neither are eligible for the ICP.

**Incentive Compensation Distribution**

Should an error be discovered after the payment date, the ASRS may make an adjustment and recover payments, including offsetting future compensation or making additional payments.

*Payment Date*

When applicable, ICP payments will be made on or before November 30 (or as feasible), following the close of the Performance Period (fiscal year ended June 30).

*Treatment of Payments*

All payments under the ICP are subject to any deductions and withholdings required by federal, state, or local law at the time of payment. The ASRS is not obligated to otherwise advise an employee of the existence of any amounts that ASRS is required to withhold.

The payments will be lump sum, not added to base pay, and not spread out over the year. The payments must be re-earned each year.
Incentive compensation payments will be considered “compensation” and will have standard retirement, health benefit supplement, and LTD contributions paid on them by either or both the employee and the employer at the time they are paid.

**Employment Status**
A Participant must be considered in “good standing” on the payment date to be eligible to receive an incentive compensation payment. That is, the employee must not be subject to current or pending corrective action, which includes working under a performance improvement plan.

A Participant also must be employed by the ASRS on the scheduled payment date to be eligible to receive an incentive compensation payment. A Participant will not receive any payment, either in full or on a pro-rated basis, if they separate for any reason, including resignation, retirement, disability, death, or involuntary termination, prior to the date of payment.

**Administration**
The ASRS Director will administer the ICP, with oversight by the ASRS Board of Trustees. Specifically, the ASRS Director will notify the Board of the participant(s) and aggregate ICP payments made to each participant within 30 days of such payments. The ASRS Director will also notify the Board if ICP payments are not made.

The ICP will be in compliance with all applicable state or federal laws, regulations, policies, and guidelines. The ASRS Director will have full discretion to decide all questions or matters relating to the interpretation of the ICP and its administration.

**Power to Amend**
The ICP may be amended by the ASRS Director upon:
1. Presenting amendments to the ASRS Investment Committee for acceptance; and
2. Presenting amendments to the full Board for acceptance; and
3. Consultation with the Director of ADOA.

**Effective Date**
The initial Performance Period for the ICP will begin July 1 of the year the plan is adopted and a copy filed with the governmental offices required by A.R.S. § 38-611.01.

**Record Keeping and Reporting**
All performance, salary, and incentive compensation records for the ICP will be maintained by the ASRS Human Resources in accordance with established records retention schedules and requirements.
Performance Category Weightings and Net Excess Return Targets

**Public Market** asset classes performance objectives will be weighted as follows:

<table>
<thead>
<tr>
<th>Internal Portfolio(s) Performance</th>
<th>Asset Class Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

**Public Market** asset classes net (after investment expenses) excess return targets as follows:

<table>
<thead>
<tr>
<th>Internal Portfolio(s) Excess Return Target (bps)</th>
<th>Asset Class Excess Return Target (bps)</th>
<th>Total Fund Excess Return Target (bps)</th>
<th>Qualitative Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>25</td>
<td>40</td>
<td>Determined by CIO and/or Director</td>
</tr>
</tbody>
</table>

**Private Market asset classes** performance objectives will be weighted as follows:

<table>
<thead>
<tr>
<th>Real Estate, Performance</th>
<th>Private Equity Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

**Private Equity and Real Estate** net (after investment expenses) excess return targets as follows:

<table>
<thead>
<tr>
<th>Real Estate Excess Return Target (bps)</th>
<th>Private Equity Excess Return Target (bps)</th>
<th>Total Fund Excess Return Target (bps)</th>
<th>Qualitative Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>300</td>
<td>40</td>
<td>Determined by CIO and/or Director</td>
</tr>
</tbody>
</table>
## APPENDIX A: Responsibility Matrices

### Chief Investment Officer

<table>
<thead>
<tr>
<th>Internal Portfolio Performance</th>
<th>Asset Class Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Internal Portfolios</td>
<td>All Asset Classes</td>
<td>Total Fund</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
</tbody>
</table>

### Deputy Chief Investment Officers

<table>
<thead>
<tr>
<th>Internal Portfolio Performance</th>
<th>Asset Class Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Internal Equity Portfolios</td>
<td>All Equities Real Estate</td>
<td>Total Fund</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Private Equity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Internal Fixed Income Portfolios</td>
<td>All Public Fixed Income Portfolios Credit Other</td>
<td>Total Fund</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
</tbody>
</table>

### Senior Portfolio Manager/Portfolio Manager/Assistant Portfolio Manager

#### Senior Portfolio Analyst/Portfolio Analyst

<table>
<thead>
<tr>
<th>Internal Portfolio Performance</th>
<th>Asset Class Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Internal Equity Portfolios + Securities Lending</td>
<td>All Public U.S. and Non-U.S. Equities</td>
<td>Total Fund</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
</tbody>
</table>

### Senior Portfolio Manager/Portfolio Manager/Assistant Portfolio Manager

#### Senior Portfolio Analyst/Portfolio Analyst

<table>
<thead>
<tr>
<th>Internal Portfolio Performance</th>
<th>Asset Class Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Internal Fixed Income Portfolios + Credit</td>
<td>Interest Rate Sensitive &amp; Credit</td>
<td>Total Fund</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
<tr>
<td>Internal Portfolio Performance</td>
<td>Asset Class Performance</td>
<td>Total Fund Performance</td>
<td>Qualitative Performance</td>
<td>TOTAL Points</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>All Internal Fixed Income Portfolios</td>
<td>Interest Rate Sensitive &amp; Credit</td>
<td>Total Fund Performance</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Real Estate and Inflation Linked Performance</th>
<th>Private Equity Performance</th>
<th>Total Fund Performance</th>
<th>Qualitative Performance</th>
<th>TOTAL Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Private Real Estate, REIT and Inflation Linked investments authorized on or after September 20, 2010</td>
<td>All Private Equity investments authorized on or after September 20, 2010</td>
<td>Total Fund Performance</td>
<td>Performance Appraisal</td>
<td>100</td>
</tr>
</tbody>
</table>
APPENDIX B: Performance Benchmarks

**Internal Portfolios**
E2 (Internal U.S. Large Cap Equity): Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
E6 (Internal U.S. Small Cap): Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
E10 (Internal U.S. Mid Cap): Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
F2 (Internal Fixed Income): Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
Securities Lending: Included in Total Fund performance

**Asset Classes**

**Public Markets:**
Asset Class benchmarks as defined by the ASRS Strategic Asset Allocation Policy Schematic (SAAP). Public Markets investment returns will be calculated using time-weighted rates of return. Asset Class sub-categories will be measured on a standalone basis and then aggregated based upon market value weights.

Public Equity benchmark: Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
Interest Rate Sensitive benchmark: Market Standard benchmark consistent with Board approved Strategic Asset Allocation Plan
Other Benchmark: Asset weighted custom benchmark

**Private Markets**
The Asset Class return for Real Estate & Inflation Linked will be a dollar-weighted composite of Real Estate, REITS and Inflation Linked Assets (Commodities, Farmland, and Infrastructure).
Real Estate: 7% Absolute

The Asset Class return for Private Equity will be a dollar weighted composite of Private Equities and Opportunistic Private Equities.
Private Equity: 8% Absolute

Private Market investment returns will be calculated using 10-year trailing IRR.
Credit returns will be calculated using a 7-year trailing IRR and compared to the relative benchmark on a 1 quarter lag (due to third-party pricing methodologies). Note, ASRS may use TWR when public and private markets investment are aggregated.

Credit benchmark: S&P/ LSTA Levered Loan Index plus 250 bps

Other
As defined by the ASRS Strategic Asset Allocation Policy Schematic (SAAP). Other investment returns will be calculated using time-weighted rates of return.

Other benchmark: Investment Specific

Total Fund
ASRS Total Fund Return: Strategic Asset Allocation Benchmark Returns
APPENDIX C: Example

Steps to calculate amounts for distribution:

For purposes of this example, we use the following assumptions:
- Position is Portfolio Manager
- July 1 base salary is $100,000
- Maximum incentive opportunity is 30%
- Each category (Internal Portfolio, Asset Class, Total Fund, and Qualitative) is worth a possible 25 points to equal 100 points
- Expected net excess return is 10 bps for internal portfolios, 25 bps for asset class, and 40 bps for total fund
- Actual Excess Returns (illustrative only):

<table>
<thead>
<tr>
<th>Category</th>
<th>1-year (50%)</th>
<th>3-year (50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Portfolio</td>
<td>33 bps</td>
<td>29 bps</td>
</tr>
<tr>
<td>Asset Class</td>
<td>-10 bps</td>
<td>10 bps</td>
</tr>
<tr>
<td>Total Fund</td>
<td>-100 bps</td>
<td>10 bps</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Meets</td>
<td>Exceeds</td>
</tr>
</tbody>
</table>

1. Determine maximum incentive compensation opportunity
   (See Maximum Incentive Compensation Opportunity section)

   $100,000 * 30% = $30,000

2. Identify established performance categories and compare to actual performance
   (See Performance Categories section)

<table>
<thead>
<tr>
<th>Category</th>
<th>1-year</th>
<th>Actual</th>
<th>3-year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Portfolio</td>
<td>10 bps</td>
<td>33</td>
<td>10 bps</td>
<td>29</td>
</tr>
<tr>
<td>Asset Class</td>
<td>25 bps</td>
<td>-10</td>
<td>25 bps</td>
<td>10</td>
</tr>
<tr>
<td>Total Fund</td>
<td>40 bps</td>
<td>-100</td>
<td>40 bps</td>
<td>10</td>
</tr>
<tr>
<td>Qualitative</td>
<td></td>
<td>Meets</td>
<td></td>
<td>Exceeds</td>
</tr>
</tbody>
</table>

   (*Note: The qualitative performance points are determined by the CIO and the Director, depending on individual objectives achieved and contributions made.)*

3. Convert actual performance (in bps) to points
   (See Performance Category Weightings and Net Excess Return Targets section)

<table>
<thead>
<tr>
<th>Category</th>
<th>1-year (15 pts)</th>
<th>3-year (15 pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Portfolio</td>
<td>15 (33=100% of points)</td>
<td>15 (29=100% of points)</td>
</tr>
<tr>
<td>Asset Class</td>
<td>0 (-10=0% of points)</td>
<td>6 (10=40% of points)</td>
</tr>
<tr>
<td>Total Fund</td>
<td>0 (-100=0% of points)</td>
<td>3.75 (10=25% of points)</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Meets</td>
<td>Exceeds</td>
</tr>
</tbody>
</table>

   Total Points = Percentage
   63.75 = 63.75%

4. Convert points to a percentage

   Total Points = Percentage
   63.75 = 63.75%

5. Determine incentive compensation amount to distribute

   63.75% * $30,000 = $19,125
How ASRS employees deliver service with **PRIDE**

**PROFESSIONALISM**

“We promote, strive for and expect individuals, teams, and divisions to possess professional qualities and skills to lead the organization”

- Friendly, respectful and courteous
- Proactive and responsive
- Good communicator / active listener
- Trusted contributor / teammate
- Personally accountable
- Subject matter expert
- Critical thinker
- Honest, fair, non-judgmental
- Adaptable to change
- Adheres to the Code of Conduct

**RESULTS**

“We treasure the achievements of individuals, teams, divisions and the agency that energize the organization”

- Completes projects
- Attains individual accomplishments
- Meets goals and objectives
- Satisfies customers
- Produces quality work products
- Manages risks successfully

**IMPROVEMENT**

“We appreciate individuals, teams or divisions who drive the agency forward with new, innovative ideas and solutions”

- Promotes new ideas
- Enhances morale
- Enhances outcomes and performance
- Improves relationships
- Solves problems
- Increases efficiency, effectiveness or reduces costs

**DIVERSITY**

“We recognize that utilizing different talents, strengths and points of view, strengthens the agency and helps propel outcomes greater than the sum of individual contributor”

- Encourages the free flow of ideas and opinions
- Treats all people with dignity and respect
- Works effectively with dissimilar individuals
- Recognizes and promotes new skills in others

**EXCELLENCE**

“We celebrate individuals, teams and divisions who exceed expectations and deliver service with a PRIDE that permeates the organization”

- Surpasses expectations
- Engenders a positive public image
- Celebrates /rewards accomplishments and contributions of others
- Embraces change in a manner which inspires others
- Promotes teamwork /collaboration through communication
- Accepts personal responsibility and challenges with enthusiasm