



Integrity

Efficiency

Transparency

Professionalism

Response to PSERB Resolution 2017-41 Re: Management Fees

Prepared by PSERS Investment Professionals
July 2018

Purpose

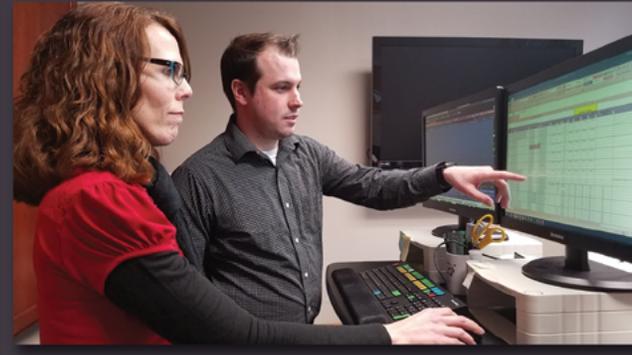
PSERB Resolution 2017- 41

Re: Management Fees

December 8, 2017

RESOLVED, that the Board hereby directs the Investment Office staff and the Board's investment consultants, to present to the Board at the June 2018 Investment Committee meeting for consideration, a long-term plan or series of recommendations for the reduction of investment management fees, by a set percentage, paid to external managers over a three-year period. The plan should identify annual goals and address the wide disparity in how "management fees" are reported among public pension funds and may include recommendations for alternate fee structures, which distinguish between "base fees" and "profit sharing" and other fee-structuring and reporting practices.

In response to these objectives, PSERS Investment Professionals and our investment consultants (Aon, Askia, and Hamilton Lane) have created a single, long-term plan to reduce base management fees paid to external investment managers as presented in the following report.



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Response to PSERB Resolution 2017-41

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Executive Summary

Guiding Principles for the Plan

PSERS Investment Professionals used the following guiding principles when creating the plan.

1. Focus on investment manager cost efficiency.
2. No future changes to the strategic asset allocation were assumed.
3. Focus on reducing the base management fees.
4. A base period (fiscal year 2017) was established to evaluate and measure investment manager fee savings.
5. The savings were evaluated on a static gross investment asset level (June 30, 2017).
6. PSERS Investment Professionals and investment consultants reviewed potential investment manager fee savings by asset class.
7. Realization of some of the savings is subject to the ability of the Board to hire additional Investment Professionals (The plan requires 9 additional Investment Professionals).
8. Annual savings were converted to cumulative compounded savings over a 30-year period using two methods.
9. No specific investment management fee reduction goals or targets were set for this study and there were no limitations on the amount of fee savings that could be achieved. PSERS Investment Professionals endeavored to get the most fee savings that could be realistically achieved based on the strategic asset allocation established by the Board. The plan provides a completely transparent view on base fees and, therefore, also includes asset classes where costs are expected to increase under the plan.

Reduces ongoing cost by over
\$35 million a year

More than **\$2 billion** in
compounded savings over 30 years

Essential Plan Elements

The Plan identifies two essential elements that are vital to the plan's success: renegotiating current fee arrangements and expanding internal management.

1. **Renegotiate management fee arrangements to create a better alignment of interest between PSERS and each investment manager.** This is to be achieved by renegotiating fee arrangements with existing managers to decrease the guaranteed fees, or base fees, in exchange for a profit sharing arrangement on returns above a negotiated benchmark. Initially, we focused on managers with higher base fees, but we will work through all current managers over time. We are carefully negotiating these arrangements to ensure that our interests are properly aligned and that the investment manager is not incentivized to take on increased risk.
2. **Expand internal management,** which in most cases will require an expansion of investment office professionals.

Results and Action Steps Required in the Plan

As of the writing of this report, PSERS Investment Professionals estimate that, within three years, we can reduce annual base management fees by \$38.7 million, or 10.4% from FY 2017 levels. To achieve 100% of those savings, we will need to hire 9 additional investment professionals at a conservative budgeted cost of \$3.15 million/year. Net annual savings amount to \$35.6 million/year beginning after fiscal year 2021 and continue for the next 27 years.

The plan to achieve reductions in management fees is ongoing and evolving as the Fund continues to grow and invest. At present, the following is the plan to achieve base fee cost savings. The table on page 4 shows the summary steps by asset class and the expected compounded savings over the next 30 years along with reference to the page(s) in the report with further details.



Executive Summary (continued)

Monitoring of Progress

We are proud to report that we have made tremendous progress on reducing base management fees as of the date of this report. We have already finalized the renegotiation of one investment management contract which impacts both the commodities and absolute return allocations, have tentatively negotiated terms on two other contracts (but we are still negotiating for better terms), and have had fruitful discussions on three other contracts. In addition, we have reduced the amount invested in private real estate from 9.8% to around 8.6% of the fund today. This progress amounts to well over \$1.5 billion in savings over 30 years.

While we have already made considerable progress, we still have work to do. The Investment Office has drafted a request for the nine additional investment professionals needed to fulfill this plan. **Please note if we are unable to get approval to hire the necessary additional investment professionals, the estimated savings over the next 30 years drops from \$2.49 billion to \$1.55 billion, with the bulk of the lost savings coming from not being able to manage more co-investments in private equity and private real estate.**

Finally, this fee savings plan is, and has been, a continuing effort by the Investment Office. By the August Board meeting, we may be far enough along on other base fee discussions to report more good news on additional base management fee savings. In addition, we have recently negotiated some very attractive fee deals on new mandates, two of which include 0% base fees (a third possible recommendation having 0% base fees is being developed at the time of this report's publication). While we can't guarantee success in minimizing all base fees to that level, we are working to create a better alignment of interest where we can. In addition, we have done a few joint deals with the State Employees' Retirement System (SERS) which resulted in fee savings for both Systems.

PSERS Investment Professionals will not increase risk, sacrifice quality and/or investment returns for fee savings. Our first job is to hire the best institutional quality managers we can find. Fortunately, the highest quality managers have the best long-term risk/return profiles. Unfortunately, the best investment managers tend to have higher fee structures. Trading down in quality for lower fees is a recipe for lower net returns and possibly higher risk. We view such a trade as fiduciarily imprudent. As the old saying goes, you get what you pay for. But, to be clear, that doesn't mean we won't aggressively negotiate on behalf of the System. We always have and always will.

Public Pension Plan Fee Reporting Differences

The request to look into the wide disparity in how management fees are reported by public pension plans that was made to PSERS' Board was also made to SERS Board. SERS' Investment Professionals completed such a study in February 2018, a copy of which is included in Appendix III of this report. Their report found that 44% of public plans' fees are understated by Pew in their report titled "State Public Funds Increase Use of Complex Investments". It showed that Pew's calculation of fees was severely understated for other funds relative to how PSERS and SERS report their fees. Our more complete transparency of fees has created unfair criticism of the Pennsylvania funds relative to an artificially low Pew median fee.

We reviewed SERS' report and found it to be of high quality. This is another example of the cooperation between the two pension systems. We'd like to thank Bryan Lewis, SERS' Chief Investment Officer, and his team for sharing this report with us.

Since the SERS study was not publicly released, we have blacklined the names of individual retirement systems identified in the study out of respect for those organizations.



Executive Summary (continued)

Manager Compensation (Base vs. Profit Share)

We have observed that there is no universal compensation arrangement that is appropriate in all circumstances. Perhaps more importantly, we believe that a focus on manager remuneration in isolation can lead to self-defeating decisions that work to the detriment of beneficiaries. Philosophically, we strive to create relationships that maximize our expected net returns on a risk adjusted basis. Fees and compensation structure, while important, are but one component of this calculation. We also accept the fact that ultimately the most talented individuals in any industry will earn considerable rewards for their efforts. Nevertheless, we look to hire the best because we believe that over time doing so will yield higher net of fee returns for our beneficiaries. Doing so is challenging because our decisions must be made without the benefit of hindsight and because good long term decisions may look questionable in the short run.

Compensation arrangements for managers come in two general types: (1) base fee only or (2) lower or no base fee plus a profit share. When we are afforded the opportunity to design compensation arrangements with active managers, we focus first and foremost on alignment of interest. The first type does little in this regard and in fact may encourage asset gathering by the manager which may degrade future performance. That type is best suited for passive mandates where matching the index is the primary and often sole objective.

The second type does a much better job of aligning interests with active managers, as most or all of the compensation is linked to performance. If the manager underperforms its benchmark, the total fees paid by PSERS will be less for the second type than the first. This is downside protection – PSERS pays less when returns are lower. If the manager outperforms, the total fees paid by PSERS will be greater for the second type than the first. PSERS pays more when returns are higher. PSERS thus obtains downside protection in return for giving up a share of the upside. It pays lower fees at times it can least afford them and pays higher fees at times it can most afford them.

While profit share arrangements improve alignment, they are not perfect. How do we encourage prudent risk taking for those managers with profit share arrangements? To discourage excessive risk taking, we seek managers with much of their own money invested in the strategy and those who are owners of their firm. To prevent too little risk taking and missing long run performance goals, we seek structures with hurdle rates where the profit share is not earned until that hurdle rate is exceeded. Most importantly, we strive to identify individuals of integrity who want to be compensated for helping their clients surpass their benchmarks and are willing to decline new investor capital if it is likely to suppress future performance.

The Plan Continues a History of Aggressively Managing Fees

PSERS has a robust internal management program. As of June 30, 2017, we managed over \$22 billion of assets in-house, saving over \$39 million each year in fees that would otherwise have been paid to external managers. As of June 30, 2018, we have over \$23.9 billion of assets being managed internally. Over the past three years, we've increased the amount of assets managed internally at very low costs from 30% to 38% of the Fund. A full implementation of the plan discussed above will further increase assets managed internally to around 43% of the Fund within three years of hiring the additional investment professionals needed.

Historically, we have always aggressively negotiated fee deals with managers which include discounts for size and discounts for first close investors in a fund. We've also aggressively moved to create a co-investment platform internally which has saved millions of dollars a year in fees. Our co-investment program began in 2012 and we have over \$600 million in co-investments today, mostly in no fee, no profit share deals. We eliminated active management in U.S. equities years ago because the performance of active managers in U.S. equities did not justify the fees we were paying.

From FY 2013 to FY 2017, total investment management fees have fallen by 15% from \$558 million to \$474 million



Executive Summary - Plan of Action

Asset Class	Projected Savings over 30 years	Steps Needed to Achieve Savings	Section w/ Detailed Discussion & Analysis
Public Equity	None	N/A	10
Private Equity	\$691.0 million	<ol style="list-style-type: none"> Hire 3 additional investment professionals Increase co-investment program by \$460 million over 3 years to 12% of private equity allocation 	11
Fixed Income			
- U.S. Core Fixed Income	\$9.6 million	<ol style="list-style-type: none"> Terminate one external active manager and bring assets in-house 	12
- Non-U.S. Developed Markets Fixed Income	\$18.1 million	<ol style="list-style-type: none"> Hire 1 additional investment professional Transfer from external active manager to in-house 	12
- Multi-Sector Fixed Income	None	N/A	13
- TIPS Fixed Income	\$511.2 million	<ol style="list-style-type: none"> Renegotiate lower base fee with external active manager in exchange for profit share Hire 1 additional investment professional Transfer leveraged U.S. TIPS portfolio from external to in-house 	13
- Emerging Markets Fixed Income	None	N/A	14
- High Yield/ Opportunistic Fixed Income	None	N/A	14
- Other Fixed Income	None	N/A	14
Real Estate	\$900.4 million	<ol style="list-style-type: none"> Reduce private markets real estate from 10% to 8% of the Fund in line with strategic allocation Hire 1 additional investment professional Increase co-investment program by \$213 million over 3 years to 8% of private real estate allocation 	15
Master Limited Partnerships	\$135.6 million	<ol style="list-style-type: none"> Renegotiate lower base fee with two external active managers in exchange for profit share 	17
Infrastructure	(\$742.1 million)	<ol style="list-style-type: none"> Costs will increase in line with moving to the Fund's 4% strategic allocation and the hiring of private managers 	18
Commodities	(\$144.1 million)	<ol style="list-style-type: none"> Hire 1.5 additional investment professionals Bring 50% of the externally managed assets in-house Renegotiate lower base fee with the portable alpha manager in exchange for a higher profit share Additional costs will be incurred with investments in private funds to optimize overall implementation of the asset class 	19
Risk Parity	\$46.8 million	<ol style="list-style-type: none"> Hire 1 additional investment professional Transfer \$250 million from external managers to in-house 	21
Absolute Return	\$1.07 billion	<ol style="list-style-type: none"> Renegotiate lower base fee with two external managers in exchange for a higher profit share. 	22
Total Projected Savings over 30 years	\$2.49 billion		



Summary of Savings

Compounded Fee Savings over 30 Years Based on Fiscal Year Ended June 30, 2017 Base Management Fees

Asset Class	CAFR Base Management Fees	Adjustments*	Adjusted Base Management Fees	Total Annual Fee Savings	Base Management Fees After Total Savings	Aon 30-Year Expected Return	30 Year Compounded Savings Assuming Aon's Expected Returns	30 Year Compounded Savings Assuming 5% Growth in Fund Assets
U.S. Equity	1,494,000	-	1,494,000		1,494,000	6.50%	-	-
Non-U.S. Equity	19,771,000	-	19,771,000		19,771,000	7.90%	-	-
Private Equity	102,714,000	-	102,714,000	(6,700,000)	96,014,000	9.00%	690,830,000	348,240,000
Fixed Income:								
U.S. Core	4,961,000	-	4,961,000	(197,000)	4,764,000	3.50%	9,640,000	12,280,000
Non-U.S. Developed Mark	420,000	-	420,000	(775,000)	(355,000)	2.90%	18,120,000	25,050,000
U.S. Long Treasuries	-	-	-		-	3.10%	-	-
Inflation-Protected	26,107,000	-	26,107,000	(11,850,000)	14,257,000	2.90%	511,190,000	715,270,000
Emerging Markets	1,669,000	-	1,669,000		1,669,000	5.70%	-	-
High Yield/Opportunistic	51,025,000	-	51,025,000		51,025,000	5.10%	-	-
Multi-Sector	1,633,000	-	1,633,000		1,633,000	-	-	-
Cash	-	-	-		-	-	-	-
Other	1,649,000	-	1,649,000		1,649,000	2.60%	-	-
Total Fixed Income	87,464,000	-	87,464,000	(12,822,000)	74,642,000			
Real Estate	50,609,000	(198,000)	50,411,000	(11,400,000)	39,011,000	6.60%	900,350,000	687,970,000
Master Limited Partnership:	8,295,000	-	8,295,000	(1,500,000)	6,795,000	7.20%	135,630,000	93,480,000
Infrastructure	-	198,000	198,000	8,800,000	8,998,000	6.90%	(742,080,000)	(540,120,000)
Commodities	4,132,000	2,625,000	6,757,000	1,500,000	8,257,000	5.80%	(144,050,000)	(126,100,000)
Risk Parity	19,632,000	-	19,632,000	(1,000,000)	18,632,000	6.20%	46,820,000	38,550,000
Absolute Return	78,202,000	(2,625,000)	75,577,000	(15,610,000)	59,967,000	5.80%	1,068,180,000	937,780,000
	372,313,000	-	372,313,000	(38,732,000)	333,581,000		2,494,630,000	2,192,400,000

Base Fee Savings/Year	10.4%
Incremental cost of internal management from hiring of 9 add'l invest. professionals	(38,732,000)
Fee Savings/Year after incremental costs from hiring 9 add'l invest. professionals	9.6%

* - reclassification of fees to appropriate asset classes
 ** - total needed investment professionals rounded up from 8.5 to 9
 *** - compound savings at 5.0% adjusted down by \$11.63 million to \$2.18 billion to account for additional 0.5 additional investment professional not included in the analyses.

The plan results in more than \$2 billion in net savings over 30 years.

The plan reduces net costs by \$35 million or nearly 10%.



Guiding Principles for the Plan

The following guiding principles were used in crafting this plan:

1. Focus on investment manager cost efficiency.

PSERS Investment Professionals and the investment consultants focused on implementation of the current long-term strategic asset allocation approved by the Board. The plan does not change the strategic asset allocation itself or the risk/return profile other than those changes currently adopted by the Board in the long-term allocation.

2. No future changes to the strategic asset allocation are assumed.

Changes can't be anticipated. Any increases/decreases in certain asset classes could increase/decrease management fees based on how those asset classes are implemented.

3. Focus on reducing the base management fees.

Although PSERS Investment Professionals always seek the fairest overall management fee deal with its investment managers, which includes negotiating both the base fee and the profit share, the plan focus was on reducing the guaranteed portion of the management fees, the base fee. Base fees are earned regardless of the manager's success in beating a passive alternative and should, therefore, be minimized. A profit share is earned when the investment manager exceeds pre-established benchmarks. A profit share better aligns the interests of the System and the investment manager. A higher profit share paid means the manager performed well and earned better net-of-fee performance for the System. Actions to reduce base fees, in most cases, will coincide with the potential for the investment manager to earn a greater profit share subject to his/her success in beating the pre-established benchmark for the portfolio being managed.

4. A base period was established to evaluate and measure investment manager fee savings. PSERS Investment Professionals have set the base year as the fiscal year ending June 30, 2017 as it was the last audited year for both base fees and investment assets under management.

5. The savings have been evaluated on a static asset level, meaning no increases or decreases in fund size will occur over the 30-year period. It is expected that the fund will grow and the savings will be greater using a larger net asset value; however, for purposes of this study, that was not modeled. As the fund grows the absolute dollar amount of base management fees will also grow. The June 30, 2017 static gross investment asset level of \$61.5 billion was used for this analysis.

6. PSERS Investment Professionals and the investment consultants reviewed potential investment manager fee savings by asset class, as reported in the 2017 CAFR (Supplementary Schedule 2, page 74, as adjusted).

7. Realization of some of the contemplated savings is subject to the ability of the Board to hire additional investment professionals.

While we could get very granular with the level of investment professionals hired and corresponding compensation, we will assume for the purposes of this analysis an all-in cost of each investment professional is \$350,000/year. We have factored this into the analysis and present a net fee savings.

8. Annual savings are converted to cumulative compounded savings over a 30-year period using the 30-year capital market assumptions provided by Aon and used by the Board in setting the asset allocation plan. We have also compounded the savings using the expected growth rate of assets of 5.0% (7.25% return assumption less 2.25% in expected net cash outflows).

9. Finally, no specific investment management fee reduction goals or targets were set for this study and there were no limitations on the amount of fee savings that could be achieved. PSERS Investment Professionals endeavored to get the most fee savings that could be realistically achieved based on the strategic asset allocation established by the Board. The plan provides a completely transparent view on base fees and, therefore, also includes asset classes where costs are expected to increase under the plan. PSERS Investment Professionals focused on generating a realistic plan that would not detract from PSERS Investment Professionals' overarching goal of maximizing expected risk-adjusted net-of-fee returns within the fiduciary parameters.



Traditional vs. Non-Traditional Asset Classes

Traditional Asset Classes

Traditional asset classes offer the Board the choice of two different implementations: passive (otherwise known as indexing) and active.

In U.S. equities, PSERS Investment Professionals have passively managed this asset class for over five years and uses certain alpha strategies to add incremental value at low risk. PSERS Investment Professionals also implement the following asset classes passively in internally-managed accounts unless otherwise noted:

- 44% of non-U.S. equity allocation
- 100% of U.S. Treasury allocation
- 100% of publicly-traded infrastructure allocation
- 80% of commodities allocation
- 79% of publicly-traded real estate securities
- 100% of currency hedge (managed by an external manager)

PSERS Investment Professionals do not currently recommend changes to these passive or passive plus approaches.

The remaining traditional asset classes are managed actively and subject to this plan. PSERS Investment Professionals could achieve higher cost savings by recommending low cost index approaches for the remaining traditional asset classes; however, the end result would be lower returns and higher costs to the employers and taxpayers. Our approach to these actively managed portfolios was to focus on reducing the base management fees in exchange for a profit share if the manager exceed an appropriate benchmark, better aligning the manager's interests with PSERS.

As noted by Aon in a recent white paper, "The active versus passive management debate is both nuanced and rich. There are good reasons why this is a hotly-debated topic, and reasonable people fall on both ends of the spectrum. It is unfortunate that often this debate is summarized with half-truths and sound bites." Our conclusion to actively manage certain asset classes is based on a successful history of active management as illustrated in Appendix II. Since we have a long history to study, PSERS does not need to rely on third party research studies, such as S&P's SPIVA studies, to make these judgments. However, PSERS Investment Professionals will continue to monitor PSERS' performance in these actively managed asset classes to ensure that it remains appropriate (benefits continue to outweigh costs).

Non-Traditional Asset Classes

Non-traditional asset classes are those that only offer active management to implement, such as private equity and absolute return. The decisions to invest in these asset classes are made by the Board when the asset allocation is set. PSERS Investment Professionals then find appropriate investment manager(s) to implement this portion of the asset allocation. Real estate is an example of an asset class that can be implemented in a variety of ways, including in traditional active and/or passive portfolios or in non-traditional limited partnership structures or direct holdings of real estate. PSERS Investment Professionals reviewed a mix of traditional (active and passive) and non-traditional real estate in its evaluation of that asset class.

Note on Fee Savings

It's important to note, the fee savings in all cases only addresses base management fees. In addition, this analysis assumes no growth in the total assets of the pension fund and, therefore, no growth in each asset class. Reality is that as the assets of the pension fund grow it is expected that assets in each asset class would grow as well. This would result in both additional base management fees and additional base management fee savings.

Any base fee savings that can be negotiated will flow directly to the bottom line and provide downside protection to the Fund should the investment manager underperform. The Board, however, may give up some upside should the manager outperform, if the negotiation for a lower base fee resulted in a higher profit share.



Net Assets Under Management

Net Assets Under Management As of June 30, 2017

Asset Class	CAFR	Internally-Managed	Externally-Managed	Adjustments**	Adjusted Externally-Managed Assets
U.S. Equity*	3,729,541,000	3,729,541,000	-	339,000,000	339,000,000
Non-U.S. Equity	6,910,141,000	3,041,602,000	3,868,539,000	413,872,000	4,282,411,000
Private Equity	7,909,926,000	486,915,000	7,423,011,000		7,423,011,000
Fixed Income:					
U.S. Core	2,389,766,000	1,235,757,000	1,154,009,000		1,154,009,000
Non-U.S. Developed Markets	177,400,000		177,400,000		177,400,000
U.S. Long Treasuries	1,520,361,000	1,520,361,000	-		-
Inflation-Protected	7,798,400,000	1,900,433,000	5,897,967,000		5,897,967,000
Emerging Markets	345,980,000		345,980,000		345,980,000
High Yield/Oppportunistic	4,486,570,000	13,823,000	4,472,747,000		4,472,747,000
Multi-Sector	410,414,000		410,414,000		410,414,000
Cash*	2,045,477,000	2,045,477,000	-		-
Other	-	-	-	484,000,000	484,000,000
Total Fixed Income	19,174,368,000	6,715,851,000	12,458,517,000	484,000,000	12,942,517,000
Real Estate	6,146,728,000	809,997,000	5,336,731,000		5,336,731,000
Master Limited Partnerships	2,369,627,000	476,238,000	1,893,389,000		1,893,389,000
Infrastructure	1,055,092,000	992,668,000	62,424,000		62,424,000
Commodities	4,052,402,000	3,331,156,000	721,246,000	269,589,000	990,835,000
Risk Parity	5,038,035,000	2,575,580,000	2,462,455,000		2,462,455,000
Absolute Return	5,082,149,000	-	5,082,149,000		5,082,149,000
Total Gross Assets	61,468,009,000	22,159,548,000	39,308,461,000	1,506,461,000	40,814,922,000
		36.05%	63.95%		
Financing	(9,070,910,000)				
Total Pension Investments - Asset Allocation Basis	52,397,099,000				
Net Asset Allocation Adj.	(213,956,000)				
Pension Investments Per Statement of Fiduciary Net Position	52,183,143,000				

The June 30, 2017 static gross investment asset level of \$61.5 billion was used for the plan development.

* - adjustment made for cash adjustment made by Investment Accounting for cash merger substitutions and portable alpha position in the amount of \$513,898,000

** - U.S. Equity - added NAV of portable alpha manager included in the internally-managed index (\$339 million)
 Non-U.S. Equity - added NAV of emerging market equity manager included in the internally-managed index to get market exposure (\$414 million)
 Other Fixed Income - represents three manager portfolios included in the PSERS LIBOR-Plus Portfolio for performance enhancement or risk mitigation
 Commodities - added NAV of portable alpha manager included in internally-managed index (\$270 million)



Base Management Fees - External Management

Base Management Fees - External Management As Of And For The Year Ended June 30, 2017

Asset Class	CAFR	Adjustments*	Adjusted Base Management Fees	Adjusted External Net Assets @ June 30, 2017	Base Management Fee in Basis Points
U.S. Equity	1,494,000	-	1,494,000	339,000,000	44.07
Non-U.S. Equity	19,771,000	-	19,771,000	4,282,411,000	46.17
Private Equity	102,714,000	-	102,714,000	7,423,011,000	138.37
Fixed Income:					
U.S. Core	4,961,000	-	4,961,000	1,154,009,000	42.99
Non-U.S. Developed Markets	420,000	-	420,000	177,400,000	23.68
U.S. Long Treasuries	-	-	-	-	n/a
Inflation-Protected	26,107,000	-	26,107,000	5,897,967,000	44.26
Emerging Markets	1,669,000	-	1,669,000	345,980,000	48.24
High Yield/Oppportunistic	51,025,000	-	51,025,000	4,472,747,000	114.08
Multi-Sector	1,633,000	-	1,633,000	410,414,000	39.79
Cash	-	-	-	-	n/a
Other	1,649,000	-	1,649,000	484,000,000	34.07
Total Fixed Income	87,464,000	-	87,464,000	12,942,517,000	67.58
Real Estate	50,609,000	(198,000)	50,411,000	5,336,731,000	94.46
Master Limited Partnerships	8,295,000	-	8,295,000	1,893,389,000	43.81
Infrastructure	-	198,000	198,000	62,424,000	31.72
Commodities	4,132,000	2,625,000	6,757,000	990,835,000	68.20
Risk Parity	19,632,000	-	19,632,000	2,462,455,000	79.73
Absolute Return	78,202,000	(2,625,000)	75,577,000	5,082,149,000	148.71
	<u>372,313,000</u>	<u>-</u>	<u>372,313,000</u>	<u>40,814,922,000</u>	<u>91.22</u>

* - portable alpha manager fees misclassified as Absolute Return fees and infrastructure fee misclassified as real estate

FY ended June 30, 2017,
was the base period used
to evaluate and measure
management fee savings.



Public Equity

U.S. Equities

- **Base management fees paid in FY 2017: \$1,494,000**
- **Net asset value of external active manager at June 30, 2017: \$339,000,000**
- **Base management fee basis points: 45 bps**

Comments

All of the U.S. equity beta is managed internally. However, we have one portable alpha investment manager included in the S&P 500 Index portfolio who receives a small base management fee and a profit share. The investment manager has added 340 bps of net of fee annualized incremental performance since inception (over \$28 million) and around 400 bps (around \$13 million) over the past year ended June 30, 2017. As such, we don't believe any incremental savings can be achieved in U.S. equities without negatively impacting performance, nor do we expect any incremental costs.

Externally-managed Non-U.S. Equities

- **Base management fees paid in FY 2017: \$19,771,000**
- **Net asset value of external active managers at June 30, 2017: \$4,282,411,000**
- **Base management fee basis points: 23 - 90 bps**

Comments

Approximately 44% of the non-U.S. equity allocation is managed internally with the remaining 56% being managed externally. The emerging markets equity exposure of the internally-managed index is managed by an external investment manager. The base management fees and net assets for this portfolio are included in the information.

We have reviewed these fees and we have made some terminations and some manager hires over the past year, but we don't anticipate having any significant fee savings or cost increases from this asset class and, therefore, have not modeled any.



Private Equity

- **Base management fees paid in FY 2017: \$102,714,000**
- **Net asset value of external active managers at June 30, 2017: \$7,423,011,000**
- **Base management fee basis points range: 50 - 250 bps**

Comments

Private equity fee structures are basically static and extremely difficult to renegotiate on existing funds given the strong long-term returns and demand for top-tier funds. PSERS Investment Professionals believe that the best avenue to achieve base fee savings will be to increase co-investments in no-fee, no-carry deals.

PSERS started the internal co-investment program in 2012 and has had considerable success since inception with a 31.1% internal rate of return and a multiple of paid-in capital of 1.72x. As of June 30, 2017, PSERS' Private Equity allocation was approximately 6.2% co-investments and 93.8% in primary fund investments. The basis point fee for externally managed assets of \$7.42 billion (illustrated below) shows a blended basis point charge of 1.38%. PSERS Investment Professionals' goal is to increase the internally-managed co-investment program from 6.2% (\$487 million) to 12% (\$950 million) of the private equity program. If this level is assumed for co-investments this past year, the externally managed assets would have fallen to \$6.96 billion and management fees would have fallen to \$96.0 million (assuming a blended 1.38% base fee load), resulting in a total savings of \$6.7 million annually.

However, to generate the fee savings of a 12% allocation program and to effectively evaluate the significant flow of co-investment opportunities, PSERS Investment Professionals estimate that it would need an additional three investment professionals (including one in operations). This would increase annual internal management costs by \$1.05 million.

Potential fee savings, net of the additional internal costs, are \$6.7 million less \$1.05 million, or \$5.65 million per year.

Execution

PSERS Investment Professionals expect that they will take 3 years to achieve these base management fee savings on an annual basis, with 1/3 of the savings coming each year until the full savings is achieved at the end of fiscal year 2021, continuing for the next 27 years. PSERS Investment Professionals also assume 100% of the cost of the three new employees to be incurred in the first year. Additionally, while PSERS Investment Professionals see significant co-investment deal flow today, PSERS Investment Professionals may need to request that the Board expand the policy parameters to permit co-investments with funds that PSERS does not have a direct relationship with currently. This could be achieved by potentially expanding the co-investment program to collaborate with (1) other pension funds with direct investment programs and (2) other general partners that our private equity investment consultant has a relationship with as a couple of examples of ways to increase deal flow.

Compounded Savings

Estimated total base management fee savings compounded at 9.0% over 30 years: \$691 million

Detailed Calculations

FY 2017 Base Mgmt. Fees:	\$102.7 million
June 30, 2017 (End of the Year) assets:	\$7.91 billion of which \$487 million was co-invest and \$7.42 billion externally-managed.
Base mgmt. fee as a percentage of externally-managed funds	$(.1027 / (7.91 - .487)) = 1.38\%$
Rebasing program as 12% internal/88% external would reduce the externally-managed component to \$6.96 billion	
Rebased FY2017 Base Mgmt. Fees:	$\$6.96 \text{ billion} * 1.38\% = \96 million
Gross fee savings:	$\$102.7 - \$96.0 = \$6.7 \text{ million/year}$ before internal costs
Internal cost:	3 employees @ \$350,000/year: \$1.05 million
Net fee savings/year:	\$5.65 million



Fixed Income

Total Externally-Managed Fixed Income

- **Base management fee paid in FY 2017: \$87,464,000**
- **Net asset value of external active managers at June 30, 2017: \$12,942,517,000**

Comments

The fees paid on fixed income cannot be reviewed with precision at the top level. The fees and assets need to be disaggregated to the various sub-components of fixed income. Below please find an analysis of each asset class.

U.S. Core Plus Fixed Income

- **Base management fee paid in FY 2017: \$4,961,000**
- **Net asset value of external active managers at June 30, 2017: \$1,154,009,000**
- **Base management fee basis points range: 20 – 65 bps**

Comments

Approximately 52% of the Fund's core fixed income is managed internally. The remainder is spread between three active investment managers, with the bulk of the assets being managed by one investment manager. Of the two remaining investment managers, one is managing a vanilla portfolio which can be easily absorbed internally while the other is a differentiated product that has performed well. By terminating the one investment manager, we can bring \$101 million in-house and save \$197,000/year in fees.

Compounded Savings

Estimated total base management fee savings compounded at 3.5% over 30 years: \$9.6 million

Non-U.S. Developed Markets Fixed Income

- **Base management fee paid in FY 2017: \$420,000**
- **Net asset value of external active manager at June 30, 2017: \$177,400,000**
- **Base management fee basis points: 15 bps**

Comments

We currently have one manager in Non-U.S. Developed Markets Fixed Income. We are currently underweight this allocation, so in a steady state full allocation, we would have more assets and more fees in this asset class. We believe we can manage this allocation internally with the addition of one additional investment professional. This will allow for gross savings based off of the \$420,000 of FY 2017 fees which will be offset by the cost of one additional investment professional, bringing the net savings used for this exercise to \$70,000/year. However, when fully allocated to this asset class, the fee savings will be approximately \$775,000 gross, or \$425,000 net of the cost of the additional investment professional.

Compounded Savings

Estimated total base management fee savings compounded at 2.9% over 30 years: \$18.1 million.



Fixed Income (continued)

Multi-Sector Fixed Income

- **Base management fee paid in FY 2017: \$1,633,000**
- **Net asset value of external active manager at June 30, 2017: \$410,414,000**
- **Base management fee basis points: 44 bps**

Comments

We currently have one multi-sector fixed income investment manager. Currently, we pay this manager a fixed fee. We will endeavor to either reduce this fixed fee in exchange for a portion of the excess returns earned (a profit share) or potentially move to manage internally in the future. However, since we are very early in the negotiating process, we are assuming no additional fee savings here.

TIPS Fixed Income

- **Base management fee paid in FY 2017: \$26,107,000**
- **Net asset value of external active managers at June 30, 2017: \$5,897,967,000**
- **Base management fee basis points: 30 - 48 bps**

We currently manage approximately 24% of the TIPS exposure internally. The remainder is managed externally by two active investment managers who, in addition to adding value above the index, also provide a source of leverage as one investment manager is levered 2:1 and the other is levered 6:1. Both investment managers are on a fixed fee. The U.S. TIPS manager is earning \$2.25 million/year for providing the beta exposure to the U.S. TIPS market; we can manage this in-house with one additional investment professional. The second investment manager is managing non-U.S. inflation-linked securities for a fixed fee. The fixed fee is only on the alpha portfolio embedded in the mandate; no fee is being charged for the beta. We believe we can reduce this fixed fee by 44% which will result in base fee savings of approximately \$9.6 million/year (of course, the reduction in base fee will be replaced by a profit sharing component prospectively). The total annual base fee savings we are projecting is \$11.85 million gross, or \$11.5 million net of the cost of the additional investment professional.

Compounded Savings

Estimated total base management fee savings compounded at 2.9% over 30 years: \$511.2 million



Fixed Income (continued)

Emerging Markets Fixed Income

- **Base management fee paid in FY 2017: \$1,669,000**
- **Net asset value of external active manager at June 30, 2017: \$345,980,000**
- **Base management fee basis points: 52 bps**

Comments

We currently have one active emerging markets fixed income investment manager. They have a fixed base fee contract with no profit share. We are currently negotiating a 50% reduction to their base fee in exchange for a profit share for returns above the emerging markets index. This will result in savings of approximately \$835,000/year. However, PSERS Investment Professionals anticipate hiring an additional emerging markets fixed income investment manager in the future which will most likely have an equivalent cost to the savings contemplated. No additional investment professional is needed and no net savings or incremental costs are contemplated.

High Yield/Oppportunistic Fixed Income

- **Base management fee paid in FY 2017: \$51,025,000**
- **Net asset value of external active managers at June 30, 2017: \$4,472,747,000**
- **Base management fee basis points: 20 - 200 bps (mostly on invested capital, but a few still on commitments)**

Comments

The high yield/opportunistic portfolio is primarily in limited partnerships, but also contains a few open-ended funds and separate accounts/funds of one. These strategies are bespoke and diversified by type (mezzanine, opportunistic, real assets, and senior lending) and geography (U.S. and Europe currently, expected to expand into Asia in the future). We believe that the fee arrangements in this asset class are competitive and will not be factoring in any savings for this analysis. Having said that, the Board has recently approved one investment manager and we have another investment manager under consideration with no base management fees (all of their compensation will be profit share after a preferred rate of return is achieved). PSERS Investment Professionals will continue to endeavor to drive better base management fee economics in this asset class.

Other Fixed Income

- **Base management fee paid in FY 2017: \$1,649,000**
- **Net asset value of external active managers at June 30, 2017: \$484,000,000**
- **Base management fee basis points: 15 - 175 bps**

Other Fixed Income represents three manager portfolios that are used to either enhance the performance or mitigate some risk in the PSERS LIBOR-Plus portfolio which is the cash vehicle used to back equity swaps and commodity futures. The dollar amounts of each of these portfolios are small and the highest fee portfolio is used to mitigate tail risk and had a fee that was renegotiated recently from a base management fee of 200 bps to 175 bps. While we will continue to monitor the base management fees of these portfolios, we are not contemplating any savings at this time.

Execution

All of the changes previously identified are in active review and/or negotiation. We expect to be able to achieve all of the savings by the end of FY 2020 and to continue for 28 years thereafter. Bringing assets in-house will take two years to achieve, following receipt of authorization to create new investment professional positions.

Compounded Savings

Estimated net fee savings (in millions) compounded over 30 years is as follows:

Core Fixed Income	\$ 9.6
Non-U.S. Developed Markets Fixed Income	18.1
TIPS	<u>511.2</u>
Total	<u>\$ 538.9</u>



Real Estate

- **Base management fees paid in FY 2017: \$50,411,000**
- **Net asset value of external active managers at June 30, 2017: \$5,336,731,000 (Including \$5.15 billion in private real estate and \$182 million in externally-managed public real estate)**
- **Base management fee basis points range: 50 - 150 bps**

Comments

Real Estate is an asset class where there are a multitude of available options to achieve market exposure, including publicly-traded real estate securities, direct asset holdings, private real estate funds, and co-investments. These investments may be equity or debt/debt-related in nature. PSERS has primarily held private real estate funds, but has been growing the portfolio of publicly-traded real estate securities (primarily through indexing) and co-investments.

Private real estate fund fee structures are generally static once a commitment is made. Given the strong long-term returns and demand for top-tier funds, it is extremely difficult to renegotiate on existing funds. However, funds often offer attractive fee arrangements for investors predicated on commitment size or for investors that participate in the fund's initial closing. PSERS Investment Professionals believe that the best avenue to achieve base management fee savings is to restructure the real estate allocation. This includes increasing the sub-asset allocation to co-investments where the deals are typically half-fee/half-carry of private real estate funds.

PSERS Investment Professionals are presenting the savings in two steps. The first step takes no additional investment professionals and represents a reduction of the total real estate allocation to 10% in accordance with the Board's long-term asset allocation, with 80% of the reduced allocation being in private real estate. The second step is increasing the co-investment program from 2.3% of the private real estate allocation to 8.0%. A full discussion of both steps follows.

Step 1

The total real estate allocation as of June 30, 2017 was 11.7%, which included 1.7% in public market securities (mostly internally managed), 0.2% in co-investments, and 9.8% in externally managed private market investments. The long-term target for real estate is 10.0% of the fund, with 2.0% targeted for public market securities and 8.0% targeted for private equity securities. The long-run target is 80% private market/20% public markets with a view that most public market assets will be managed internally,

utilizing indexes. Currently, the private market portion is primarily private real estate funds and co-investments. To get to the long-term target for private real estate of 8.0%, the externally-managed private real estate allocation will have to fall from 9.8% to 7.8% (plus the 0.2% in co-investments gets to the target of 8.0%). This represents a reduction in private real estate of approximately 20%, which will equate to a fee savings of \$10.3 million/year (see calculations on the next page).

Step 2

PSERS Investment Professionals would also like to increase the allocation to co-investments from 2.3% to 8.0% of the private real estate portfolio (concurrently with Step 1 adjustments). PSERS started the internal real estate co-investment program in 2012 and has had considerable success since inception with a 21.8% internal rate of return and a multiple of paid-in capital of 1.36x. These co-investments typically charge 50% of the base fee/profit sharing that is typical in a fund structure. As of June 30, 2017, PSERS' private real estate allocation was approximately 2.3% co-investments and 97.7% in private real estate fund investments. PSERS Investment Professionals' goal is to increase the internally-managed real estate co-investment program from 2.3% (\$122 million) to 8.0% (\$335 million after Step 1 adjustments) of the private real estate program. If this level is assumed for co-

investments, the externally managed assets would fall by an additional \$213 million, resulting in a fee savings of \$1.1 million (see calculations on the next page).

However, to generate the fee savings of an 8.0% co-investment program, PSERS Investment Professionals estimate that it would need to retain one additional investment professional to properly administer the program. PSERS Investment Professionals currently is offered a significant flow of co-investment opportunities, but don't have the human resources to effectively evaluate them all. To be properly staffed, PSERS Investment Professionals believe that an additional investment professional would be required and would increase internal management costs by \$0.35 million/year.



Real Estate (continued)

Execution

PSERS Investment Professionals expect that it will take 3 years to achieve these fee savings, with 1/3 of the savings coming each year until the full savings are achieved at the end of fiscal year 2021, continuing for the next 27 years. PSERS Investment Professionals also assume 100% of the cost of the one new employee to be incurred in fiscal year 2019. Additionally, while PSERS Investment Professionals see significant co-investment deal flow today, PSERS Investment Professionals may need to request that the Board expand the policy parameters to permit co-investments with funds that PSERS currently does not have a direct relationship, potentially expanding to other pension funds with direct investment programs and other GP's that our real estate investment consultant has a relationship with as two examples of ways to increase deal flow.

Compounded Savings

Estimated total base fee savings compounded at 6.6% over 30 years: \$900 million

Detailed Calculations

FY 2017 Base Mgmt. Fees:	\$50.41 million
June 30, 2017 (End of the Year) assets:	\$6.15 billion of which \$122 million was co-invest, \$871 million in publicly-traded real estate, and \$5.15 billion externally-managed limited partnerships and direct investments.
Base management fee as a percentage of externally-managed limited partnership funds	$0.5041 / (5.15 + (.122 * 0.5)) = 0.97\%$
Step 1: Reducing externally-managed private real estate from 9.8% to 7.8% of the fund would reduce externally-managed LP to \$4.07 billion	
Rebased FY2017 Base Mgmt. Fees	$(\$4.07 \text{ B} * 0.97\%) + (\$0.122 \text{ B} * 0.485\%) = \40.07 million
Gross and net step 1 fee savings/year	$\$50.41 - \$40.1 = \$10.30 \text{ million}$
Step 2: Rebasing program as 8.0% internal co-invest/92% external would reduce the externally-managed component to \$3.86 billion (\$335 million in co-invest)	
Rebased FY2017 Base Mgmt. Fees	$(\$3.86 \text{ B} * 0.97\%) + (\$0.335 \text{ B} * 0.485\%) = \39.03 million
Gross step 2 fee savings/year	$\$40.1 - \$39.0 = \$1.1 \text{ million before internal costs}$
Internal cost:	1 employee @ \$350,000/year: \$0.35 million
Net step 2 fee savings/year:	\$750,000
Net step 1 and 2 fee savings/year	$\$10.30 + \$0.75 = \$11.05 \text{ million}$



Master Limited Partnerships

- **Base management fees paid in FY 2017: \$8,295,000**
- **Net asset value of external active managers at June 30, 2017: \$1,893,389,000**
- **Base management fee basis point range: 25 - 50 bps**

Comments

Master Limited Partnerships portfolios are a targeted form of active management in the infrastructure asset class. It is a specialized asset class with few active managers. Active management has historically been, and continues to be, a good place to find alpha given the asset class has been dominated by yield-oriented individual investors as opposed to total-return institutional investors. While institutional investors have been making inroads into the asset class, it still appears inefficient to PSERS Investment Professionals.

PSERS currently has 3 active investment managers who manage approximately 80% of the MLP allocation as of June 30, 2017. One of the three active investment managers has a combination of base management fees and profit sharing while the other two are solely base management fees. PSERS Investment Professionals will endeavor to renegotiate the two investment managers solely charging base management fees to a combination of base management fees/profit share. We believe that we will be able to negotiate the base fees down by 25% to 50% reducing base management fee charges by \$1.5 million to \$3.0 million/year for these investment managers.

Execution

PSERS Investment Professionals believe that the base management fees can be renegotiated over the course of the second half of 2018 and first half of 2019. PSERS Investment Professionals are currently completing diligence on a fourth MLP mandate which would provide a more flexible concentrated portfolio construction approach that can branch across smaller market capitalizations and potentially private transactions. Given the strategy's capacity limitations, the standard fee schedule is higher than our current investment manager slate (100bps flat); however, PSERS Investment Professionals believe we will be able to utilize our scale and structuring to bring this in line with our current investment managers, making the addition, base fee neutral.

Compounded Savings

Estimated total base management fee savings (assuming \$1.5 million, the lower end of our target) compounded at 7.2% over 30 years with no savings in fiscal year 2019: \$136 million



Infrastructure

- **Base management fees paid in FY 2017: \$198,000**
- **Net asset value external active managers at June 30, 2017: \$62,424,000**
- **Base management fee basis points: 50 - 100 bps**

Comments

Infrastructure is a relatively new allocation for the Fund. PSERS current long-term target is 4% of the Fund. The current allocation is 2%, with 95% of the allocation being managed internally using total return swaps. PSERS Investment Professionals will continue to buildout the infrastructure program to provide an improved long-term risk/return profile for our implementation of the asset class. As we build out the allocation, PSERS Investment Professionals anticipate that 50% of the allocation will be managed internally and 50% will be managed in either open-ended or closed-ended comingled fund vehicles. PSERS recently hired two infrastructure investment managers and committed \$600 million, in aggregate, to the new funds. PSERS Investment Professionals are in advanced stages of due diligence with a third investment manager and anticipates further building out the active component of this allocation. Long-term, PSERS Investment Professionals anticipate that 10% of the active component will be in co-investments. PSERS Investment Professionals believe it will be easier to scale co-investments in infrastructure given the large size of asset purchases.

Execution

Two investment manager contracts have been executed by PSERS Investment Professionals over the past 18 months. We anticipate additional hires over the next couple of years to get to the 2% target allocation.

Compounded Cost Increase

Estimated total base management fee cost increase compounded at 6.9% over 30 years: \$742 million



Commodities

- **Base management fees paid in FY 2017: \$6,757,000**
- **Net asset value of external active managers at June 30, 2017: \$990,835,000 (includes portable alpha manager assets)**
- **Base management fee basis point range: 29.5 - 115 bps**

Comments

Commodity beta is 80% managed internally using total return swaps (including diversified commodities and gold) with the other 20% managed externally by two commodity managers. PSERS also utilized the services of a third manager as a portable alpha source for the commodity portfolio (an absolute return commodity manager). We recently renegotiated the contracts of two of the three investment managers. We reduced the one investment manager's base management fee by 50 bps in exchange for a 15% profit share on returns above the commodity benchmark plus 1.00%. We also renegotiated the alpha investment manager's contract to reduce the base management fee from 95 bps to 65 bps. In exchange, we increased the profit share from 22.25% of profits above the base management fee to the higher of 29% of the profits or 65 bps (the base management fee). These contract negotiations will result in PSERS saving \$2.8 million/year in base management fees.

These fee savings are offset by a continued buildout and improvement of the commodity program to provide an improved long-term risk/return profile for our implementation of the asset class. PSERS Investment Professionals have recently invested in a commodity private limited partnership and will be proposing an investment in a second private limited partnership in 2018. The combined base fees for these investments will be \$5.4 million/year. PSERS Investment Professionals currently project that it will re-up with their future successor funds, so PSERS Investment Professionals have assumed these base fees will continue over the 30-year window for purposes of this analysis. Over time PSERS Investment Professionals expect to invest in co-investment opportunities with the General Partners of these partnerships. Co-investments are compelling because they typically incur no fees. As success in this area is demonstrated, PSERS Investment Professionals envision requesting an expanded allocation for these endeavors.

PSERS Investment Professionals have recently hired a Senior Portfolio Manager for Commodities (he previously successfully managed a multi-billion dollar actively managed commodity portfolio at a large European money management firm). His job will be to review the structure of our commodity portfolio and make recommendations on how to improve it. He may ultimately manage a sizable percentage of the commodity portfolio internally and actively. If half of the current externally managed assets are brought in house, this will save \$1.1 million/year in base management fees. By keeping the other half of the externally managed assets with the external investment managers, he would continue to receive information and insights that he can use for the internally managed portfolio. Bringing assets in house will necessitate one additional investment professional on his team, as well as an additional ½ operations professional to support it. The need for 1-½ investment professionals has been included in this analysis but won't be implemented until the Senior Portfolio Manager has had an opportunity to evaluate our existing portfolio and make his own recommendations.



Commodities (continued)

Execution

The two investment manager contracts have been renegotiated this fiscal year and one of the two limited partnerships has been entered into by the Board. The second limited partnership will be presented to the Board for approval in the second half of 2018. Bringing assets in-house will take 2 years to achieve, with all of the costs of the new investment professionals occurring up front and all the savings beginning in year fiscal year 2020 and continuing for the next 28 years.

Compounded Cost Increase

Estimated base management fee increase, includes cost of additional investment professionals, compounded at 5.8% over 30 years: \$144 million

Detailed Calculations

FY 2017 Base Mgmt. Fees:	\$6.76 million
Rebasing program with the fee reduction/manager hires noted.	
Rebased FY2017 Base Mgmt. Fees:	$\$6.76 - \$2.80 + \$5.40 - \$1.1 = \$8.26$ million
Base mgmt. fee increase before internal cost	$\$8.26 - \$6.76 = \$1.5$ million
Internal cost	1.5 employees @ \$350,000/year: \$0.525 million
Total fee increase, including cost of additional investment professionals	\$2.025 million



Risk Parity

- **Base management fees paid in FY 2017: \$19,632,000**
- **Net asset value of external active managers at June 30, 2017: \$2,462,455,000**
- **Base management fee basis points range: 45 - 135 bps**

Comments

Risk Parity portfolios are actively managed risk balanced portfolios where the active part can come in two flavors: portfolio construction and portfolio construction with alpha tilts. The portfolios focused solely on portfolio construction are less expensive than those that include alpha tilts. The portfolios are leveraged providing around 2 times market exposure to beta. Risk Parity is a specialized asset class with few institutional investment managers.

PSERS currently has 3 active investment managers who manage 4 separate portfolios representing approximately 50% of the Risk Parity allocation as of June 30, 2017. PSERS Investment Professionals will endeavor to renegotiate the fees on the active portfolios to achieve a lower base fee and include a profit sharing component. However, at this time, we are uncertain of our ability to generate fee savings, so none are anticipated. PSERS Investment Professionals anticipate adding one new externally managed portfolio to offer geographical diversification. It is expected that this addition will not materially impact base fees prospectively.

PSERS Investment Professionals believe, with the addition of 1 additional investment professional, that we will be able to reduce the reliance somewhat on external active managers. With the addition of one additional investment professional, PSERS Investment Professionals will be able to bring an additional \$250 million of assets internally, which would provide fee savings of \$1 million/year, or \$650,000/year net of the cost of one additional investment professional.

Execution

PSERS Investment Professionals will be able to reduce management fees by \$1 million within 6 months of hiring an additional investment professional. We anticipate hiring an additional investment professional at the end of fiscal year 2019.

Compounded Savings

Estimated total base management fee savings compounded at 6.2% over 30 years: \$46.8 million



Absolute Return

- **Base management fees paid in FY 2017: \$75,577,000**
- **Net asset value of external active managers at June 30, 2017: \$5,082,149,000**
- **Base management fee basis points range: 50 - 250 bps**

Comments

Absolute Return fee structures generally consist of a base management fee as well as a profit sharing fee. At times, PSERS can negotiate base fees up/down in exchange for decreasing/increasing the profit share component. Since Absolute Return managers are charged with generating idiosyncratic returns with minimal systematic exposure to beta, the benchmarks generally used are cash benchmarks such as LIBOR or Treasury Bills. PSERS Investment Professionals believe that the best avenue to achieve base management fee savings will be to negotiate with investment managers and request a lower base management fee in exchange for providing the investment managers with the opportunity to earn higher profit sharing based on the success of the investment fund.

PSERS Investment Professionals will constantly look for ways to reduce base management fees. Given our significant assets under management with certain investment managers and long-term relationships we've established, PSERS Investment Professionals have identified two relationships where we can achieve significant base management fee savings.

- The first renegotiation reduced the base management fee from 95 bps to 65 bps which will save PSERS approximately \$3.25 million/year. In exchange, we increased the profit share from 22.25% of profits above the base management fee to a structure where the maximum we will pay is the greater of 29% of the profits or 65 bps (the base management fee).
- The second renegotiation is another long-term relationship where we pay a base fee but no profit share. PSERS Investment Professionals believe, based on discussions with this manager, that we will be able to cut the base fee in half. While negotiations have not been finalized, PSERS Investment Professionals believe that we can reduce the base fees by over 50% in exchange for a 20% profit share. This should result in \$12.36 million of base management fee savings annually. We anticipate completing this negotiation by the end of 2018 and implementing the new fee structure by the end of fiscal year 2021.

To generate these fee savings, no additional staffing is required.

Execution

PSERS Investment Professionals expect that it will take 2 years to achieve these fee savings, with \$3.25 million of the savings coming during fiscal year 2018 and an additional \$12.36 million in savings coming no later than fiscal year 2021; the total savings will then continue for the next 27 years.

Compounded Savings

Estimated total base management fee savings compounded at 5.8% over 30 years: \$1.068 billion



Appendix I



July 23, 2018

James Grossman
Chief Investment Officer
Pennsylvania Public School Employees' Retirement System
5 North 5th Street
Harrisburg, PA 17101

Re: PSERS Response to PSERB Resolution 2017-41

Dear Jim:

As requested, we have evaluated the current fees paid by PSERS in order to identify potential opportunities for fee savings. As part of this evaluation, we have reviewed the PSERS Investment Professionals' proposals for specific fee savings recommendations.

Evaluating, monitoring and negotiating asset management fees are key tasks in developing a successful investment management program. Evaluating fee levels is not necessarily a straightforward exercise in that fees will vary based on a number of factors including:

- Asset class
- Portfolio risk
- Degree of active management/investment skill
- Availability of alternatives (passive products, # of managers, capacity)
- Time horizon/lock-up
- Hurdle rate (for performance fees)

A primary goal for investors is to build a fee-efficient portfolio. It is important to note that a fee efficient portfolio is NOT necessarily a portfolio with 1) the lowest fee possible; 2) all passive management; or 3) a lower fee than the current fee. Rather, a fee-efficient portfolio is one which:

1. Only pays active fees where active management can add value
2. Provides strong net-of-fee excess returns
3. Pays no more than is needed

In order to accomplish a fee-efficient portfolio, Aon recommends clients use the following framework for evaluating a fee-efficient program:

- Get beta (market passive returns) cheaply
- Pay fees commensurate with the expected value added
- Optimize the investment structures and vehicles used
- Negotiate hard

Evaluation of PSERS Investment Professionals' Fee Proposal

Aon has conducted an independent analysis of the base fees paid in FY 16-17 by asset class and evaluated these fees versus the institutional peer median fees by asset class. Different investment

structures including lower fee external managers, internal management, and alternative fee structures (base plus performance fee versus fixed fee) were considered. We concur with PSERS Investment Professionals that evaluating opportunities for fee savings should be done in context of the existing strategic target asset allocation. Therefore, all fee savings are evaluated within each asset class. The strategic asset allocation is set by the Board of Trustees based on the desired risk/return needed to meet the Plan's long-term objectives. Lowering fees by shifting assets from more expensive asset classes to lower cost asset classes may achieve lower total fees but this change will not occur without also altering the risk/return profile of the Plan, such as potentially reducing the expected return and/or increasing the risk of the portfolio. These changes would negatively impact PSERS' ability to achieve its goal to grow its assets to meet the future benefit needs of the PSERS' beneficiaries over the long-term.

Aon concurs with the guiding principles outlined by PSERS Investment Professionals regarding the process for evaluating fees and identifying opportunities for cost efficiency. In summary these are:

- Maintain the current strategic asset allocation mix
- Focus on the base management fee calculations. These fees are certain fees to the Plan and are paid regardless of absolute or relative performance. Thus any fee savings achieved on base fees will generate increased assets for the Plan. As performance fees are tied to excess performance, higher fees are only paid when the performance exceeds a hurdle rate. While higher fees are paid for higher performance, PSERS benefits from the excess returns generated above the hurdle rate. Proper alignment of the performance fee profit share and hurdle rate will ensure that PSERS achieves net of fee returns consistent with its expectations for the asset class.
- All fee savings are calculated on a static base asset value as of June 30, 2017
- Fee savings are calculated over a 30 year time horizon, consistent with the time horizon utilized for evaluating the strategic asset allocation and actuarial metrics for contributions, funded status, etc.
- Estimate the compound fee savings over 30 years utilizing Aon's capital market assumptions for each asset class, consistent with the 30 year calculations utilized in evaluating the strategic asset allocation as well as a fixed rate of 5% (7.25% EROA less 2.25% cash outflow). ***In addition, Aon has estimated the expected range of the fee savings using the expected volatility assumptions for each asset class as well as the expected volatility of the long-term asset allocation of 11.54%. Over 30 years, 68% of outcomes are expected to fall within +/- 1 standard deviation of the median expected returns.***

Aon Analysis

Base Management Fees – External Management

As of Fiscal Year Ended June 30, 2017

Asset Class	CAFR	Adjustments*	Adjusted Base		Current Base Mgmt Fee (bps)	Institutional	
			Mgmt Fees	Adjusted External Net Assets @ 6/30/17		Fee Median	Peer Universe
US Equity	1,494,000	-	1,494,000	339,000,000	44	80	eVestment Credit Market Neutral ¹
Non-US Equity	19,771,000	-	19,771,000	4,282,411,000	46	57	eVestment Non-US Equity
Private Equity	102,714,000	-	102,714,000	7,423,011,000	138	134	Greenwich Associates Public Funds greater than \$5B Private Equity Median
Fixed Income							
US Core Plus	4,961,000	-	4,961,000	1,154,009,000	43	86	eVestment Multi-Strategy Credit
Non-US Developed	420,000	-	420,000	177,400,000	24	30	eVestment Non-US Fixed Income
US Long Treasuries	-	-	-	-	-	-	-
Inflation Protected	26,107,000	-	26,107,000	5,897,967,000	44	22	eVestment Global Inflation Indexed
Emerging Markets	1,669,000	-	1,669,000	345,980,000	48	50	eVestment EMD Local
High Yield/Opp	51,025,000	-	51,025,000	4,472,747,000	114	150	Prequin Private Debt
Multi-Sector	1,633,000	-	1,633,000	410,414,000	40	30	eVestment Global Core Plus
Other	1,649,000	-	1,649,000	484,000,000	34	38	eVestment Structured FI-Non Traditional
Total Fixed Income	87,464,000	-	87,464,000	12,942,517,000	68		
Real Estate	50,609,000	(198,000)	50,411,000	5,336,731,000	94	95	Greenwich Associates Public Funds greater than \$5B Real Estate Median
MLP	8,295,000	-	8,295,000	1,893,389,000	44	69	eVestment MLP
Infrastructure	-	198,000	198,000	62,424,000	32	100	eVestment AI Infrastructure
Commodities	4,132,000	2,625,000	6,757,000	990,835,000	68	75	eVestment AI Commodities
Risk Parity	19,632,000	-	19,632,000	2,462,455,000	80	71	HFRI and eVestment Risk Parity
Absolute Return	78,202,000	(2,625,000)	75,577,000	5,082,149,000	149	123	Greenwich Associates Public Funds greater than \$5B Hedge Funds Median
	372,313,000	-	372,313,000	40,814,922,000	91		

¹ Active strategy used in US Equity is a Portable Alpha Strategy utilizing alpha generated from a Credit Market Neutral strategy. The peer universe for the alpha strategy is utilized for comparison.
* Portable alpha manager fees misclassified as Absolute Return fees and infrastructure fee misclassified as real estate

Based on the evaluation of total base fees paid to external managers versus asset class peer universe medians, Aon has identified the following asset classes as areas for the highest potential for fee savings:

- Private Equity
- Inflation-Protected
- Multi-Sector Fixed Income
- Risk Parity
- Absolute Return

In addition to reviewing PSERS Investment Professionals' proposal for fee savings in these asset classes, we also reviewed the fee structures for all asset classes in order to determine reasonableness and potential for further savings.

We agree with the proposal for generating ongoing investment fee savings to external managers of \$38.73 million and propose an additional \$1.63 million in potential cost savings in the fixed income portfolio. This will result in a total annual cost savings of \$40.36 million annually or a 10.8% annual fee reduction. After accounting for the expected cost of \$3.15 million for an additional 9 internal heads required to manage in-house an additional \$3.8 billion of assets across various asset classes, total fee savings are \$37.2 million or a 10.0% annual fee reduction. Over 30 years, these annual fees will generate an expected median net fee savings of \$2.57 billion using Aon's capital market assumptions. As we know, actual experience of returns will not generate the median return every

Aon

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year. The compound net fee savings over 30 years is expected to fall within the range of \$1.80 and \$4.22 billion when the volatility of the expected returns is considered. When a flat 5% assumed rate of return is used, the cumulative net fee savings over 30 years is expected to fall within the range of \$1.68 and \$3.33 billion with a median expected fee savings of \$2.28 billion.

A summary of the new expected fees by asset class versus the peer medians is as follows:

Projected Base Management Fees – External Management

As of Fiscal Year Ended June 30, 2017

Asset Class	CAFR	Adjustments*	Adjusted Base Mgmt Fees	Adjusted External Net Assets @ 6/30/17	Current Base Mgmt Fee (bps)	New Base		Institutional Fee Median	Peer Universe
						Fee Savings	Mgmt Fee		
US Equity	1,494,000	-	1,494,000	339,000,000	44	-	1,494,000	44	80 eVestment Credit Market Neutral ¹
Non-US Equity	19,771,000	-	19,771,000	4,282,411,000	46	-	19,771,000	46	57 eVestment Non-US Equity
Private Equity	102,714,000	-	102,714,000	7,423,011,000	138	(6,700,000)	96,014,000	129	134 Greenwich Associates Public Funds greater than \$5B Private Equity Median
Fixed Income									
US Core Plus	4,961,000	-	4,961,000	1,154,009,000	43	(197,000)	4,764,000	41	86 eVestment Multi-Strategy Credit
Non-US Developed	420,000	-	420,000	177,400,000	24	(775,000)	(355,000)	0	30 eVestment Non-US Fixed Income
US Long Treasuries	-	-	-	-	-	-	-	-	-
Inflation Protected	26,107,000	-	26,107,000	5,897,967,000	44	(11,850,000)	14,257,000	24	22 eVestment Global Inflation Indexed
Emerging Markets	1,669,000	-	1,669,000	345,980,000	48	-	1,669,000	48	50 eVestment EMD Local
High Yield/Opp	51,025,000	-	51,025,000	4,472,747,000	114	-	51,025,000	114	150 Preqin Private Debt
Multi-Sector	1,633,000	-	1,633,000	410,414,000	40	(1,633,000)	-	0	30 eVestment Global Core Plus
Other	1,649,000	-	1,649,000	484,000,000	34	-	1,649,000	34	38 eVestment Structured FI-Non Traditional
Total Fixed Income	87,464,000	-	87,464,000	12,942,517,000	68	(14,455,000)	73,009,000	56	
Real Estate	50,609,000	(198,000)	50,411,000	5,336,731,000	94	(11,400,000)	39,011,000	73	95 Greenwich Associates Public Funds greater than \$5B Real Estate Median
MLP	8,295,000	-	8,295,000	1,893,389,000	44	(1,500,000)	6,795,000	36	69 eVestment MLP
Infrastructure	-	198,000	198,000	62,424,000	32	8,800,000	8,998,000	** 82	100 eVestment All Infrastructure
Commodities	4,132,000	2,625,000	6,757,000	990,835,000	68	1,500,000	8,257,000	83	75 eVestment All Commodities
Risk Parity	19,632,000	-	19,632,000	2,462,455,000	80	(1,000,000)	18,632,000	76	71 HFRI and eVestment Risk Parity
Absolute Return	78,202,000	(2,625,000)	75,577,000	5,082,149,000	149	(15,610,000)	59,967,000	118	123 Greenwich Associates Public Funds greater than \$5B Hedge Funds Median
	372,313,000	-	372,313,000	40,814,922,000	91	(40,365,000)	331,948,000	81	

Base Fee Savings/Year	10.8%
Incremental cost of internal management from hiring 9 additional investment professionals	3,150,000
Fee Savings/Year after incremental costs from hiring 9 additional investment professionals	(37,215,000) 10.0%

¹ Active strategy used in US Equity is a Portable Alpha Strategy utilizing alpha generated from a Credit Market Neutral strategy. The peer universe for the alpha strategy is utilized for comparison.

* Portable alpha manager fees misclassified as Absolute Return fees and infrastructure fee misclassified as real estate

** New Base Fee calculated in basis points assuming fully invested \$1,100,000,000 commitments

Asset Class Analysis

Public Equity

The US Equity asset class is over 90% internally managed with just one portable alpha strategy utilized within the internally managed portfolio. This is a market neutral credit strategy and the base fee of 45bps is significantly below the median fee for market neutral credit strategies. The manager has consistently delivered excess returns with 340bps of excess returns versus its benchmark since its inception of October 2014.

The Non-US Equity average fee of 46bps is very competitive versus the peer median manager fee of 57bps. The portfolio already utilizes passive management extensively (44%) and the Non-US equity composite has outperformed its benchmark 100% of the time over the last 24 rolling 3-year periods (measured quarterly) as of March 31, 2018 with an average excess return of 1.11%.

Aon concurs with PSERS Investment Professionals' assessment that there are no further fee reduction opportunities.

Aon

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Fixed Income

Aon concurs with the proposed fee saving opportunities outlined by PSERS Investment Professionals for the sub-sector allocations in Core Plus Fixed Income, Non-US Developed Markets, TIPs, Emerging Markets Fixed Income, High Yield and Other Fixed Income. The revised fee structures for these asset classes are consistent with the peer universe median fees for these asset types.

In addition to the fee savings proposed by PSERS Investment Professionals, Aon suggests that PSERS eliminate the external manager in the multi-sector fixed income category and bring the \$410 million of assets in-house. The assets in this portfolio are managed in core fixed income, non-US fixed income and long duration strategies. PSERS already manages assets in the core and long duration categories. The additional head for the non-US fixed income portfolio will provide the additional needed capacity to absorb the non-US fixed income assets from the multi-sector portfolio. The excess returns for this strategy have been modest providing an opportunity for fee savings by bringing these assets in-house.

Aon calculates an annual savings of \$1.6 million which compounded at 3.5% generates \$79.9 million in savings over 30 years. The compound net fee savings over 30 years is expected to fall within the range of \$69.2 and \$91.8 million when the volatility of the expected returns is considered.

Investment Professional Requirements

The proposed addition of nine Full Time Equivalents (FTEs) to absorb the increased management of assets in-house is consistent with our analysis of investment professional needs that we conducted for PSERS in 2014. This growth in investment professionals will ensure that PSERS is properly resourced to absorb the additional \$3.8 billion in new assets managed internally.

Sincerely,



Claire Shaughnessy
Partner



Amanda Janusz
Senior Consultant

July 20, 2018

Jim Grossman, CIO
Commonwealth of Pennsylvania,
Public School Employees' Retirement System
5 North Fifth Street
Harrisburg, PA 17101

Re: PSERS Response to PSERB Resolution 2017-41

Dear Jim:

Aksia LLC, having been duly authorized by the Board of PSERS as hedge fund consultant to the System, has evaluated PSERS Investment Professionals' Response (the "Response") to PSERB Resolution 2017-41 (the "Resolution"), with a view to its reasonableness and actionability as it relates to the Absolute Return program.

After our review of the Response, we believe the fee saving initiatives described should meet the management fee reduction requirements of the Resolution. In our opinion, the initiatives outlined should provide an effective means of reducing base management fees, aligning interests and incentives between the managers and PSERS, and retaining the investment flexibility necessary to achieve the System's long-term risk and return objectives.

Aksia has served, and continues to serve, as the consultant to many institutional investors with similar concerns, objectives and constraints as PSERS. In our opinion, PSERS Investment Professionals and the PSERS Board have continually been pro-active in negotiating reduced fees and improved terms with external investment managers. We believe that the initiatives provided in the Response will continue to build on these efforts. We believe the assumptions, long-term plans, and management fee-saving initiatives outlined in the Response are generally consistent with best practices, reasonable in scope, and actionable.

We look forward to continuing to work closely with PSERS to evaluate and implement fee structures that provide for additional management fee savings and a greater alignment of interest with external managers. Please feel free to contact us should you have any questions about this letter.

Respectfully,



Matt Mullarkey
Head of Advisory, Americas



To: James H. Grossman, Chief Investment Officer, PSERS
From: Hamilton Lane Advisors, L.L.C.
Date: July 16, 2018
Subject: Response to PSERB Resolution 2017-41 Memo

Overview

The following response has been created by Hamilton Lane Advisors, L.L.C. (“Hamilton Lane”) at the request of the PSERS Investment Professionals of the Commonwealth of Pennsylvania, Public School Employees’ Retirement System (“PSERS” or “the System”), in response to the PSERB Resolution 2017-41 memo (the “Memo”).

Memorandum Review

Hamilton Lane thoroughly reviewed the Memo which included an asset class by asset class evaluation of the key areas where PSERS could generate management fee savings paid to external investment managers. After doing a thorough assessment to understand and analyze the long-term plan, Hamilton Lane agrees that the assumptions in the Memo are reasonable and we are in agreement with the best practices suggested to quantifiably reduce management fees paid to external managers going forward.

Additional Suggestions

After taking into consideration the Guiding Principles as presented on page 2 and 3 of the Memo, Hamilton Lane has several additional go-forward suggestions and best practices that could be implemented to financially benefit the System. While a total dollar fee improvement for PSERS is not quantified at this time for the suggestions below, Hamilton Lane has helped other clients generate real cost savings by implementing those suggestions. Should one of the below ideas be strongly considered as a viable option for reducing fees on a go-forward basis, Hamilton Lane will work with PSERS Investment Professionals to model out any potential cost savings. In addition to potential benefits, Hamilton Lane has included potential considerations for each of the below suggestions.

- Increased Pursuit of Strategic Partnerships:

Potential Benefits: Given PSERS long-term relationship with many larger General Partners (“GPs”), Hamilton Lane believes there is a potential to identify and commit to tactical relationships either specific to an asset class, or across asset classes. Key to implementing a Strategic Partnership would be a large upfront capital commitment, which is potentially several times greater than PSERS typical average commitment bite size. However, the large commitment size allows for a “one-fee” approach to multiple underlying funds and products, which could also lead to efficiency gains by investment and back office operations. This efficiency is gained through a reduction in the number of commitment decisions and tracked partnerships. Strategic Partnerships can often be structured with a lower base fee and incentive fee relative to what is typically charged at the individual fund level. Hamilton Lane believes PSERS has a competitive size advantage to secure favorable structures and broaden existing relationships with lower fees on a go-forward basis.

Potential Considerations: In order for most GPs to consider a Strategic Partnership, PSERS would likely have to commit a significant amount of capital at one time. As noted above, PSERS has many large GP relationships within the private markets. However, given the sizeable amount of capital needed, PSERS should consider the entire universe of GPs before determining which is best for forming a Strategic Partnership. PSERS may also have to offer some level of discretion to managers in order to successfully operate the strategic partnership.



- Side-car Co-Investment Vehicles:

Potential Benefits: As mentioned throughout the Memo, Co-Investments are a significant tool that can be used in a portfolio to achieve fee savings as direct deals are often done on a no-fee, no-carry basis. We believe that PSERS has several long-term Core GP relationships that it can leverage for Co-Investment side-car funds. A Co-Investment sidecar is an overflow fund used by a GP to add more capital to an investment. For example, if a deal required \$75m of equity and the GP's active fund was going to commit \$50m, the side car could commit all or a part of the additional \$25m. In addition to taking advantage of the overflow from the main fund on a no-fee basis, this strategy also decreases single-deal risk as diversification is broadened across multiple assets from a single GP.

Potential Considerations: While Co-Investment side car funds can be beneficial, they are not offered by all GPs. Typically, these are offered by larger GPs that source inherently larger deals. Additionally, since a Co-Investment side-car fund acts as an overflow vehicle if capital is needed, there is a possibility that not all capital within the side-car fund will be deployed. It is important to understand the potential impact on overall pacing should the capital not be deployed.

- Secondary Sale of Non-Core, Fee-Paying Funds:

Potential Benefits: A secondary sale is the sale of an existing limited partner interest in a closed-end fund to a third-party at an agreed upon price. While there are costs associated with engaging a broker, the sale option could offer an immediate reduction in fees paid to non-Core funds. The proceeds could then be re-deployed into Co-Investments or other strategic buckets of capital with reduced fee rates.

Potential Considerations: Secondary sales are a more-popular form of portfolio rebalancing in today's market. However, secondary pricing for older vintage year funds can vary widely with the potential of having to take large discounts and PSERS could be under-allocated to private markets in the short to interim-term. Large scale rebalancing of private equity portfolio could also place strain on the near-term IRR of portfolios as mature assets could potentially be replaced with funds in their J-curve period.

- Enhanced Measurement of Fee Savings & Board Reporting:

Potential Benefits: Given the PSERB Resolution 2017-41 and increased focus across the private markets industry on fee reductions, Hamilton Lane recommends actively tracking and annually updating the Board on negotiated term savings and improvements. Hamilton Lane can assist PSERS with the creation of a template to measure these cost savings. While PSERS Investment Professionals, with assistance from Hamilton Lane, are focused on identifying managers early to engage on key legal terms & participate in first close/size-based fee discounts, having a more open and robust conversation about annual savings is a good best practice to continue the dialogue going forward.

Potential Considerations: Providing transparency into fee savings achieved or terms moved will be beneficial for the PSERS Board. However, it is only a tool to hold PSERS staff and consultants more accountable and not a direct method for lowering fees.

- Targeting Non-Management Fee Reductions for New Investments:

Potential Benefits: PSERS has a large number of manager relationships across closed-end private markets vehicles. While many of these funds have reduced fees, or fees and carry in line with market averages, there is an opportunity to quantify the savings associated with negotiating other terms. For example, changes to hurdle rates which drive the priority of cash flow distributions could increase the time it takes for the GPs to receive proceeds thereby reducing fees on an interim basis. In addition, pushing for 100% fee offsets can reduce management fees paid by PSERS. LP cash



flow and IRR would also generally be enhanced as they contribute less capital for management fees. The proposal is to model and account for the potential fee savings for any movement in term regardless of whether or not it is directly associated with the management fee.

Potential Considerations: Current market conditions and fundraise timelines for top-tier managers can make it challenging for LPs to negotiate terms without potentially losing allocation. PSERS should not shift away from its current focus of targeting the best managers across the private markets, which can make term negotiations more difficult.

- Direct Investing:

Potential Benefits: PSERS has had prior success executing a direct investment strategy, primarily within Real Estate. By investing directly into assets (companies, infrastructure, real estate, etc.), PSERS would eliminate all fees paid to a GP, including base and incentive fees, as the System becomes the manager of the assets. Direct investing creates a very similar series of benefits and savings as co-investing. In addition, there are potential return benefits if a deal is successful as PSERS would not be participating in any profit sharing.

Potential Considerations: Direct investing, while beneficial from a fee perspective, can present a few significant challenges. In order to execute, PSERS may have to recruit professionals with specific deal sourcing and execution capabilities – these professionals are difficult to find in the current market environment. By investing directly, PSERS would be responsible for sourcing its investment deal flow, independent of their GP relationships. This may create strains with current or potential new portfolio GPs as PSERS may become viewed as a competitor. Lastly, by investing directly into an asset, PSERS may at times leave itself vulnerable to headline risk. As an owner and likely participant on the board of directors, any issues or litigation at the asset level may leave PSERS exposed to large expenses and negative press coverage.

Appendix II



July 24, 2018

James Grossman
Chief Investment Officer
Pennsylvania Public School Employees' Retirement System
5 North 5th Street
Harrisburg, PA 17101

Re: PSERS Public Markets Asset Classes - Risk Profiles

Dear Jim:

As requested, we have evaluated the risk profiles of the public markets asset classes in the PSERS pension fund. The attached reports are run as of March 31, 2018 and include both return and risk metrics, measuring each composite versus its respective policy benchmark. The time periods shown vary by asset class depending on the length of the composite track record.

As illustrated in the attached risk profiles, PSERS' composite returns have demonstrated outperformance net of all fees and costs versus the policy benchmarks in each asset class, with the exception of Risk Parity and High Yield, which have experienced slight underperformance relative to their benchmarks. Each composite also has strong risk-adjusted historical performance, with a Sharpe Ratio that is either in line or better than the corresponding benchmark.

The composites shown are inclusive of both internal and externally managed portfolios. The internally-managed portfolios are primarily passive or passive plus, so the outperformance at the composite level is largely attributable to value added from active external management. For the internally-managed portfolios that are actively managed (US Core Plus and TIPS), the outperformance at the composite level is attributable to value added from both active internal management and active external management.

With regard to Risk Parity, the non-scaled composite returned 3.68% net of fees vs. 3.80% for the blended policy benchmark for the 5-year period ended March 31, 2018. While the risk parity composite has 5 years of history, 3 of the 4 external managers were hired within the last 3 years. More time will be needed to evaluate their performance.

With regard to High Yield, the hedged composite returned 8.10% net of fees vs. 8.24% for the policy benchmark, the Bloomberg Barclays High Yield Corporate Index, for the 10-year period ended March 31, 2018. While the composite has outperformed the benchmark in 7 out of the last 10 calendar years, it did not keep pace with the benchmark during the strong 2009 rally, which is the main driver of the relative underperformance over the trailing 10-year period.

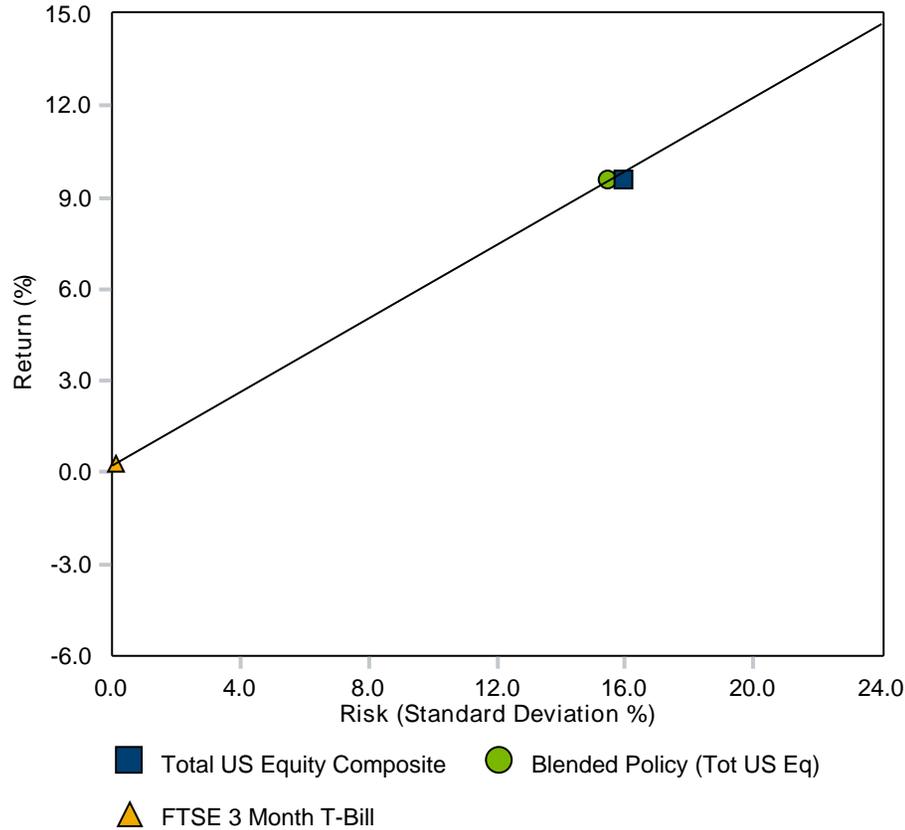
Sincerely,

Claire Shaughnessy
Partner

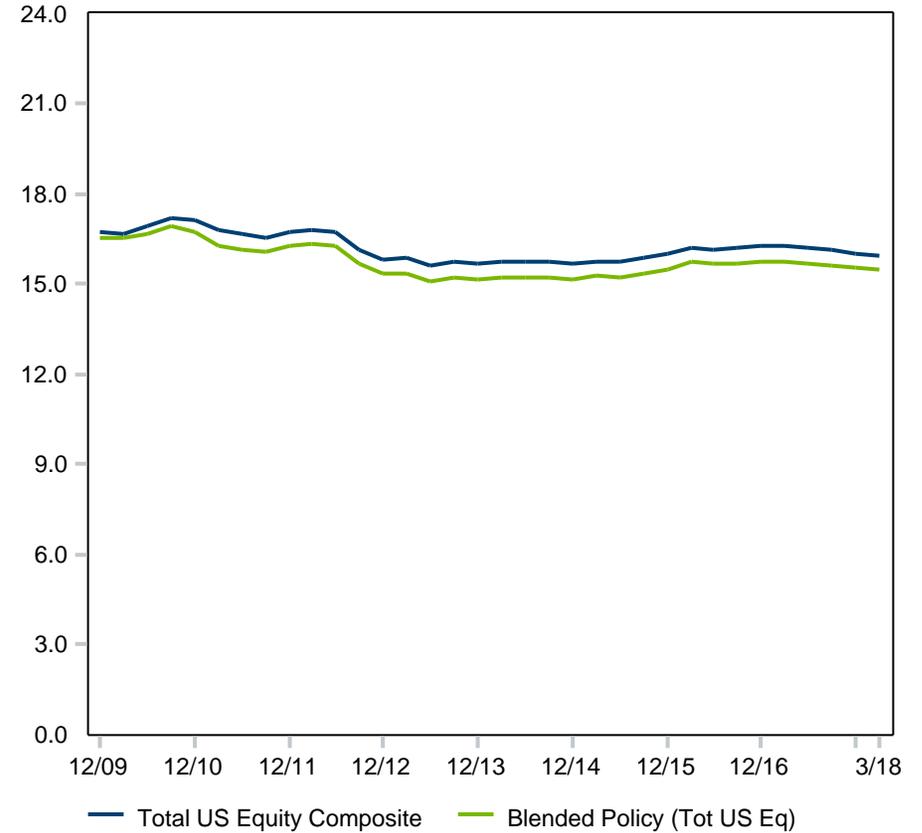
Amanda Janusz
Senior Consultant

Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



Rolling 10 Years Standard Deviation

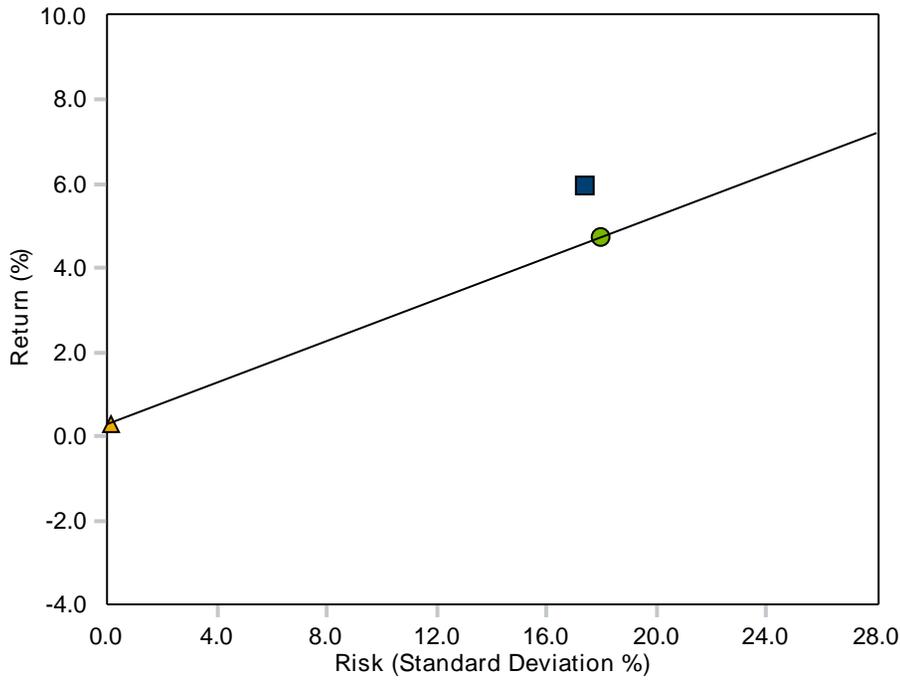


10 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Total US Equity Composite	0.09	1.68	0.05	0.99	0.64	-0.17	1.02	9.58	15.97	0.99
Blended Policy (Tot US Eq)	0.00	0.00	N/A	1.00	0.65	0.00	1.00	9.57	15.50	1.00
FTSE 3 Month T-Bill	-10.09	15.53	-0.65	0.04	N/A	0.32	0.00	0.31	0.13	-0.20

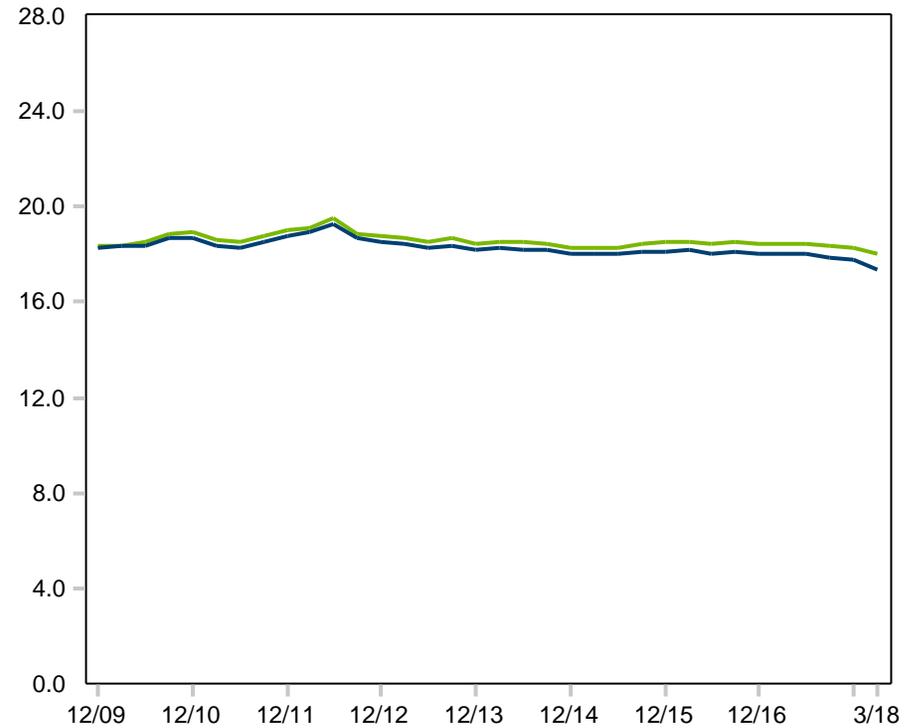
Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



- Total Non-U.S. Equity Composite (hedged)
- Blended Policy (Total Non-US Eq) (Hedged)
- ▲ FTSE 3 Month T-Bill

Rolling 10 Years Standard Deviation



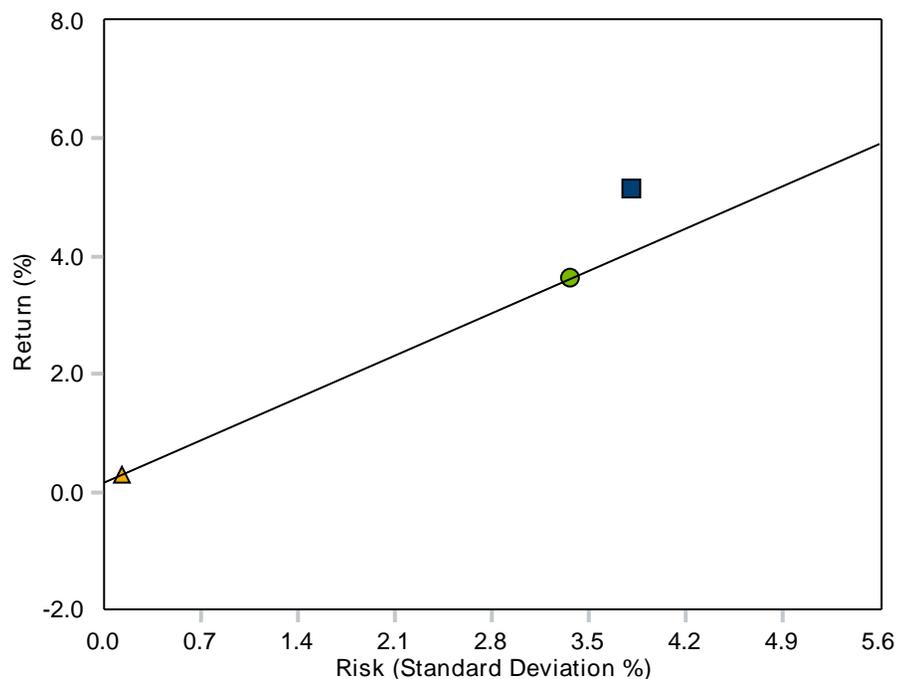
- Total Non-U.S. Equity Composite (hedged)
- Blended Policy (Total Non-US Eq) (Hedged)

10 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Total Non-U.S. Equity Composite (hedged)	1.05	1.50	0.70	0.99	0.40	1.28	0.96	5.94	17.40	1.00
Blended Policy (Total Non-US Eq) (Hedged)	0.00	0.00	N/A	1.00	0.33	0.00	1.00	4.72	17.99	1.00
FTSE 3 Month T-Bill	-5.96	18.02	-0.33	0.04	N/A	0.32	0.00	0.31	0.13	-0.20

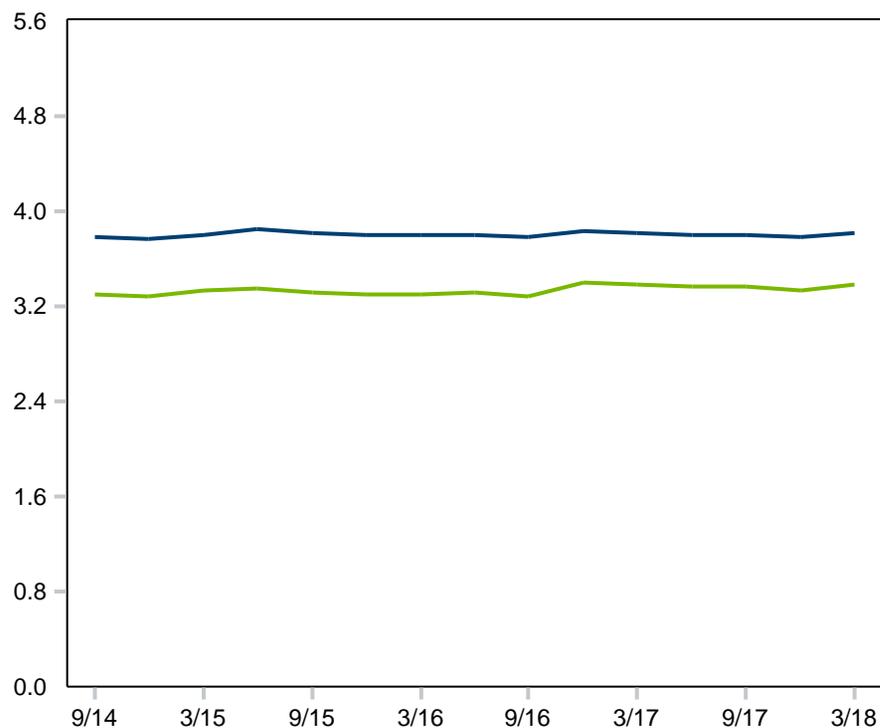
Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



- US Core Plus Fixed Income Composite
- Blended Policy (Barclays Aggregate Index)
- ▲ FTSE 3 Month T-Bill

Rolling 10 Years Standard Deviation



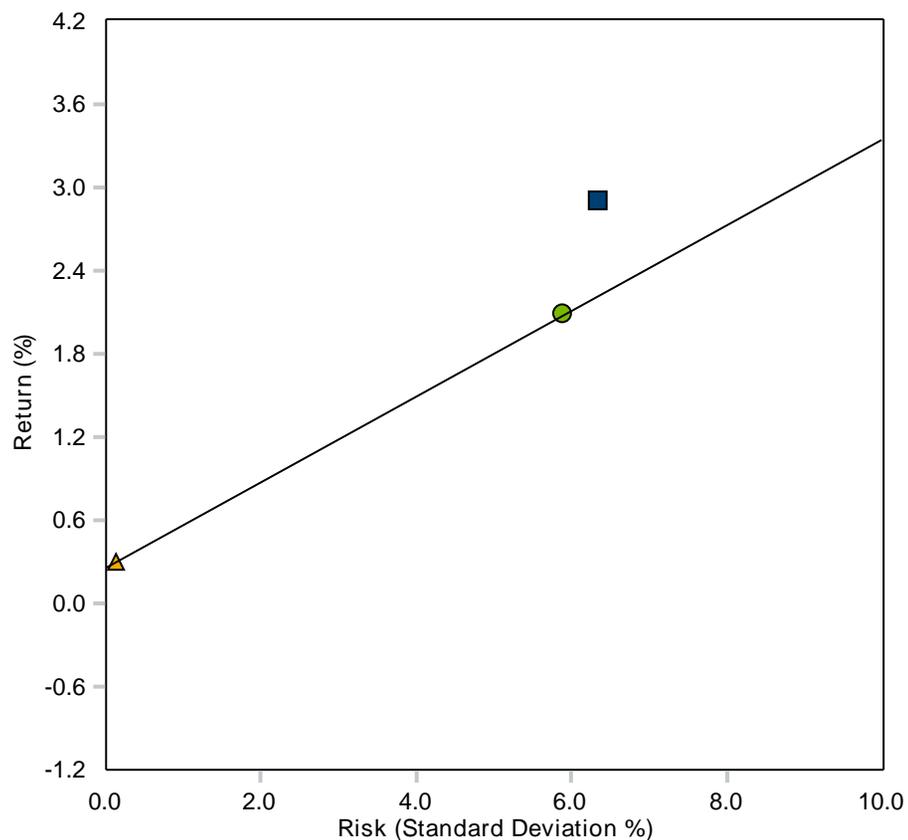
- US Core Plus Fixed Income Composite
- Blended Policy (Barclays Aggregate Index)

10 Years Historical Statistics

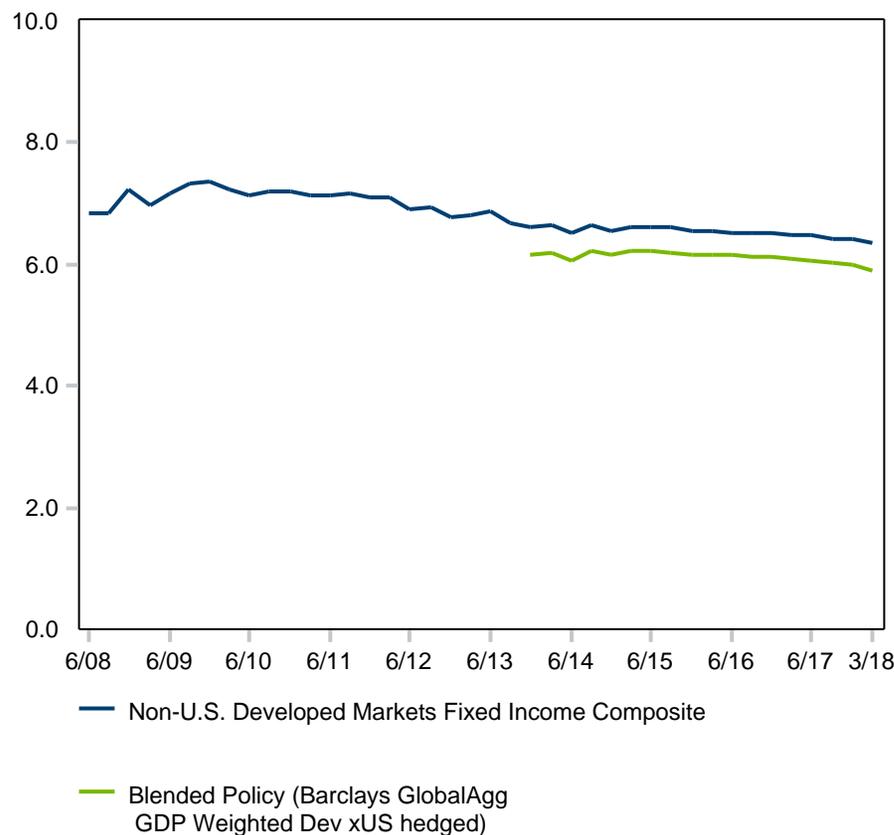
	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
US Core Plus Fixed Income Composite	1.46	1.65	0.89	0.81	1.24	1.40	1.02	5.14	3.81	0.90
Blended Policy (Barclays Aggregate Index)	0.00	0.00	N/A	1.00	0.98	0.00	1.00	3.64	3.38	1.00
FTSE 3 Month T-Bill	-3.33	3.41	-0.98	0.04	N/A	0.33	-0.01	0.31	0.13	-0.20

Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



Rolling 10 Years Standard Deviation

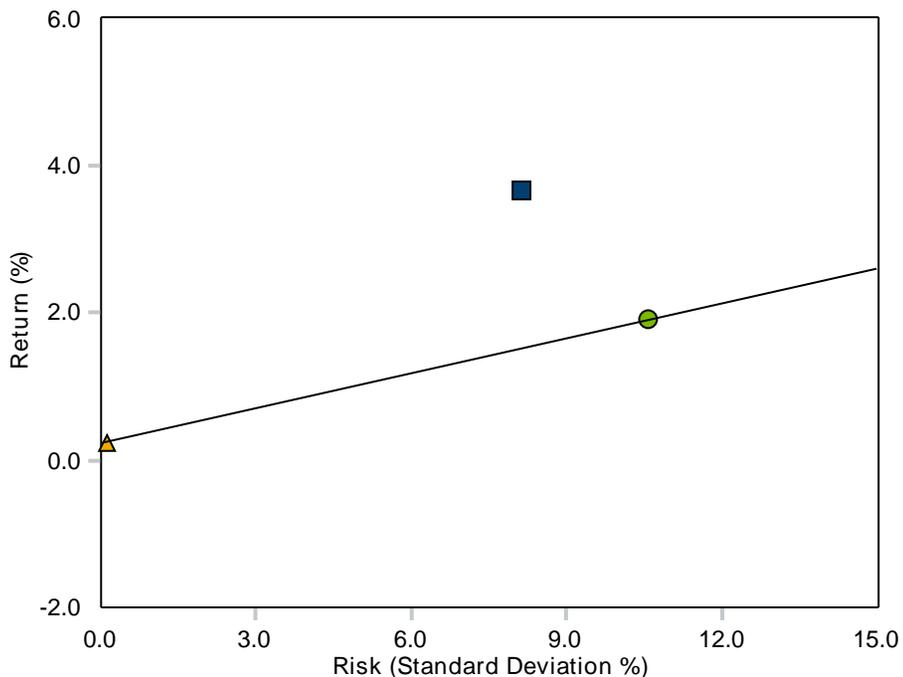


10 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Non-U.S. Developed Markets Fixed Income Composite	0.83	2.23	0.37	0.88	0.43	0.82	1.01	2.90	6.34	0.94
Blended Policy (Barclays GlobalAgg GDP Weighted Dev xUS hedged)	0.00	0.00	N/A	1.00	0.33	0.00	1.00	2.08	5.90	1.00
FTSE 3 Month T-Bill	-1.93	5.91	-0.33	0.01	N/A	0.31	0.00	0.31	0.13	-0.12

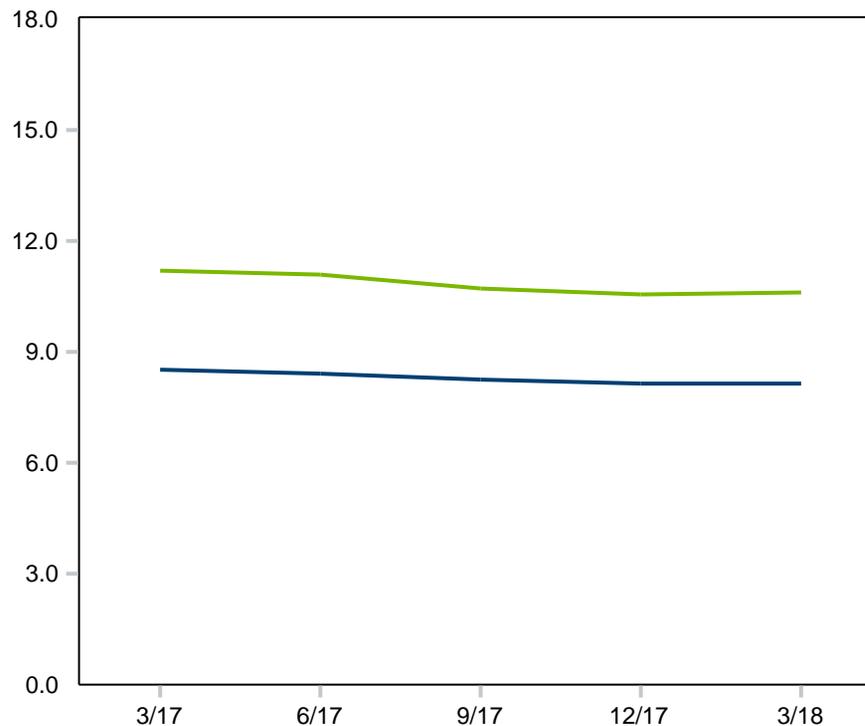
Risk Profile

Annualized Return vs. Annualized Standard Deviation 7 Years



- Emerging Markets Fixed Income Composite
- Blended Policy (Barclays Emerging Mkt 10% Country Cap)
- ▲ FTSE 3 Month T-Bill

Rolling 7 Years Standard Deviation



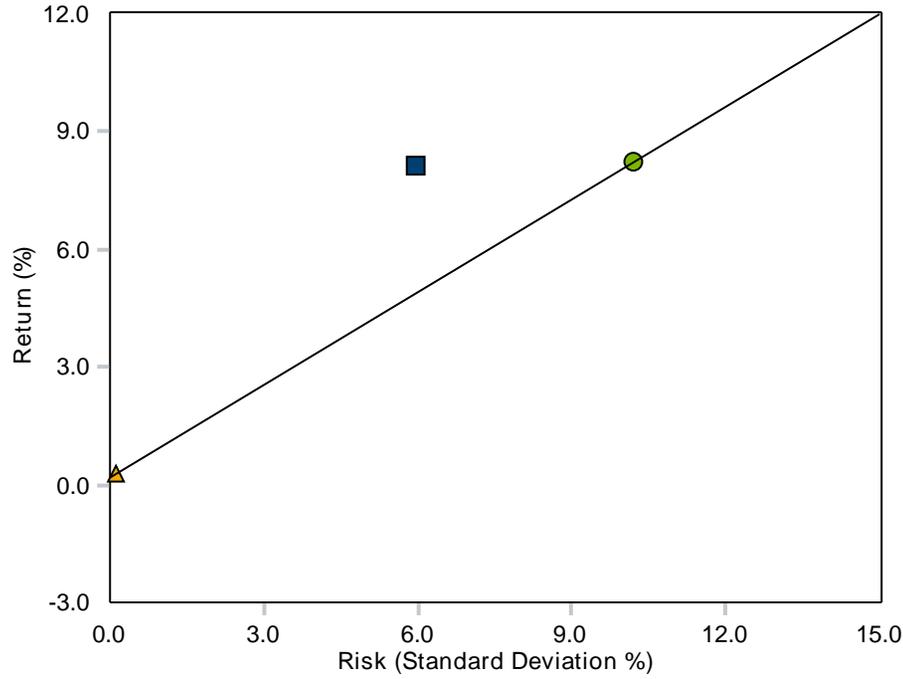
- Emerging Markets Fixed Income Composite
- Blended Policy (Barclays Emerging Mkt 10% Country Cap)

7 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Emerging Markets Fixed Income Composite	1.47	4.55	0.32	0.84	0.45	2.22	0.70	3.65	8.13	0.91
Blended Policy (Barclays Emerging Mkt 10% Country Cap)	0.00	0.00	N/A	1.00	0.21	0.00	1.00	1.91	10.58	1.00
FTSE 3 Month T-Bill	-2.21	10.57	-0.21	0.02	N/A	0.24	0.00	0.24	0.11	0.14

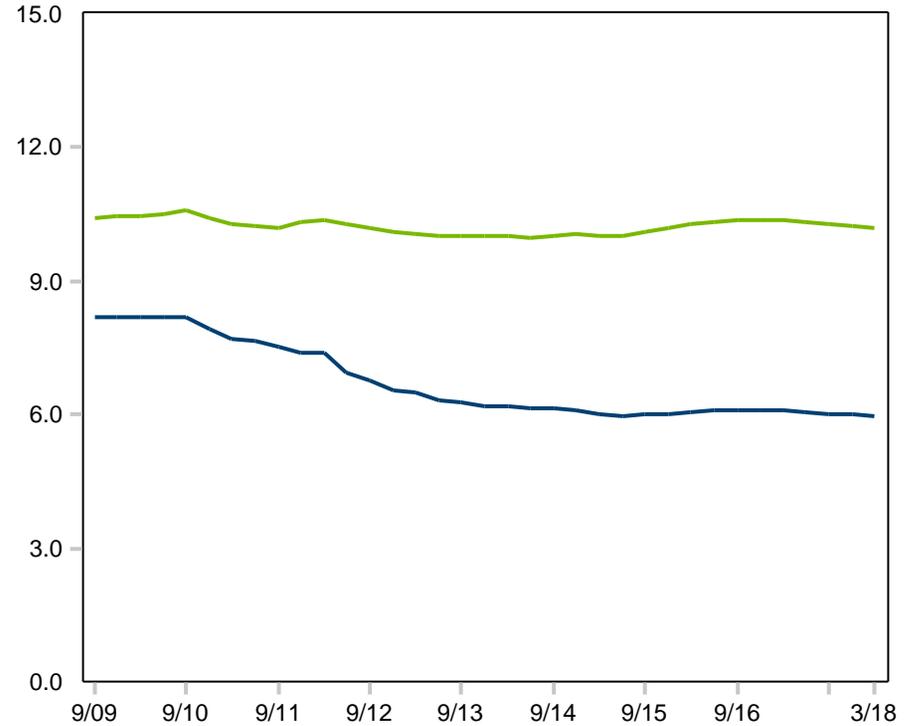
Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



- High Yield Fixed Income Composite (hedged)
- Blended Policy (Barclays Corporate HY)
- ▲ FTSE 3 Month T-Bill

Rolling 10 Years Standard Deviation



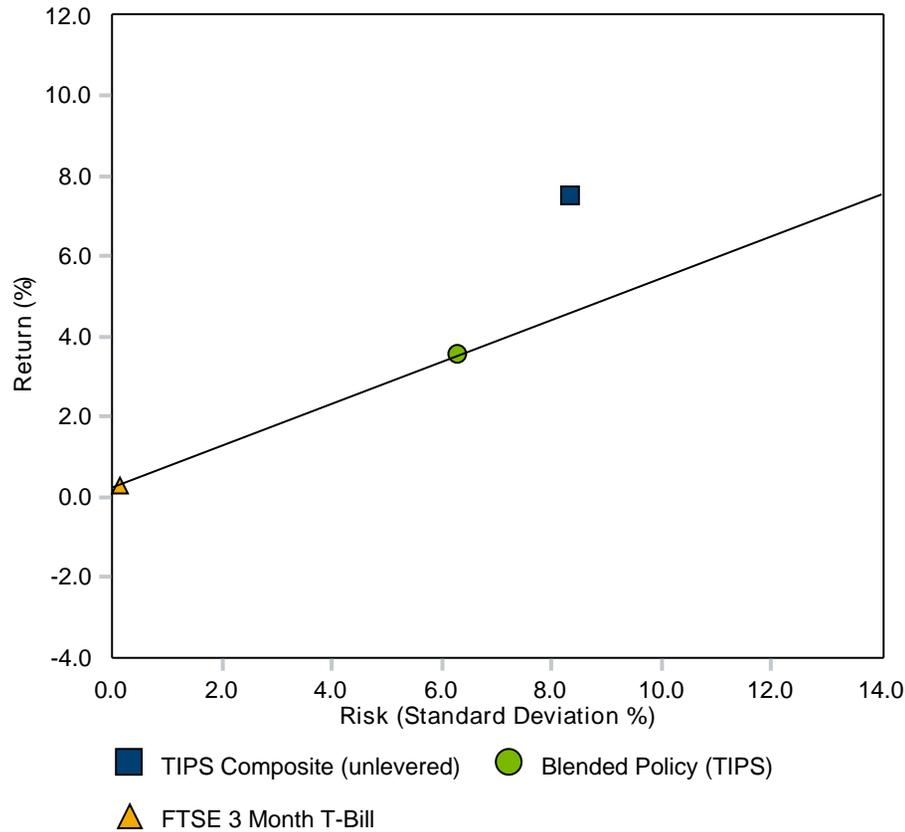
- High Yield Fixed Income Composite (hedged)
- Blended Policy (Barclays Corporate HY)

10 Years Historical Statistics

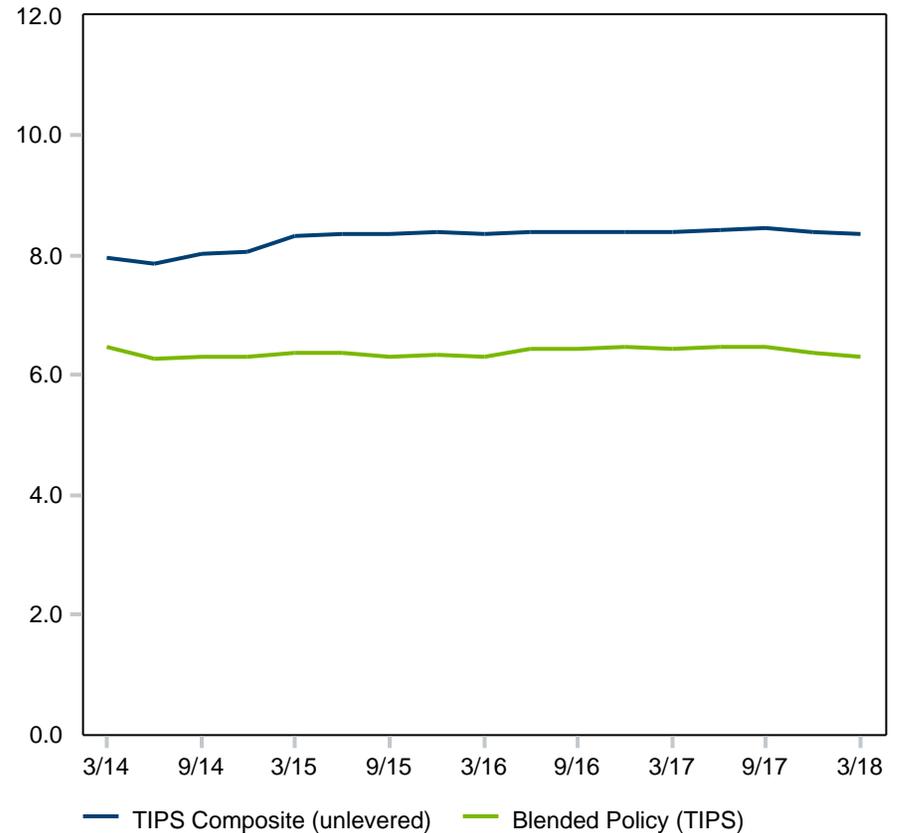
	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
High Yield Fixed Income Composite (hedged)	-0.48	7.21	-0.07	0.52	1.27	4.50	0.42	8.10	5.99	0.72
Blended Policy (Barclays Corporate HY)	0.00	0.00	N/A	1.00	0.80	0.00	1.00	8.24	10.21	1.00
FTSE 3 Month T-Bill	-8.16	10.25	-0.80	0.07	N/A	0.34	0.00	0.31	0.13	-0.27

Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



Rolling 10 Years Standard Deviation

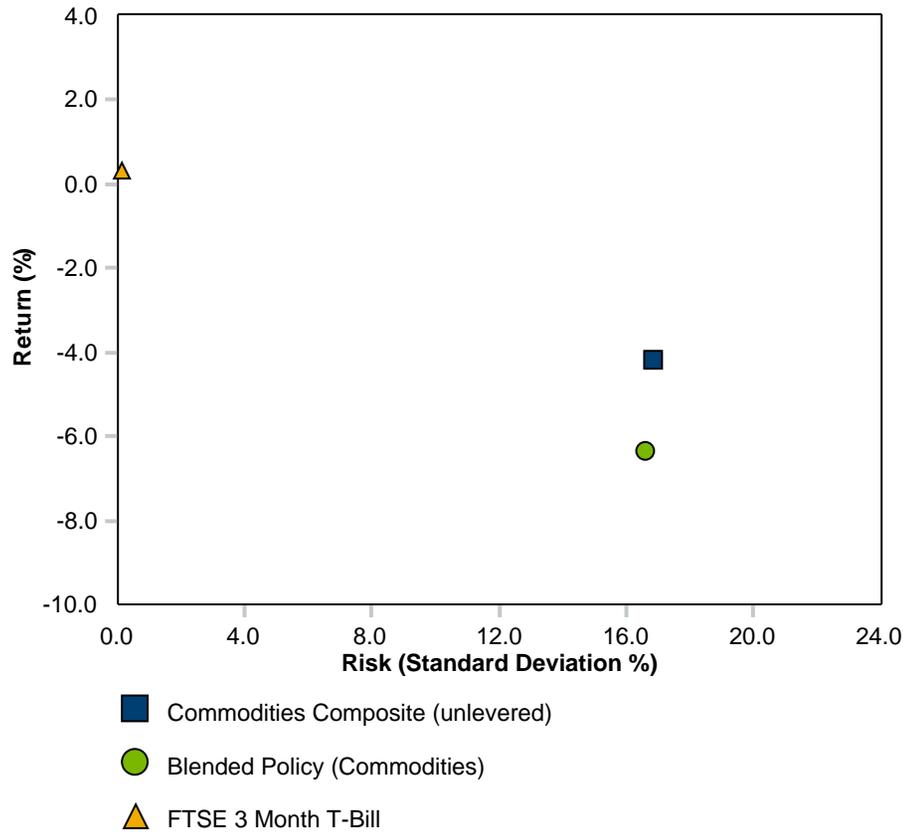


10 Years Historical Statistics

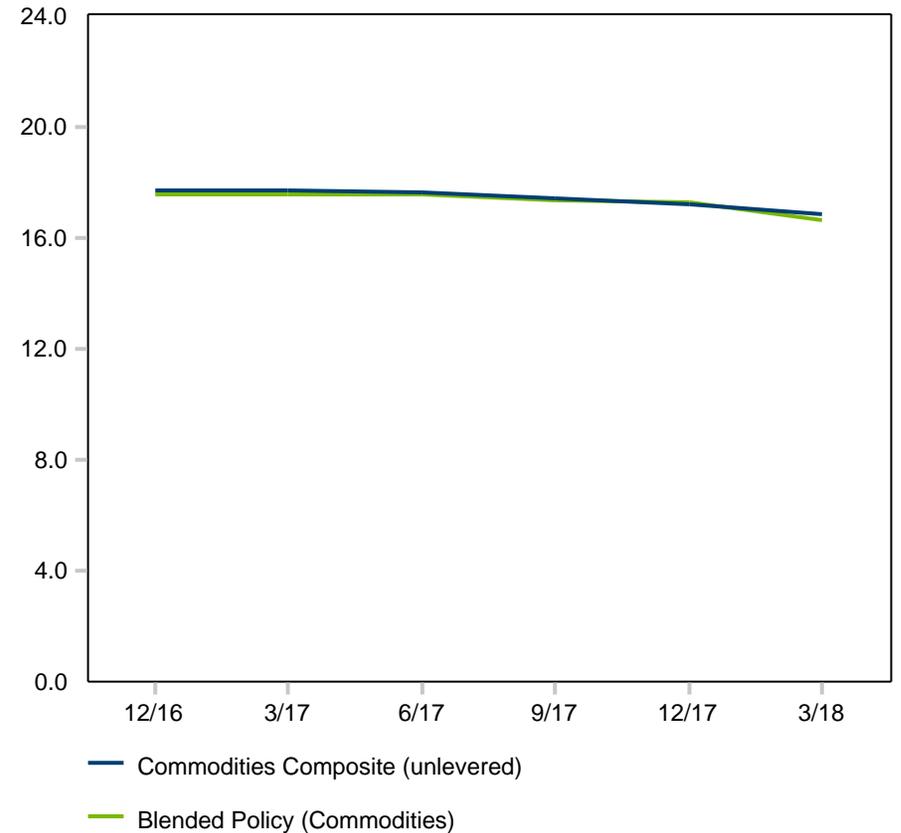
	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
TIPS Composite (unlevered)	3.90	3.43	1.14	0.86	0.87	3.10	1.23	7.48	8.35	0.93
Blended Policy (TIPS)	0.00	0.00	N/A	1.00	0.53	0.00	1.00	3.54	6.31	1.00
FTSE 3 Month T-Bill	-3.38	6.33	-0.53	0.03	N/A	0.32	0.00	0.31	0.13	-0.17

Risk Profile

Annualized Return vs. Annualized Standard Deviation 10 Years



Rolling 10 Years Standard Deviation

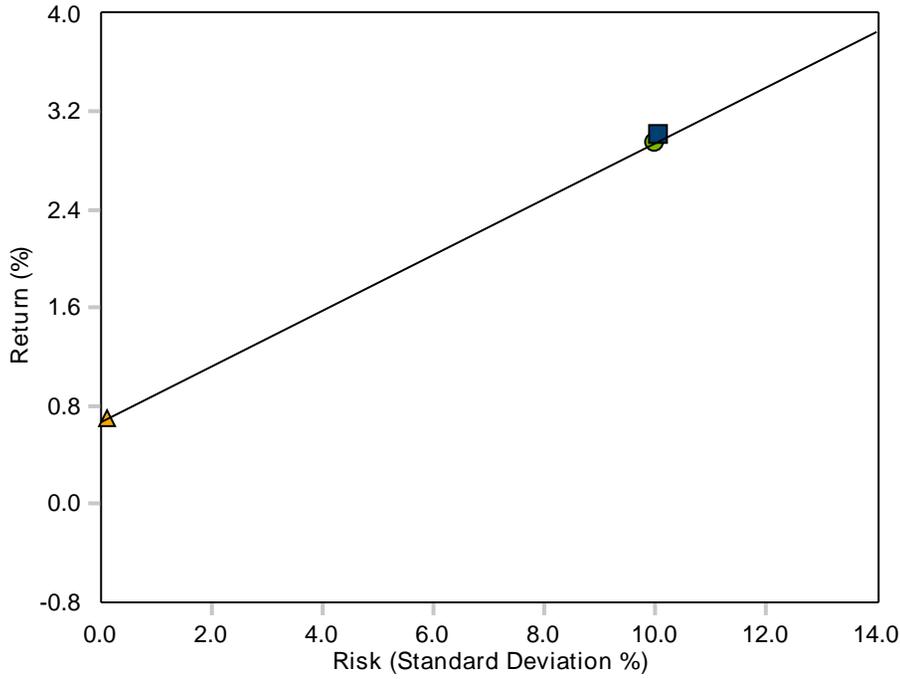


10 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Commodities Composite (unlevered)	2.30	3.80	0.60	0.95	-0.19	2.25	0.99	-4.20	16.86	0.97
Blended Policy (Commodities)	0.00	0.00	N/A	1.00	-0.33	0.00	1.00	-6.35	16.64	1.00
FTSE 3 Month T-Bill	5.42	16.66	0.33	0.02	N/A	0.30	0.00	0.31	0.13	-0.15

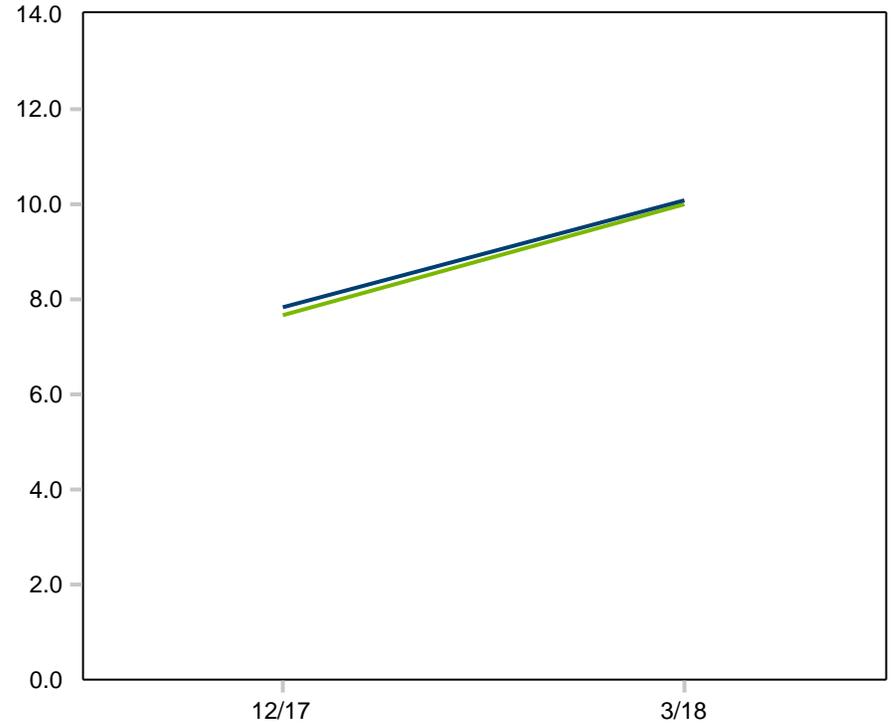
Risk Profile

Annualized Return vs. Annualized Standard Deviation
2 Years



- Total Infrastructure Composite (unlevered/hedged)
- Blended Policy (Infrastructure Hedged)
- ▲ FTSE 3 Month T-Bill

Rolling 2 Years Standard Deviation



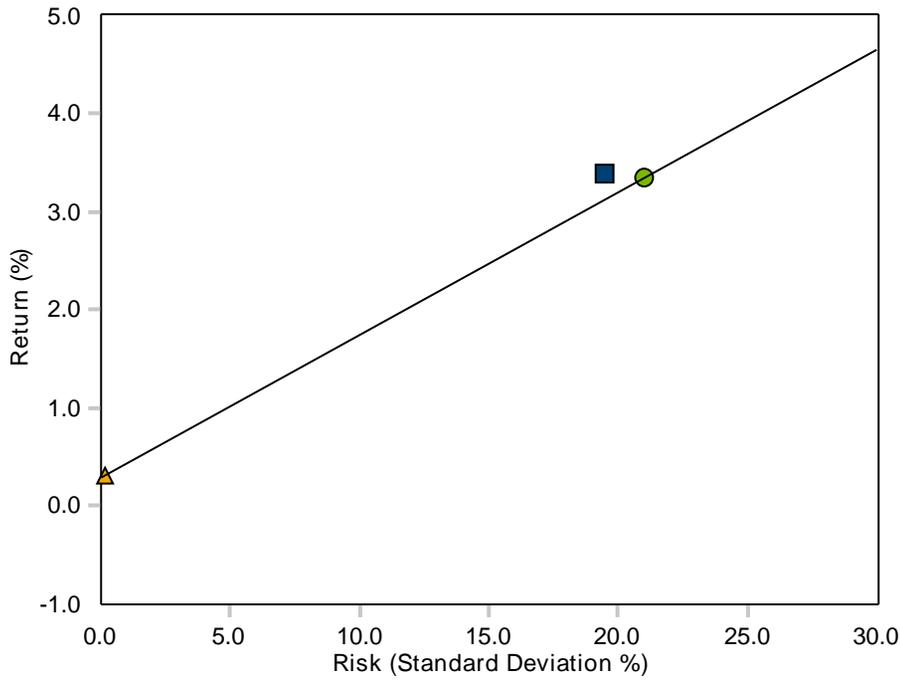
- Total Infrastructure Composite (unlevered/hedged)
- Blended Policy (Infrastructure Hedged)

2 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Total Infrastructure Composite (unlevered/hedged)	0.07	0.88	0.08	0.99	0.27	0.06	1.00	3.01	10.08	1.00
Blended Policy (Infrastructure Hedged)	0.00	0.00	N/A	1.00	0.27	0.00	1.00	2.95	10.01	1.00
FTSE 3 Month T-Bill	-2.69	10.05	-0.27	0.12	N/A	0.72	0.00	0.70	0.12	-0.34

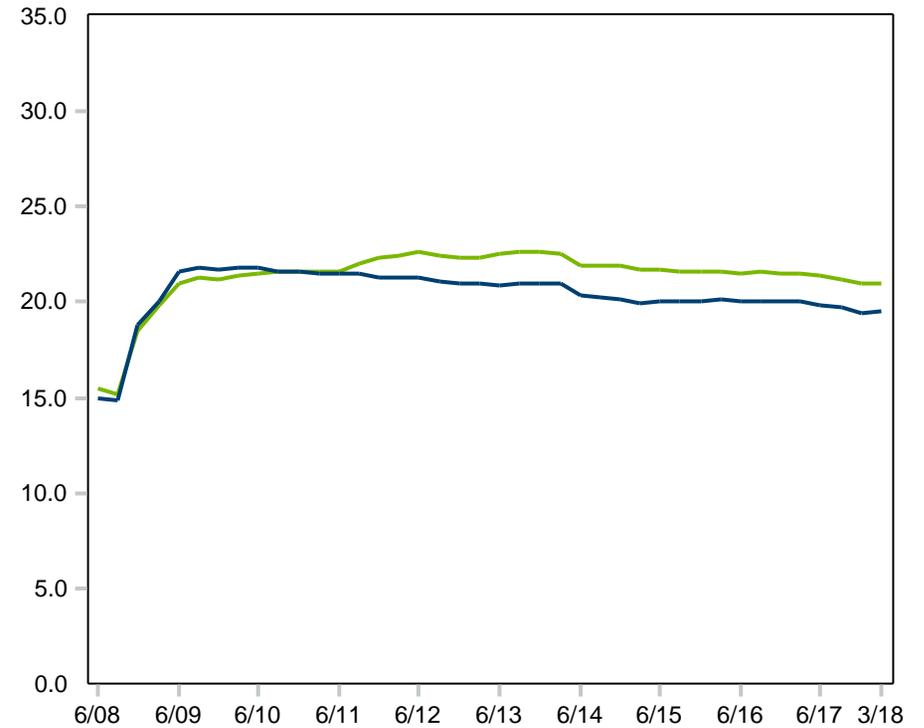
Risk Profile

Annualized Return vs. Annualized Standard Deviation
10 Years



- PTRES Composite (unlevered/hedged)
- Blended Policy (PTRES) (Hedged)
- ▲ FTSE 3 Month T-Bill

Rolling 10 Years Standard Deviation



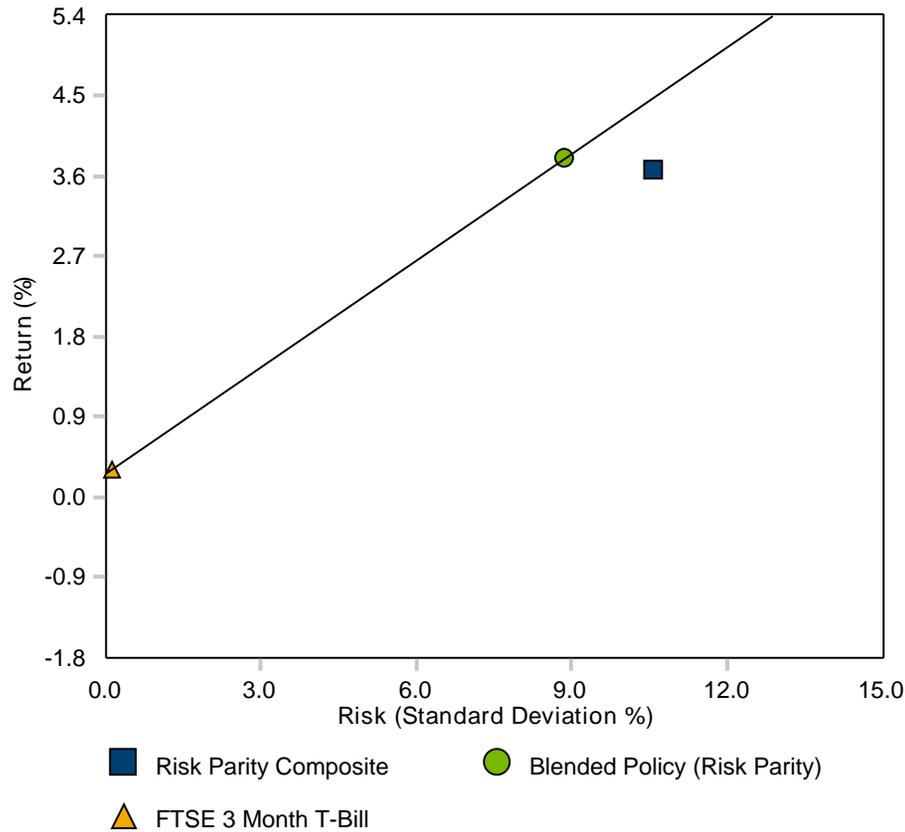
- PTRES Composite (unlevered/hedged)
- Blended Policy (PTRES) (Hedged)

10 Years Historical Statistics

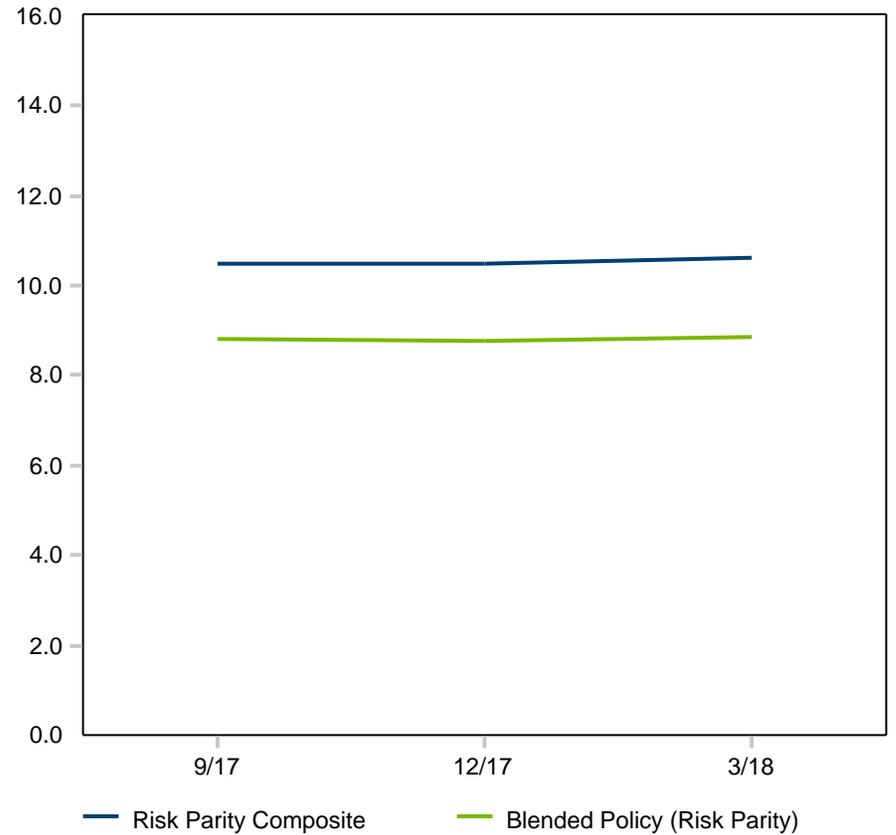
	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
PTRES Composite (unlevered/hedged)	-0.25	8.19	-0.03	0.85	0.26	0.55	0.86	3.39	19.55	0.92
Blended Policy (PTRES) (Hedged)	0.00	0.00	N/A	1.00	0.25	0.00	1.00	3.35	21.03	1.00
FTSE 3 Month T-Bill	-5.28	21.06	-0.25	0.06	N/A	0.31	0.00	0.31	0.13	-0.24

Risk Profile

Annualized Return vs. Annualized Standard Deviation
5 Years



Rolling 5 Years Standard Deviation



5 Years Historical Statistics

	Active Return	Tracking Error	Information Ratio	R-Squared	Sharpe Ratio	Alpha	Beta	Return	Standard Deviation	Actual Correlation
Risk Parity Composite	0.05	3.12	0.02	0.93	0.37	-0.58	1.15	3.68	10.61	0.96
Blended Policy (Risk Parity)	0.00	0.00	N/A	1.00	0.43	0.00	1.00	3.80	8.87	1.00
FTSE 3 Month T-Bill	-3.82	8.86	-0.43	0.01	N/A	0.30	0.00	0.31	0.12	0.09

Appendix III

**Commonwealth of Pennsylvania
Public School Employees' Retirement System**

DATE: July 24, 2018
SUBJECT: Public Pension Plan Fee Reporting Differences
TO: Members of the Board
FROM: James H. Grossman, Jr., CPA, CFA
Chief Investment Officer

PSERB Resolution 2017-41 called upon Investment Office staff and Board consultants to address, in part, "...the wide disparity in how "management fees" are reported among public pension funds." Prior to adoption of this resolution, SERS' investment staff began a similar project and eventually prepared the attached presentation for certain members of the SERS Board.

SERS' presentation summarizes analysis they had performed comparing data contained in a Pew report titled "State Public Pension Funds Increase Use of Complex Investments" with data sourced from the 2016 (or most recently available) Comprehensive Annual Financial Report ("CAFR") for 73 different plans. PSERS' staff reviewed SERS' work and recently discussed their approach with them. Because it appears to be well performed and responsive to PSERS Resolution 2017-41, we are providing it to PSERS' Board members. We did not, however, audit or re-perform SERS' work.

SERS' analysis confirmed there is no uniform reporting methodology used by public pension funds to calculate or report investment fees, and found that it is not appropriate to compare public pension funds based on investment fees reported without taking into account these methodology and reporting differences. Common expenses where practices differed widely included treatment of performance fees, fees relating to alternative investments, and fees within commingled funds. As indicated in SERS' presentation, when adjusting for such disparate practices whenever possible, SERS found that the total fees reflected in the Pew report were significantly understated.

We thank Bryan Lewis, Chief Investment Officer, and Matt Meads, Investment Analyst, at SERS for permission to distribute this presentation to members of PSERS' Board.

Public Pension Plan Fee Reporting Differences

February 14, 2018

Key Takeaways

- 44% of public plans' fees are understated by the Pew Report¹**
- Public pension plans record and present investment fees differently. As such, it is not appropriate to compare plans without factoring in these differences. (See examples 1 & 2: ██████████ in the appendix)
 - **18 of the 73** plans did not report certain investment expenses in their Comprehensive Annual Financial Reports (CAFRs), this may include performance fees, fees relating to alternative investments or fees within commingled funds²
- The fees in the Pew report are understated due to their exclusion of certain fees, in particular alternative investment fees, that are often reported in the footnotes of public plan financial statements. (See examples 3 & 4: ██████████ in the appendix)
 - **14 of the 73 plans** reported fees in the footnotes of their CAFR's that Pew did not include²

¹Pew Report titled, State Public Pension Funds Increase Use of Complex Investments.

²Data for SERS research was sourced from each respective state's 2016 Comprehensive Annual Financial Report, or the most recent publicly available CAFR. Investment expenses include all administrative, investment management & performance, consulting and custodian fees.

Comparability of Pews data set

- Using the same 73 public plans from the Pew report, **SERS research¹ indicates the average investment expense paid as a percentage of assets is 57 basis points (bps)² vs. Pew's calculation of 34 bps³**. However, this comparable set could be argued as inappropriate because it includes much smaller plans relative to SERS and plans with differing asset allocations.
- SERS used the following criteria to create a more comparable peer group from a subset of the original 73 plans included in the Pew report. This comparable peer group accounts for the size and asset allocation of the plan:
 - Plans with higher than the median exposure to alternative investment (>25.4%)¹ in an effort to reduce volatility
 - Plans that are larger than the median public plan (>\$17.3 Billion)¹
 - **The average investment expense for this more comparable group is 67 bps while the median is 64 bps¹**

¹Data for SERS research was sourced from each respective state's 2016 Comprehensive Annual Financial Report, or most the recent publicly available CAFR. Investment expenses include all administrative, investment management & performance, consulting and custodian fees. See appendix.

²Basis points equal one hundredth of one percent, and are calculated throughout this presentation by dividing the investment management fees by the total fund assets under management.

³Page 16 of Pew Report titled, State Public Pension Funds Increase Use of Complex Investments.

Appendix

Example 1:

- Investment fees as reported in the [REDACTED] 2014 CAFR: 12 bps¹
- Investment fees as reported in the [REDACTED] 2016 CAFR: 103 bps²
- Between 2014 and 2016 [REDACTED] modified their reporting policies to become more transparent in the reporting of investment management fees. **This resulted in reported fees increasing from 12 bps to 103 bps.**

¹ 2014 [REDACTED] CAFR (page 118) shows that the state was only reporting management fees for domestic and international equity and fixed income. This fee calculation excludes 36% of [REDACTED]'s investments according to their Asset Allocation, page 115. It also excludes fees and commissions associated with commingled funds.

² 2016 [REDACTED] CAFR (page 164) shows management fees paid to managers using a new methodology which includes performance fees as well as fees paid to managers outside of equity and fixed income asset classes.

Example 2: [REDACTED]

- Investment fees as reported in the [REDACTED] 2014 CAFR: 39 bps¹
- Investment fees as reported in the [REDACTED] 2016 CAFR: 81 bps²
- In 2014 [REDACTED] did not provide management fee details in its CAFR³. In 2016 [REDACTED] did provide management fee details in its CAFR⁴. **This change in reporting methodology showed an increase in reported fees of 39 bps to 81 bps.**

¹ [REDACTED] 2014 CAFR (page 103)

² [REDACTED] 2016 CAFR (page 164)

³ [REDACTED] 2014 CAFR (page 104)

⁴ [REDACTED] 2016 CAFR (page 48), “In fiscal year 2015, [REDACTED] changed the reporting of private equity investment fees from a net basis to a gross basis. Prior to 2015, the majority of [REDACTED] private equity investment fees were netted against investment activity.”

Example 3:

- Investment fees as reported by Pew for ██████████ 2014: 14 bps¹
- Investment fees as reported by ██████████ 2014 CAFR: 55 bps²
- By simply using the Investment Expense number from the Statement of Net Position without consulting the notes to the financial statements, **the fee in the Pew report significantly understates ██████████'s total fees by 41 bps .**

¹ To calculate the investment expense for ██████████, Pew used the “management expense” number given in the 2014 statements of pooled net position and divided it by assets under management. (██████████ CAFR page 57)

² ██████████ CAFR (page 65) states “The total cost of managing the fund for fiscal year 2014, inclusive of investment management (direct and indirect), advisory, custodial and overhead charges remained unchanged at 55 basis points”.

Example 4:

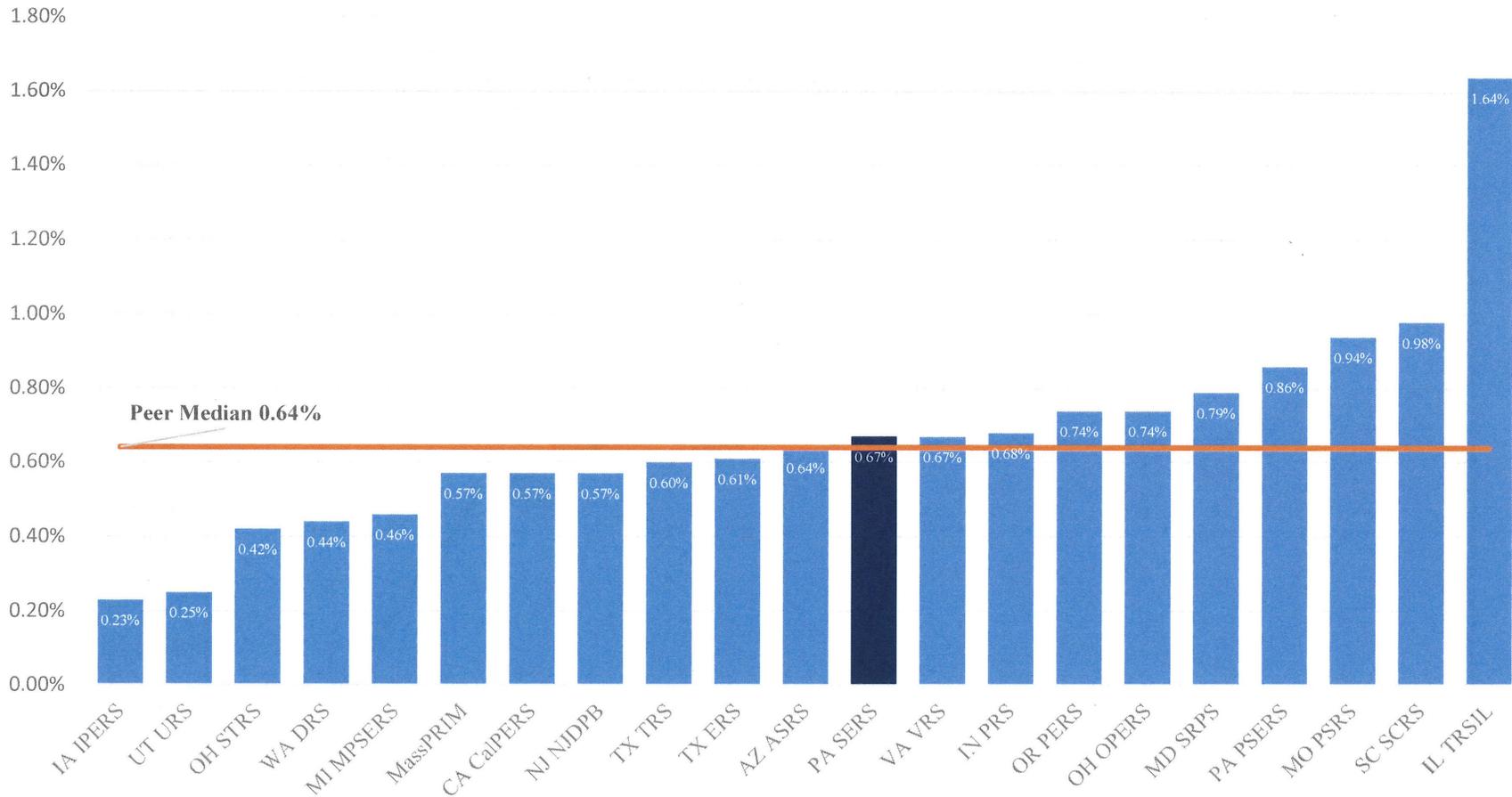
- Investment fees as reported by Pew for ██████████ 2014: 14 bps¹
- Investment fees as reported by ██████████ 2014 CAFR: 41 bps²
- The use of the number found in the investment expense line without consulting notes to the financial statements to adjust for accounting policies results in **the fee in the Pew report significantly understating ██████████ total fees by 27 bps.**

¹ To calculate the investment expense for ██████████ the Pew Study used the “Investment Expense” line item reported and divided it by assets under management. (█████████ CAFR, page 3)

² ██████████ 2014 CAFR, Note A (page 8), states that “\$70,039,985 management fees for Alternative Investments were reported as part of the fair value of investments. Details of the management fees are listed in the Investment Section.” Adding the fees from Note A to the other management fees listed (█████████ 2014 CAFR, page 3) and dividing by the firms assets under management investment fees reported as a percentage of AUM increases to 41 basis points.

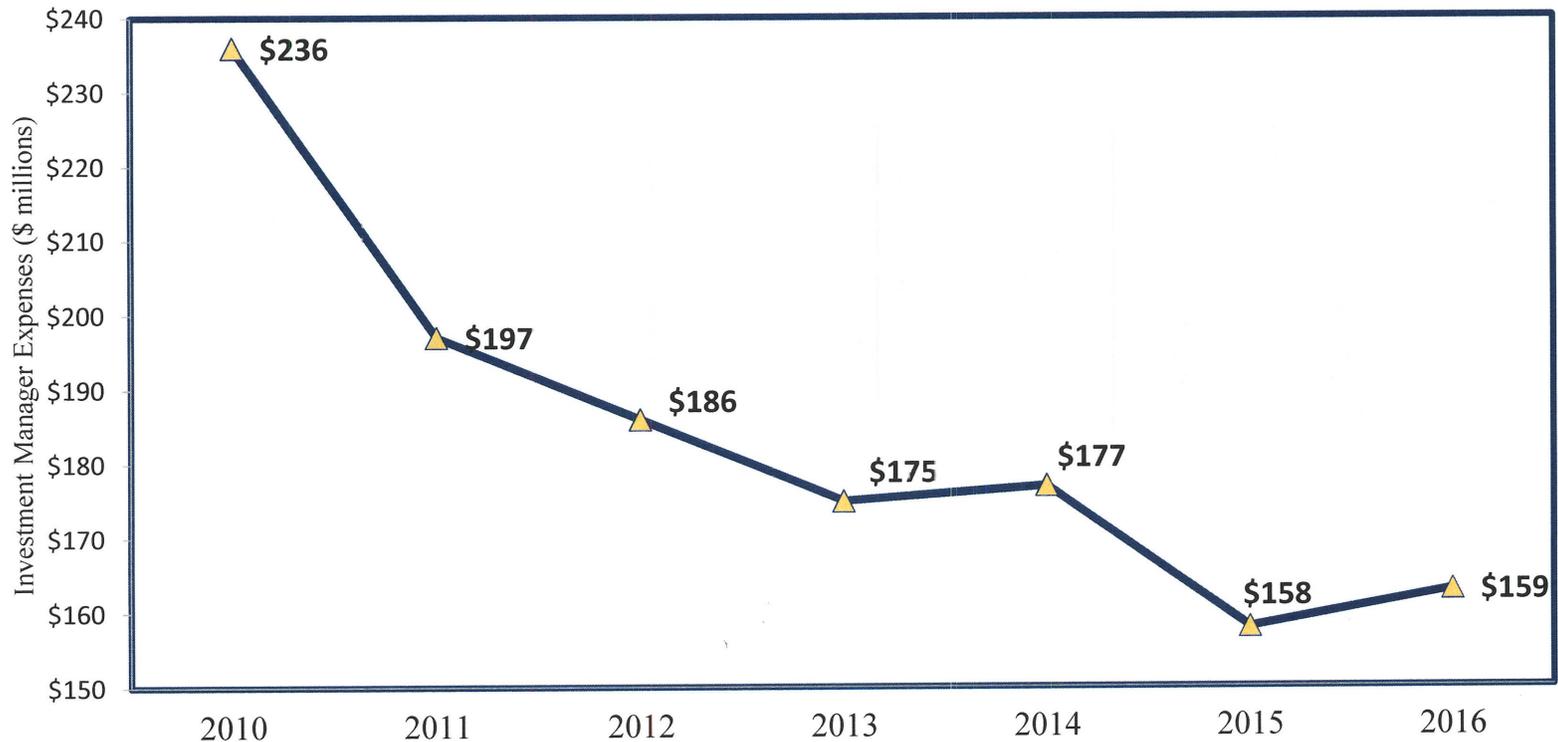
2016 Investment Expenses for Public Plans with > 25% allocation to Alternatives, and >\$17.3 billion AUM

Investment Expenses 2016 (% of Assets under Management)¹



¹Data for graph was sourced from each respective state's 2016 Comprehensive Annual Financial Reports. Investment expenses include all administrative, investment management & performance, consulting and custodian fees.

SERS reduced annual investment manager expenses by approximately \$77 million since 2010¹



Expense Ratio ²	0.96%	0.77%	0.75%	0.68%	0.65%	0.59%	0.63%
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1. Sources: SERS' 2016 CAFR for 2016 investment manager expenses. SERS' 2016 Supplemental Budget Book for 2010-2012 investment manager expenses.
2. The Investment Expense Ratios are disclosed in SERS' supplemental budget books and calculated by dividing the investment management fees by SERS' total fund and asset class quarterly average values during the calendar year. SERS' comprehensive annual financial reports are produced later in the year (June) and updated to include the more current investment management expense. SERS will update future supplemental budget books with the most current investment management expense and recalculate the expense ratio to reflect the most current investment management expenses.

Please contact SERS with any concerns or questions.

Bryan Lewis, Chief Investment Officer

Matt Meads, Investment Analyst

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