TEACHERS' RETIREMENT BOARD

INVESTMENT COMMITTEE Item Number: **7**

SUBJECT: 2019 Asset Liability Study – Asset Allocation Step Three

CONSENT: _____ ATTACHMENT(S): 4

ACTION: __X___ DATE OF MEETING: May 8, 2019 / *45 mins.*

INFORMATION: ____ PRESENTER(S): ALM Team

POLICY

Asset-liability management is governed by the CalSTRS Investment Policy and Management Plan, IPMP, Teachers' Retirement Board Policy Manual, Section 1000, page A-1**.** As the overarching policy document for the Investment Branch, the IPMP begins with CalSTRS Investments Beliefs then presents the framework for meeting CalSTRS' objectives including the current Strategic Asset Allocation Long-term Policy Targets. After completion of the 2019 Asset-Liability Study, the IPMP will be updated with the new asset allocation policy targets.

HISTORY AND BACKGROUND

This item is the third in the 2019 Asset Liability Management (ALM) study reviewing the total fund asset allocation to meet the long-term pension liabilities. During the January 30th Investment Committee meetings, staff presented an overview of the ALM process and a timeline for the study (Attachment 1). Information was provided showing how this study and the resulting policy will have the largest impact on CalSTRS investment portfolio's expected return and risk profile along with its ability to fund retirement benefits.

During the March 28th Investment Committee meetings, staff presented the pension funding formula showing the investment returns are expected to fund 60 percent of pension benefits and presents the greatest variable to funding retirement benefits. To address this opportunity and risk, the ALM study will consider the role of assets in the portfolio and how best to combine them to maximizing the tradeoff between return and risk.

To focus this discussion on the largest drivers of risk and return in the portfolio, the traditional Asset Classes were mapped to Strategic Classes categorized by economic risk factors. Table 1 below shows the current Asset Classes mapped to these Strategic Classes.

Table 1. CalSTRS Asset Classes to Strategic Classes

Traditional Asset Class	Long-Term Target	Strategic Class	Strategic Class Weight
Total Public Equity	47%	Economic Growth	60%
Private Equity	13%		
Real Estate	13%	Real Assets	17%
Inflation Sensitive	4%		
Fixed Income	12%	Diversifying	23%
Risk Mitigating Strategies	9%		
Cash	2%		

At this meeting, Staff will recommend Investment Committee approve capital market assumptions in Attachment 2 for the ALM modeling. The assumptions include:

1. The risk and return assumptions for each Strategic Class and traditional Asset Class.
2. The correlations between each Strategic Class.
3. The inflation expectation for both the investment asset modeling and the actuarial liability modeling for the 2019 valuation.

Once approved, these assumptions form foundational building blocks for the ALM study. Attachment 2 has the assumptions for approval while Attachment 4 has the consultant opinion letter. At the May meeting, Staff and consultants are available to discuss the methodology and answer questions about the assumptions as the Investment Committee discusses and then approves the assumptions.

DISCUSSION

The capital markets assumptions are a key building block for constructing the long-term strategic asset allocation. These assumptions define expected returns and risk across different investment opportunities, enabling the Investment Committee's decision about how best to meet the long-term obligations of the fund. They are the key inputs in subsequent portfolio modeling steps, with a time horizon of 20 years. The 20-year forecast horizon aligns the assumptions with the long investment and liability horizon of the fund.

Forming capital markets assumptions is as much art as it is science and it's a process subject to significant uncertainty. The process of building assumptions involves considerable economic modeling and collaboration between Staff and consultants. While the assumptions involve a complex interaction of modeling, uncertainty, and collaboration, there are some important guiding principles that help ensure reasonableness:

1. Risk and return are inextricably linked: to achieve higher levels of return requires acceptance of higher risk.
2. Forward-looking returns are affected by current prices. When asset prices are higher relative to a normalized level, forward-looking returns tend to be lower (and vice versa), all else being equal.
3. Assets with similar drivers of risk, like public equity and private equity, tend to move together.
4. Assets that provide diversification to riskier assets tend to have lower returns.

Capital Markets Assumptions Definitions

Table 2 below identifies the three quantitative metrics that define the capital markets assumptions.

Table 2. Assumptions Definitions

Assumption	Definition
Expected Return ("Reward")	The long-term average annual return expected from an asset.
Expected Volatility ("Risk")	The long-term annual variation in returns expected for an asset, which also reflects the uncertainty in achieving a particular long-term rate of return.
Expected Correlation ("Diversification")	The degree of co-movement between assets. When one asset goes up, does another asset also go up (or down)? The scale for correlation is -1 to 1: the more negative (closer to -1), the more the assets move in opposite directions or diversify one another; the more positive (closer to 1), the more the assets tend to move together.

Strategic Class Assumptions

The strategic class assumptions in Table 3 and Table 4 reflect expected returns, volatilities, and correlations that incorporate a) the feasible private markets allocations discussed later in the memo and b) the detailed Asset Class assumptions in Attachment 2. These assumptions are the product of Staff modeling and debate, as well as extensive collaboration with Meketa.

Table 3. Strategic Class Assumptions

Strategic Class	**Expected Long-Term Return**	**Expected Volatility (Risk)**	**Composition**
Economic Growth	7.9% to 8.2%	17.7% to 17.9%	Public Equity & Private Equity
Real Assets	6.3% to 6.4%	12.5% to 13.4%	Real Estate & Inflation Sensitive
Diversifying	4.1% to 4.2%	6.1% to 6.3%	Fixed Income, RMS & Cash
Inflation Assumption	2.75%		

Table 4. Strategic Class Correlations

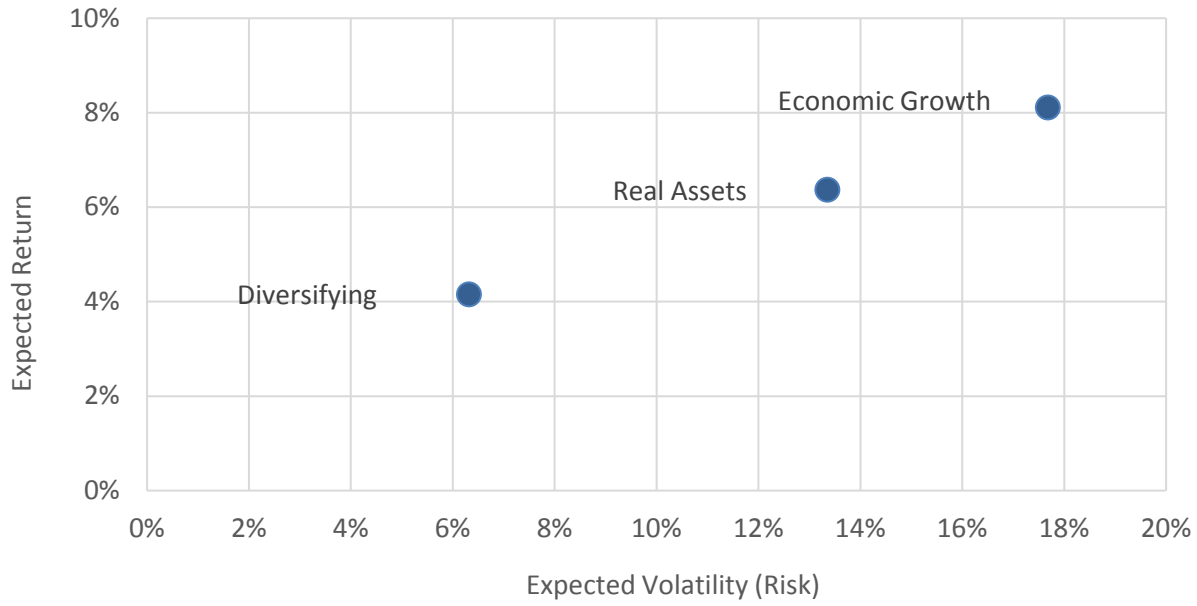
	Economic Growth	Real Assets	Diversifying
Economic Growth	1	0.46	-0.05
Real Assets		1	0.13
Diversifying			1

There are some important themes that emerge from the strategic class assumptions

1) Consistent with the ALM step 2 discussion in March, the Economic Growth class is expected to provide the highest level of return (and risk)
2) Real Assets have moderately high expected risk and return, with some exposure to Economic Growth
3) Diversifying assets are expected to provide the lowest levels of risk and return but also provide diversification to Economic Growth and Real Assets

Figure 1 below shows the relationship between risk and return for the three strategic classes.

Figure 1. Strategic Class Risk and Return



Key Assumptions

For each of the Strategic Classes, there are key components driving the assumptions as shown in Table 5. Attachment 3 (Capital Market Assumption Modeling Process) further details the approach to forming each assumption.

Table 5. Key Strategic Class Assumptions

Strategic Class	Key Assumption	Major Driver of Assumption
Economic Growth	Global Equity return	Equity Risk Premium – the excess return over cash for accepting company ownership risk
Real Assets	Real Estate return	Expected income from Real Estate
Diversifying	Fixed Income return	The yield, or income return, from lending to high quality borrowers

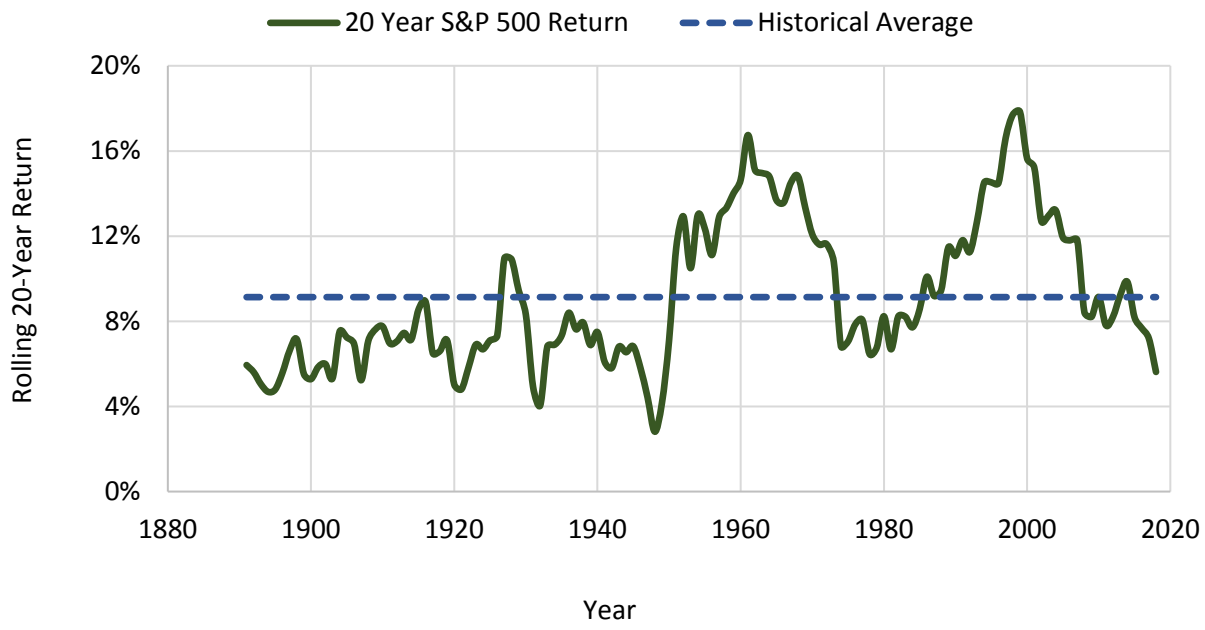
Market Variation from Expectations

Uncertainty and volatility are inherent in the estimation of future expected returns. The relationship between market returns and the metrics used for forecasting is imperfect. Estimates of some of the important metrics are themselves subject to uncertainty – inputs like growth in future earnings, changes in interest rates, and the future path of inflation are all fraught with uncertainty.

The natural variation present in markets can itself lead to results that differ from expectations for extended periods of time. For example, the proposed long-term expected return for Global Equity is 7.5%, with an expected volatility of 17.6%. The year-to-year variation of returns possible in Global Equity means that over a 20-year horizon, there's a 25% chance that Global Equity could experience a return of 4.9% or less.

It's important to note that this could result from nothing more than typical market volatility over time and is consistent with historical experience. Figure 2 below shows the rolling 20-year performance for the S&P 500 from 1871 through 2018. There are periods during which 20-year returns fell below 5% and other periods where 20-year returns exceeded 10%.

Figure 2. Historical 20-Year S&P 500 Performance



Implementation Returns

Modeling for the strategic asset allocation is focused on the underlying strategic allocation and does not include expectations of excess returns from different areas of the portfolio. The risk budgeting and benchmark education items in January and March touched on the importance of setting such expectations with a desired level of risk relative to the strategic allocation. Activities like the collaborative model implementation, active management in public markets, and Environmental, Social, and Governance-related activities are all examples of portfolio implementation considerations and are not part of the capital markets assumptions.

Modeling Private Market Weights

Allocations to private markets – Private Equity, Real Estate, and Inflation Sensitive – involve different allocation pacing than public markets. For public markets, transitioning to a new allocation target can be much quicker as the assets tend to trade frequently and with enough

volume. Private markets tend to have longer lead-times and lag-times to increase or reduce allocations. This is a result of the nature of the investments, which often require significant time to source opportunities and finalize legal agreements.

There are also some practical limitations on the total allocation possible in a private strategy. This is largely driven by the idea that, beyond a certain level of allocation, it becomes difficult or impossible to earn the returns expected from a private strategy.

The portfolio modeling in subsequent steps of the ALM process will reflect these practical limitations in two ways: first, through constraints on the total allocations to Private Equity, Real Estate, and Inflation Sensitive; and second, by modeling the allocation weight on a path from the current weight to the long-term target. Table 6 shows the fund allocation limits proposed for private markets.

Table 6. Private Market Maximum Weights

Asset Class	Part of Strategic Class	Maximum Fund Weight
Private Equity	Economic Growth	15%
Real Estate	Real Assets	16%
Inflation Sensitive	Real Assets	6%

Table 7 shows the assumed annual change in allocation weights to reach new targets. For example, Private Equity has a current weight of approximately 9% and a long-term target of 13%. Portfolio modeling for the current long-term target will assume that the Private Equity weight increases by 1% each year until it reaches the 13% target. In other words, it will take about four years to reach the long-term Private Equity target. The modeling assumptions will work similarly for the other private markets, ensuring that the risk and return metrics presented later in the study all reflect the practical reality of allocating to private markets.

Table 7. Maximum Annual Private Market Allocation Changes

Asset Class	Part of Strategic Class	Annual Allocation Weight Change
Private Equity	Economic Growth	1%
Real Estate	Real Assets	1% to 1.5%
Inflation Sensitive	Real Assets	1%

RECOMMENDATION

Staff recommends the Investment Committee approve the capital market assumptions for the Strategic and Asset Classes in Attachment 2.

Looking Ahead

- July 2019: Consider a broad range of total portfolio risk levels. Provide feedback to Staff and Consultants regarding desired risk levels and, possibly, the balance of risks within the portfolio (e.g. between Economic Growth, Inflation, Diversifying).
- September 2019: Using feedback from the July meeting, consider more detailed portfolio allocations. After narrowing the range of portfolio options to a desired level of risk, the focus can shift to the best policy portfolio with the desired level of risk. This could include refining the mix of Inflation versus Diversifying.
- November 2019: Further refine portfolio allocation options and adopt a long-term asset allocation.
- February 2020: Approve the new asset allocation in policy and review the implementation plan.

ATTACHMENTS/POWERPOINT

Attachment 1 – 2019 ALM Modeling Project Timeline
Attachment 2 – Capital Market Assumption for Adoption
Attachment 3 – Capital Markets Assumption Modeling Process
Attachment 4 – Meketa Concurrence Memo

PowerPoint – Asset-Liability Study March 2019

2019 Asset-Liability Modeling Project Timeline

Meeting	Full Board	Investment Committee
January 2019	Review of the CalSTRS Funding Plan	Introduction to ALM Project Overview Education
March 2019	None	Strategic Classes Education: their role, structure This item is an important "foundation" component for later portfolio modeling. It deals with what's in the portfolio and why.
May 2019	**Most recent valuation, projection of funding levels.** **Action: Adopt state contribution rate** **Action: Adopt 2% at 62 Normal Cost**	**Capital Markets Assumptions discussion** **Portfolio Constraints** **Action: Adopt Capital Markets Assumptions** **This is an important foundational item. Capital markets assumptions form the basis for all portfolio return modeling.**
July 2019	None	Preliminary portfolio modeling and discussion of Key Decision Factors This item provides a broad context for the risk-return tradeoff under the CalSTRS funding plan. The Key Decision Factors are important metrics that show the effect of different portfolios on CalSTRS' funding.
September 2019	None	Candidate portfolio modeling This item focuses on detailed portfolio modeling and the implications for funding.
November 2019	Annual Actuarial risk report	**Action: Adopt new asset allocation targets**
February 2020	**Action: Adopt experience study and new actuarial assumptions (based on new asset allocation)**	**Action: Approve the new Investment Policy and Management Plan**
May 2020	Most recent valuation, projection of funding levels. Action: Adopt state contribution rate Action: Adopt 2% at 62 Normal Cost	None

Capital Markets Assumptions for Approval

Strategic Classes

Strategic Class	Expected Geometric Return	Expected Volatility
Economic Growth	7.9% to 8.2%	17.7% to 17.9%
Real Assets	6.3% to 6.4%	12.5% to 13.4%
Diversifying	4.1% to 4.2%	6.1% to 6.3%
Inflation Assumption	2.75%	

Correlation	Economic Growth	Real Assets	Diversifying
Economic Growth	1	0.46	-0.05
Real Assets		1	0.13
Diversifying			1

Asset Classes

Asset Class	Geometric Return	Volatility	2015 Assumption	Change in Return From 2015
Global Equity	7.5%	17.6%	7.5%	**0%**
Private Equity	9.0%	24.0%	9.2%	**-0.2%**
Real Estate	6.3%	14.9%	7.2%	**-0.9%**
Inflation Sensitive	6.0%	12.3%	6.2%	**-0.2%**
Fixed Income	4.0%	6.2%	3.1%	**0.9%**
Risk Mitigating Strategies	4.5%	10.0%	5.3%	**-0.8%**
Cash	2.4%	1.0%	2.0%	**0.4%**
Inflation	2.75%			

Asset Class Correlations

	Global Equity	Private Equity	Real Estate	Inflation Sensitive	Fixed Income	Risk Mitigating Strategies	Cash
Global Equity	1	0.70	0.37	0.55	0.13	-0.18	0
Private Equity		1	0.49	0.54	0.05	-0.12	0
Real Estate			1	0.62	0.13	0.07	0.20
Inflation Sensitive				1	0.36	0.11	0.10
Fixed Income					1	0.58	0.25
Risk Mitigating Strategies						1	0
Cash							1

Capital Markets Assumption Modeling Process

Economic Growth

The expected return for Global Equity is a key assumption for the Economic Growth class. It directly defines the assumption for the largest asset class in the portfolio and is also a key part of the total return assumption for Private Equity. The basic process for estimating the long-term expected return incorporates two major assumptions:

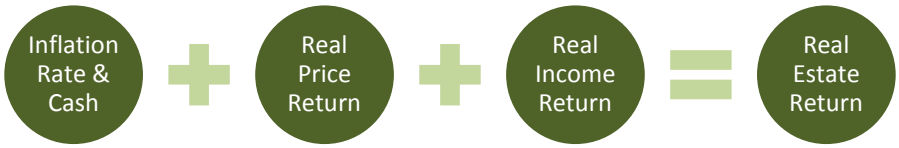
- Expected return on cash
- Equity risk premium

The expected return on cash is directly tied to the long-term assumed inflation rate, a consistent assumption across assets in the portfolio and for liability modeling. The equity risk premium – the additional return above cash for accepting risk of ownership in companies – reflects a few basic factors. One is the current level of prices in public equity markets and the resulting expectation for dividend yields. Another is the expected growth in company earnings and dividends over time.

Lower dividend yields or lower expected earnings growth translate into lower expected returns. The long-term assumption for public equity blends a short-term expectation based on dividend yields and earnings growth with a long-term historical average for public equity.

Real Assets

For the Real Assets strategic class, the assumption for Real Estate is a key component as it's the largest portion of the Real Assets class. Like the approach in Global Equity, the process for estimating Real Estate is similar: blend the expected cash and inflation rate with the expected income return for Real Estate. Instead of a dividend yield like with Global Equity, Real Estate has a similar measure of income relative to price (the so-called "capitalization rate"). Income return, the largest source of return in Real Estate, is closely tied to this measure. When Real Estate prices are high, the income relative to price is lower, resulting in lower expected returns (and vice versa). The process for estimating future Real Estate returns is:



Diversifying

The expected return from Fixed Income is the most important component for the Diversifying class. Like the dividend yield in Global Equity and income return in Real Estate, the yield – a measure of the current income returns in Fixed Income – is a key driver of future returns. When yields are higher, expected returns are higher (and vice versa). The expected return for Fixed Income combines the cash and inflation return with the additional yield for longer-term bonds:

The common theme in the major components of capital markets assumptions is the idea that current level of prices and yields for different assets influences the future expected returns. The long-term assumptions used by CalSTRS combines relatively short-term expectations that are influenced by current asset prices with long-term historical averages.

Market Comparison of Key Assumptions

	CalSTRS (20 years)	Meketa (20 years)	Callan (10 Years)	JP Morgan (10-15 Years)	PCA (20 Years)
Global Equity	7.5%	8.6%	7.1-7.3%	6.0%	7.4%
Private Equity	9.0%	10.1%	8.5%	8.25%	8.5%
Real Estate	6.3%	6.7%	6.3%	5.75%	6.8%
Fixed Income	4.0%	4.1%	3.8%	4.0%	4.0%
Cash	2.4%	2.9%	2.5%	2.0%	2.9%

MEMORANDUM

To: Investment Committee, CalSTRS

From: Neil Rue, Stephen McCourt, Mika Malone, Allan Emkin, Meketa Investment Group

Date: April 17, 2019

Re: Concurrence Memo – Asset Liability Project: Strategic Class Assumptions

SUMMARY & RECOMMENDATION

Staff Item "2019 Asset Liability Study – Asset Allocation Step Three" covers the first set of recommendations associated with the 2019 Asset Liability Management Study (2019 ALM Study). Specifically, the recommendations focus on key inputs into the modeling process: assumptions for the forward-looking behavior of the broad spectrum of CalSTRS' asset classes. Over the last several weeks, as is the normal course for a project of this scale, CalSTRS' Staff and consultants (Meketa and legacy PCA) have had significant dialogue about these assumptions, debating the various return, risk and co-movement aspects of the major asset groups utilized by CalSTRS. *In summary, after significant review and discussion, Meketa concurs with the recommended assumptions as displayed in Attachment 2 of Staff's memo.* The remainder of this memo describes some of the key aspects and nuances associated with the proposed assumptions. In conclusion, Meketa believes that Staff established and executed on a reasonable and prudent process to develop these assumptions, which are highly critical to the upcoming asset-liability modeling phase.

DISCUSSION

Staff's memorandum provides significant detail on the progress of the 2019 ALM Study to date. As highlighted elsewhere during prior agenda items, discussions, and presentations, an ALM Study (and the decisions that it requires) is very likely the most important set of decisions the Investment Committee will make over a typical work-plan cycle.

As the timeline in Attachment 1 of Staff's memo points out, the proposed capital market assumptions are the first key item that the Investment Committee needs to approve for this project. As described in Attachment 2, these assumptions cover three main attributes of each investment's long-term behavior: (i) its expected long-term return, (ii) its expected variation (or volatility) over time; and (iii) how the investment is expected to relate/co-move with other investments (i.e., its correlation to every other considered investment).

MEKETA INVESTMENT GROUP
411 PARK AVENUE SUITE 401 PORTLAND, OR 97209
503 226 1050 fax 503 226 3304 www.meketagroup.com

In arriving at its proposed assumptions, Staff undertook a multi-faceted process that included a few key steps. First, Staff gathered capital market assumptions from a variety of other practitioners, including consultants (e.g., Meketa and legacy PCA) as well as well-known institutional investment managers (e.g., JP Morgan and others). Estimates from these various experts provided a general point of reference as Staff considered their own unique assumptions for each specific asset class. Second, Staff applied well-known industry-standard formulas for building expected returns for each major asset class (see Attachment 3 for explanations). Each formula provides a general framework for constructing a return estimate. Finally, for the risk and correlation estimates, Staff examined historical trends across the various asset classes and sought input from various Meketa professionals for their independent views and opinions.

After Staff completed its process, Meketa met with Staff to review each of the assumptions in detail. Where appropriate, Staff modified their recommendations accordingly. Attachment 2 shows how the expected returns changed from the prior ALM Study, conducted in 2015. The most noteworthy changes are to the Real Estate and Fixed Income asset classes. The change to Real Estate reflects a continued expected shift to more core-oriented investments (i.e., marginally less risky assets with less leverage); the change to Fixed Income reflects a higher level of interest rates today in relation to four years ago. Meketa believes these shifts, along with the other adjustments, are reasonable and reflect consensus thinking about the trends in these classes. As another reference point, Meketa has attached a summarized survey of advisor expectations, the *Horizon Actuarial 2018 Survey of Capital Market Assumptions*. While slighted dated (showing assumptions from 2018, not 2019, as this year's survey has not been completed), the survey provides extensive coverage, receiving estimates from 34 separate organizations. A quick glance of the survey's summary table in the Attachment to this memo indicates that CalSTRS capital market assumptions are well within the range of expectations for each comparable class.

If you have any questions, please do not hesitate to contact us.

cc: Christopher Ailman

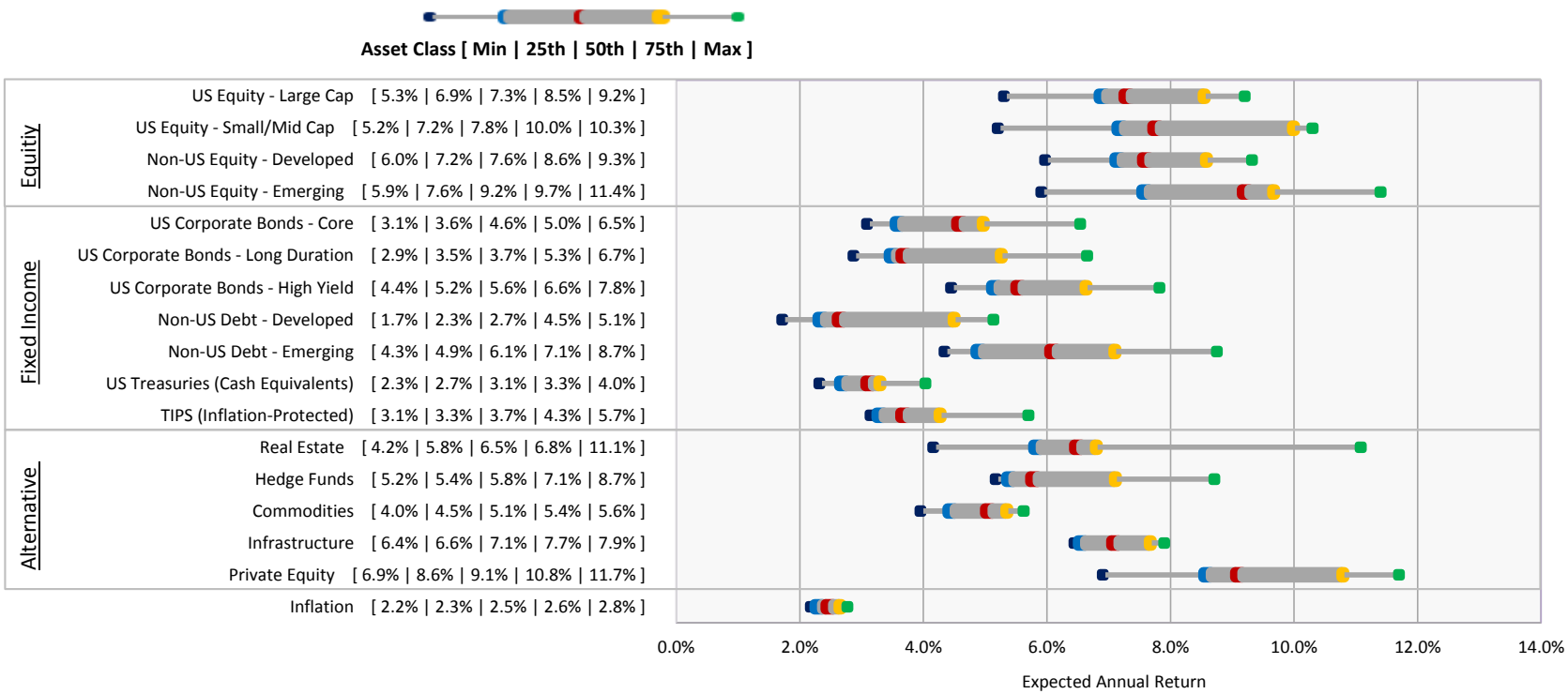
NR/SPM/MLM/AE/jls

Exhibit 18

The exhibit below shows the ranges of expected annual returns for different asset classes over a 20-year investment horizon. The ranges shown below are based on the assumptions for 13 advisors who provided longer-term assumptions (horizons of 20 years or more). Expected returns shown below are annualized (geometric). Note that the ranges of expected returns are somewhat narrower when the investment horizon is longer.

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.

2018 Survey: Expected Returns by Asset Class (20-Year Horizon)



Expected returns are annualized over 20 years (geometric), based on a subset of 13 advisors who provided longer term assumptions.