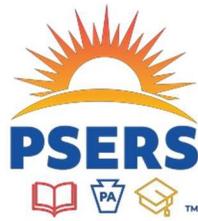




# Exhibit 3



COMMONWEALTH OF PENNSYLVANIA  
PUBLIC SCHOOL EMPLOYEES' RETIREMENT SYSTEM

September 1, 2020

Honorable Joseph M. Torsella, State Treasurer  
Treasury Department  
Commonwealth of Pennsylvania  
129 Finance Building  
Harrisburg, Pennsylvania 17120

Dear Treasurer Torsella:

Thank you for your August 12<sup>th</sup> inquiry regarding discussions which occurred during the August 7<sup>th</sup> Board meeting on the presentation of PSERS' investment returns in various publications. I have reviewed your letter with PSERS' senior management team and Aon and I can assure you and the Board the following:

- (1) All public reporting of PSERS' financial condition has been appropriate and in accordance with all applicable accounting and professional standards;
- (2) PSERS' investment performance has been calculated in accordance with the Investment Consultant Performance Reporting Policy (ICPRP), which has been in existence since September 2015, and most recently amended 12/21/2016 (a copy is enclosed); and
- (3) PSERS' investment returns are not used in any of Buck's actuarial valuation calculations performed to determine PSERS' annual employer contribution rate. In lieu of investment returns, Buck utilizes in its calculations the Total Plan Fiduciary Net Position in the audited financial statements.

Additionally, PSERS' accounting and reporting policies conform to accounting principles generally accepted in the United States of America (GAAP) as promulgated by the Governmental Accounting Standards Board (GASB). PSERS' actuarial policies, practices and reporting are conducted in accordance with all applicable Actuarial Standards of Practice issued by the Actuarial Standards Board (ASB).

PSERS has received multiple awards for its financial reporting. The Government Finance Officers Association of the United States and Canada (GFOA) awards the Certificate of Achievement for Excellence in Financial Reporting. This is a prestigious national award recognizing conformance with the highest standards for preparation of state and local government financial reports. PSERS has received a Certificate of Achievement for Excellence in Financial Reporting for 37 consecutive years from Fiscal Year 1983 to Fiscal Year 2019.

PSERS staff has researched and compiled responses to your specific questions as follows:

**1) Have staff previously provided records to the Board specifically identifying and explaining retroactive revisions to previously reported returns? If so, please refresh my memory and direct me to those documents.**

No, due to the immaterial nature of the differences, they were not specifically discussed with the Board.

Case ID: 221102792

## 2) Why have adjustments of over two basis points occurred between the CAFR returns and returns in the Aon reports?

Aon has compared the Fiscal Year returns currently on their Performance system (PARIS) and reported in the March 31, 2020 report to the Fiscal Year returns reported in the CAFR. The table below summarizes the differences:

Fiscal Year	Aon 3/31/20	CAFR	Difference
2010	14.58%	14.59%	-0.01%
2011	20.36%	20.37%	-0.01%
2012	3.44%	3.43%	0.01%
2013	7.95%	7.96%	-0.01%
2014	14.82%	14.91%	-0.09%
2015	3.41%	3.04%	0.37%
2016	1.33%	1.29%	0.04%
2017	10.20%	10.14%	0.06%
2018	9.26%	9.27%	-0.01%
2019	6.66%	6.68%	-0.02%

For the past 10 fiscal years there are only three Fiscal Years with adjustments greater than +/- 0.05% with only one fiscal year (2015) with a difference greater than +/-0.10%. Fiscal year 2015 returns have been revised by 37 basis points.

### Monthly Reporting

Due to the delayed timing in the reporting of the final net asset values (NAVs) for private market funds held in the public market composites (Absolute Return and Private Credit), the NAVs sourced from the investment manager can be very delayed and PSERS uses estimated market values for monthly reporting. If an estimated monthly NAV is not available by 20 business days after month end, the Investment Consultant (Aon) will carry forward the prior month NAV adjusted for any cash flow activity during the month, reflecting a 0% return. Cash flows are sourced from the Custodian Bank, and the Investment Consultant will make every effort to reconcile the cash flows with Investment Manager/fund administrator records and statements where available.

### Quarterly Reporting

For quarterly reporting, Aon updates the previously reported monthly NAVs with final NAVs or in some cases as noted above, with the preliminary NAV as the most current valuation available from the Investment Manager/fund administrator. In cases where accounts/funds are quarterly valued, the monthly reporting reflects a return based on the last available NAV (typically prior quarter end) and cash flows for the period. The Investment Consultant's quarterly report reflects the current quarter's NAV and performance for these funds unless otherwise specified. With these NAV adjustments, any monthly reporting on composite/asset class level is preliminary and expected to be finalized with the quarterly report.

Situations where revisions to NAVs/cash flows occur after finalizing and publishing the quarterly report are reviewed on a case-by-case basis. The Investment Consultant affects these changes for the period they have occurred with such adjustments being reflected with the next monthly/quarterly performance report.

FY 2015 Reporting Adjustment

Aon has re-reviewed the returns for Fiscal Year 2015 and has verified that the revised returns as reported in the March 31, 2020 report are correct based on the new revised NAVs received for some private market funds after the fiscal year close. A combination of (1) revisions to the market values and cash flows for some Private Credit funds and (2) the opening up of the performance books during the third quarter 2019 report to restructure the composites to reflect the new Investment Policy Statement division of public and private markets resulted in the re-calculation of prior fiscal years. It was the combination of these two changes that led to changes in the performance reported by Aon. The originally reported returns in 2015 were based on the NAVs and cashflows available at the time. The adjustments reflect revised information according to policy.

**3) In Aon's 3<sup>rd</sup> quarter report for 2019, why were nearly \$190 million of investment gain and loss adjustments made to valuations dating as far back as 2013?**

Adjustments to the investment gain and losses in Aon's 3Q2019 report:

**Quarterly Differences of Reported Gains and Losses**

**Quarters From Sept. 2013 to Sept. 2019**

**In \$000**

Quarter	9/30 Values	6/30 Values	Differences	Absolute Values
Sep-13	1,390,116.47	1,389,685.21	431.26	431.26
Dec-13	1,652,703.45	1,653,594.99	(891.54)	891.54
Mar-14	1,799,515.72	1,795,946.40	3,569.32	3,569.32
Jun-14	2,126,107.48	2,129,620.59	(3,513.11)	3,513.11
Sep-14	305,918.49	305,731.96	186.53	186.53
Dec-14	73,391.93	73,636.67	(244.74)	244.74
Mar-15	1,465,859.22	1,458,105.84	7,753.38	7,753.38
Jun-15	(85,942.86)	(78,189.47)	(7,753.39)	7,753.39
Sep-15	(2,021,300.10)	(1,975,325.66)	(45,974.44)	45,974.44
Dec-15	11,691.83	(34,282.61)	45,974.44	45,974.44
Mar-16	695,895.38	686,046.88	9,848.50	9,848.50
Jun-16	1,880,401.97	1,890,250.48	(9,848.51)	9,848.51
Sep-16	1,805,042.28	1,805,042.28	-	-
Dec-16	613,829.27	613,829.27	-	-
Mar-17	1,627,829.91	1,624,051.18	3,778.73	3,778.73
Jun-17	847,229.68	848,662.44	(1,432.76)	1,432.76
Sep-17	1,651,228.38	1,650,241.65	986.73	986.73
Dec-17	1,904,074.35	1,904,995.11	(920.76)	920.76
Mar-18	77,423.55	77,178.72	244.83	244.83
Jun-18	1,127,175.16	1,126,934.56	240.60	240.60
Sep-18	679,160.88	679,645.23	(484.35)	484.35
Dec-18	(1,571,687.17)	(1,563,406.77)	(8,280.40)	8,280.40
Mar-19	2,729,082.74	2,707,952.17	21,130.57	21,130.57
Jun-19	1,733,583.09	1,750,076.39	(16,493.30)	16,493.30
Sep-19	1,133,371.89			
<b>Totals</b>	<b>23,651,702.99</b>	<b>22,520,023.51</b>	<b>(1,692.41)</b>	<b>189,982.19</b>
<b>Estimated Performance Impact</b>			<b>-0.003%</b>	

The table above summarizes the quarterly differences of the gains and losses from the June 30, 2019 and the September 30, 2019 Aon performance reports. As illustrated in the Differences column, the cumulative adjustment of historical gains and losses back to September 30, 2013 is (\$1,692,410) not \$189,982,190. As noted in the response to question two, adjustments have been made to the timing of cash flows and market values when finalized statements for private market funds become available. Many of these adjustments were made to correct the timing of the cash flows and the adjustments are offsetting not cumulative. The calculated performance impact of the (\$1,692,410) adjustments is 0.3 basis points cumulative over the past six years.

**4) Why have Buck's actuary reports not reflected the updated returns in communications to the system?**

Buck's actuarial valuation reports were prepared using investment returns which were consistent with the investment returns Buck used in their previously issued reports. As a result, the investment returns in Buck's most current reports always agreed to and were consistent with the investment returns reported in all previous Buck reports. The investment returns from Aon are included in Buck's actuarial valuation for information purposes only. Aon's investment returns are not used in any of Buck's calculations to prepare the annual actuarial valuation of PSERS.

Although the previous reports were not incorrect, in order to reduce potential confusion over the differences in returns, the June 30, 2019 Actuarial Valuation report has been revised to include Aon's updated fiscal year returns since 2009/2010.

**5) Should the CAFR or any other official accounting document be amended for years in which the fiscal year return changed by a material amount (i.e. greater than two basis points)?**

No, the Fund's investment return is presented for disclosure purposes only in the notes to the financial statements and CAFR. As noted previously, PSERS' accounting and reporting policies conform to U.S. GAAP as promulgated by GASB. A revision in the investment return would not change any of the dollar amounts presented in PSERS' basic financial statements, the Statement of Fiduciary Net Position and Statement of Changes in Fiduciary Net Position. As a result, the overall financial position of PSERS is not impacted by a small change in Aon's previously reported investment returns and, as such, a reissuance of an amended CAFR or actuarial valuation is not required.

**6) Were the previous – now apparently incorrect – returns used to determine the annual required contributions (ARC) calculations for those years?**

PSERS returns were not incorrect. Nor were there any errors by PSERS staff or consultants. Both the actuarially required contributions (ARC) used to calculate PSERS' employer contribution rate and the actuarially determined contributions (ADC) required by current accounting standards are based on the Total Plan Fiduciary Net Position in the audited financial statements and not the stated investment return of the Fund as reported by Aon.

The only instance where Aon's investment return is used by Buck is for the Member's risk share. As defined in PSERS Retirement Code, Aon's return for the 9 years ended June 30, 2020 will be used in the Member's risk share calculation which Buck will include in their June 30, 2020 actuarial valuation report. The 9-year return to be used in Buck's June 30, 2020 actuarial report will be the same as and agree to Aon's June 30, 2020 investment performance report.

**7) Would you please provide a copy of any PSERS policy or protocol governing when and how performance returns are revised, when and how Board members are informed of any material performance revisions, and when and how identified errors within the CAFR or actuarial reports are corrected?**

Honorable Joseph M. Torsella  
September 1, 2020  
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The use of “errors” is incorrect. As shown above, these are adjustments that are made as more data is reported to PSERS. The adjustments are not errors in reporting.

As noted in the first paragraph of this letter, a copy of the Investment Consultant Performance Reporting Policy (ICPRP) is enclosed. After the Total Fund Report is finalized, revisions to NAVs/cash flows are reviewed on a case-by-case basis. Currently, the policy does not address reconciliation with the CAFR or informing Board Members of revisions to fund returns. Amendments to the Policy to establish materiality thresholds and procedures for involving or notifying the Board in a formal fashion could be developed.

PSERS and Aon have worked together to create the ICPRP. The policy discusses revisions as follows:

“Situations where revisions to NAVs/cash flows occur after finalizing and publishing the quarterly report will be reviewed on a case-by-case basis. The Investment Consultant and Staff will work to determine the best way to make adjustments and document them accordingly. If there is no significant materiality to the revisions, the Investment Consultant affects these changes for the period they have occurred with such adjustments being reflected with the next monthly/quarterly performance report.”

“The Private Markets Policy Benchmark is updated retroactively for the past 20 quarters in order to reflect more accurate measure of changes in constituents of such benchmark. This methodology results in a restatement of the Total Fund Policy Benchmark return from quarter to quarter; as a result, the return for a specific quarter may differ from the return for that quarter reported in an earlier report. Any material changes to the returns of the Total Fund Policy Benchmark as a result of this methodology are expected to be documented accordingly.”

While it is beneficial to wait to finalize the PSERS quarterly performance report until all final market values are received from the Investment Managers, this need has been balanced with the need to provide timely reporting to the Board in advance of meetings. Staff and Aon have worked diligently to receive final valuations and achieve timely reporting of performance to the Board. This has been noted by you in the past with receiving performance reports a day before Investment Committee meetings as the books were held open to get as many final NAVs as possible.

Please let me know if you have any questions on the information provided or would like to meet to discuss the response.

Sincerely,



Glen R. Grell  
Executive Director  
Public School Employees' Retirement System

cc: Christopher Santa Maria, PSERS Chairman of the Board  
State Representative Frances Ryan, PSERS Audit/Compliance Chairman  
Jason Davis, PSERS Investment Chairman  
James Grossman, PSERS Chief Investment Officer  
Brian S. Carl, PSERS Chief Financial Officer

# Investment Consultant Performance Reporting Policy

## I. Overview

### a. Purpose

The purpose of this Investment Consultant Performance Reporting Policy is to detail the guidelines, procedures, and processes for the performance calculation and reporting for the System's investments. Ensuring a consistent and transparent process to determine and report performance is critical for performance data to be a useful analytical tool for the Board and Investment Office Staff (IOS). Responsibility for implementation of this Policy is assigned jointly to IOS dedicated to investment operations and risk responsibilities (Staff) and to the general Investment Consultant, and additionally to the extent applicable, each asset class-specific Investment Consultant and Investment Manager.

### b. Performance Reports

The Monthly Flash Report and Quarterly Total Fund Report provide the NAVs, returns, attribution, risk profiles, and risk statistics for the Public School Employees' Retirement Fund (Fund). The Monthly Flash Report information is considered to be preliminary as it shows preliminary market values and performance for all individual accounts that are typically valued monthly. The Quarterly Total Fund Report is a comprehensive report reflecting finalized market values and performance for all accounts and asset class composites (including private investments that are valued quarterly); the report also provides detailed performance review, attribution, and risk profile statistics on individual account, asset class/composite, and total Fund level. The Quarterly Total Fund Report will reflect the most-recently available valuations available when the report is closed; once closed, performance depicted in The Quarterly Total Fund Report will be considered official and final.

### c. Performance System

The current Investment Consultant uses a third party performance reporting system, the Investment Metrics' Performance Analysis and Reporting Information System (PARis), which is a Windows-based desktop application supporting performance measurement, analysis, and performance reporting. The core functions of the system include performance measurement, performance attribution, portfolio monitoring, and customized client reporting. PARis reporting is on a month-end basis, and cash flows are day-weighted within the month they occur.

### d. Performance Calculation Methodology

The calculation methodology is applied on individual account level as well as asset class/composite and total Fund performance calculation. PARis treats a composite as an aggregate of individual portfolios, combining assets and cash flows of the individual portfolios to arrive at a total composite portfolio assets and transactions total. After the composite portfolio is created, the time-weighted return (TWR) modified Dietz method is used to calculate the composite and total Fund's return.

TWR allows an investor to directly measure the portfolio's true performance over a given time frame. TWR is defined as the compounded growth rate of \$1 over the period being measured. The time-weighted formula is essentially a geometric mean of a number of holding-period returns that are linked together or compounded over time.

**Investment Consultant's Calculation:**

TWR Formula

$$HPR = ((MV1 - MV0 + D1 - CF1)/MV0)$$

Where: HPR is the holding period return

MV0 = beginning market value,

MV1 = ending market value,

D1 = dividend/interest inflows,

CF1 = cash flow received at period end (deposits subtracted, withdrawals added back)

The time-weighted rate of return specified above measures the investment performance of a pool of assets, removing the impact of cash flows, and it is the more acceptable measure of investment performance. The Investment Consultant's calculation (shown below) for TWRs is based on the modified Dietz method which is an industry standard measure for the calculation of a time-weighted return. Modified Dietz is a method of evaluating a portfolio's return based on a weighted calculation of its cash flow. The modified Dietz method takes into account the timing of cash flows, and assumes that there is a constant rate of return over a specified period of time.

Modified Dietz Formula

$$R_{MDietz} = \frac{Gain}{AverageCapital} = \frac{EMV - BMV - F}{BMV + \sum_{i=1}^n W_i \times F_i}$$

where

*EMV* is the ending market value

*BMV* is the beginning market value

*F* is the net external inflow for the period (contributions to a portfolio are entered as positive flows while withdrawals are entered as negative flows)

and

$$\sum_{i=1}^n W_i \times F_i = \text{the sum of each flow } F_i \text{ multiplied by its weight } W_i$$

The weight  $W_i$  is the proportion of the time period between the point in time when the flow  $F_i$  occurs and the end of the period.  $W_i$  can be calculated as

$$W_i = \frac{CD - D_i}{CD}$$

where

$CD$  is the number of calendar days during the return period being calculated, which equals end date minus start date plus 1

$D_i$  is the number of days from the start of the return period until the day on which the flow  $F_i$  occurred. This assumes that the flow happens at the end of the day. If the flow happens at the beginning of the day, use the following formula for calculating weight:

$$W_i = \frac{CD - D_i + 1}{CD}$$

## II. Sourcing for Performance Reports

### a. Separate Accounts – Public Markets Investments

The Custodian Bank is the primary source for market values and transactions for all Separate Accounts for which performance is calculated and reported on a monthly basis. The Investment Consultant sources data from the Custodian Bank after books close typically within 6 business days after month-end. On a quarterly basis, the Custodian Bank will reconcile balances after their book of record is closed. If restatements are necessary, a restatement letter will be sent with the change in market value. The Investment Consultant will update their records to reflect any restatement changes.

### b. Liquid Public Markets Funds (Commingled Funds)

The exceptions to the current source of inputs (Custodian Bank) are made to reflect more current valuations available directly from the Investment Managers/administrators. The Investment Consultant provides supplemental reporting for Commingled Funds as described below.

- i. **Absolute Return Investment Funds** Due to the delayed timing in reported valuations (NAVs) by Absolute Return Investment Managers being reflected on the Custodian Bank's books, the Investment Consultant sources the updated NAVs directly from the Absolute Return Investment Managers or their respective administrator (typically 15-20 business days after month end). If an estimated monthly NAV is not available by 20 business days after month end, the Investment Consultant will carry forward the prior month NAV adjusted for any cash flow activity during the month, reflecting a 0% return. Cash flows for

Absolute Return Investment Funds are sourced from the Custodian Bank, and the Investment Consultant will make every effort to reconcile the cash flows with Absolute Return Investment Manager/administrator records and statements where available.

- ii. **High Yield Managers** Due to the delayed timing in reported valuations (NAVs) by these Investment Managers being reflected on the Custodian Bank's books, the Investment Consultant sources the updated NAVs directly from the Investment Managers or their respective administrator (typically 15-20 business days after month end). If an estimated monthly NAV is not available by 20 business days after month end, the Investment Consultant will carry forward the prior month NAV adjusted for any cash flow activity during the month, reflecting a 0% return. Cash flows are sourced from the Custodian Bank, and the Investment Consultant will make every effort to reconcile the cash flows with Investment Manager/administrator records and statements where available.
- iii. **Risk Parity Managers** Due to the delayed timing in reported valuations (NAVs) by these Investment Managers being reflected on the Custodian Bank's books, the Investment Consultant sources the updated NAVs directly from the Investment Managers or their respective administrator (typically 15-20 business days after month end). If an estimated monthly NAV is not available by 20 business days after month end, the Investment Consultant will carry forward the prior month NAV adjusted for any cash flow activity during the month, reflecting a 0% return. Cash flows are sourced from the Custodian Bank, and the Investment Consultant will make every effort to reconcile the cash flows with Investment Manager/administrator records and statements where available.

For monthly reporting, the Investment Consultant initially sources NAVs and cash flows from the Custodian Bank – if a monthly statement from the Investment Manager/administrator is not available at the time of the preliminary monthly report, the Investment Consultant will calculate performance based on the latest available NAV and cash flows from the Custodian Bank as of month end. Typically, if no cash flows are present, this will result in a monthly return of 0%. For those accounts that the Investment Manager/administrators provides a preliminary NAV for the period, the performance calculation will be based on that preliminary NAV as it is considered the most current valuation available at the time of reporting.

Cases where a month-end transaction's trade date/settlement date land in different months will be reviewed on a case-by-case basis, the Investment Consultant and Staff will work to determine the best way to make adjustments and document them accordingly. If deemed necessary, the Investment Consultant will adjust the NAV to

capture the cash flow in the current month and offset the cash movement to the Cash Management account.

For quarterly reporting, the Investment Consultant updates the previously reported monthly NAVs with final NAVs (or in some cases, with the preliminary NAV as the most current valuation available from the Investment Manager/administrator) as provided by the Investment Manager/administrator as part of finalizing the quarterly report. In cases where accounts/funds are quarterly valued, the monthly reporting for such an account reflects a return based on the last available NAV (typically prior quarter end) and cash flows for the period. The Investment Consultant's quarterly report reflects the current quarter's NAV and performance for these funds unless otherwise specified. With these NAV adjustments, any monthly reporting on composite/asset class level is preliminary and expected to be finalized with the quarterly report.

Situations where revisions to NAVs/cash flows occur after finalizing and publishing the quarterly report will be reviewed on a case-by-case basis. The Investment Consultant and Staff will work to determine the best way to make adjustments and document them accordingly. If there is no significant materiality to the revisions, the Investment Consultant affects these changes for the period they have occurred with such adjustments being reflected with the next monthly/quarterly performance report.

In the calculation of Absolute Return/High Yield accounts and composites, the Investment Consultant follows the same methodology of performance calculation in the Performance Calculation Section. The Investment Consultant performance calculation methodology for the Absolute Return/High Yield accounts day-weights the cash flows within the month they occur as sourced from the Custodian Bank; as a result, the Investment Consultant calculated return for these accounts/composites may differ from those calculated by Staff, given differences in calculation methodology, which currently weighs cash flows at the end of the month. Any specific differences are reviewed and documented consistent with the reconciliation process followed by the Investment Consultant and the System.

**c. Illiquid LP Structures (Non- Marketable - Private Market Investments) -Quarterly Reporting Only**

Performance reporting for Private Markets (Private Real Estate, Private Debt, Private Equity, and Venture Capital) is quarterly and reflected in total Fund performance on a quarter lag. The performance is a time-weighted return (modified Dietz methodology) and it is based on a quarter lagged valuations and a quarter lagged cash flows (for example, 3Q Total Fund reporting reflects 2Q valuations and cash flows as occurred on the date in 2Q). The Investment Consultant sources the valuations and transactions from the System. The data provided is on an individual fund level. The Investment Consultant reports only on a composite level - as a result the

Investment Consultant aggregates the data (both valuations and cash flows) before updating PARis. Private Market NAVs are quarterly valued, however the performance needs to be calculated on a monthly basis in PARis in order to roll up to Total Fund. The Investment Consultant will adjust the NAVs as follows: during each quarter, the NAV for month 1 will be the NAV for the prior quarter-end, adjusted for cash flows during month 1, reflecting a 0% return. The NAV from month 2 will be carried forward from month 1 and further adjusted for any cash flows during month 2, reflecting a 0% return. The NAV for month 3 will be provided by the System, reflecting the full quarterly return. After review and reconciliation of Private Markets performance with Staff, the Investment Consultant provides the valuations and quarterly performance to the Custodian Bank's performance reporting group.

- d. **Blended Accounts.** Blended accounts are defined as those with both individual asset holdings at the Custodian Bank and underlying investments being Commingled Fund vehicles or accounts of several Commingled Funds (fund of funds structure). The Custodian Bank is the primary source for market values and transactions for which performance is calculated and reported on a monthly basis. Exceptions to the current source of inputs (primarily valuations) for a fund of funds type of blended accounts are made to reflect more current valuations available directly from the Investment Managers/administrator. For those accounts that the Investment Manager/administrator has provided a preliminary NAV for the period, the performance calculation will be based on that preliminary NAV as it is considered the most current valuation available. Cash flows for these accounts are sourced from the Custodian Bank and Investment Consultant will make every effort to reconcile them with Investment Manager/administrator records and statements where available. If an estimated monthly NAV is not available by 20 business days after month end, the Investment Consultant will carry forward the prior month NAV. Performance calculations for underlying accounts will be provided only if market values/cash flows for these underlying accounts is available either from the Custodian Bank or Investment Manager/administrator; in cases where such level of detail is not present, any performance reporting for such underlying accounts will be only supplemental in nature.

### III. Additional Calculations

#### a. Levered (Cash)/ and Unlevered (Notional) Performance

The Investment Consultant calculates both levered and unlevered performance for several accounts. The levered return is based on market values and transactions as reported by the Custodian Bank. The unlevered or notional return is based on notional valuations (sourced from Investment Manager/brokerage statements and the System's internal reports as prepared by SIOS) and respective transactions/changes in exposures on a monthly basis. The unlevered reporting is for supplemental purposes only and it is consistently shown in the Investment Consultant monthly/quarterly reports. For example, the levered return calculation for the US Long Treasury account (one of the accounts that is currently permitted to employ leverage) is based on the net asset value and cash flows of the account. The unlevered return calculation is based on the gross

asset value of the account (i.e. economic exposure achieved with the use of leverage/derivatives) adjusted for any changes in exposure during the period. In order to include the impact of employed leverage, the calculated performance for total Fund and appropriate asset class composites reflects the returns and market values of the levered accounts, based on market values and transactions sourced from the Custodian Bank.

**b. Currency Hedge Composite/ Currency Overlay Manager**

The currency overlay mandate performance as shown in the Investment Consultant monthly/quarterly report reflects the value added by currency hedging and it is an actual measure of cash flow activity as required by the nature of the currency contracts held in the account. Specifically, the performance captures the changes in gains/losses as sourced from the Custodian Bank's statements over the monthly notional value (currently sourced from the currency overlay manager monthly statement). The Investment Consultant calculation for the notional return is  $(\text{Realized G/L}) + (\text{Unrealized G/L}) / \text{Month-End Floating Notional Value}$ . The Investment Consultant reconciliation performance tolerance targets on a monthly basis for the notional currency returns is 5 bps. The Investment Consultant will calculate performance using partial period or daily returns to bring any monthly return deviations to within this tolerance range. The total Fund and asset class/composite return reflects the currency gains/losses and the calculated total Fund/asset class return in effect captures the impact of currency hedging.

**c. Risk Parity (volatility-adjusted) Reporting**

The purpose of the volatility-adjusted reporting for this asset class composite is to provide a more comparable monitoring versus the specific asset class policy benchmark given an explicitly defined volatility target. For additional reporting purposes, the Investment Consultant calculates and reports volatility-adjusted performance for the risk parity composite and individual risk parity accounts. The adjustment for each portfolio is as follows:

$$\text{Volatility Adjustment} = ((\text{Manager Actual Return} - \text{Risk free Rate}) * (\text{Scaling Factor})) + \text{Risk free Rate.}$$

The Scaling Factor for volatility adjustment for each individual account is defined as follows:

$$\text{Scaling Factor} = \frac{\text{Asset Class Volatility Policy Target}}{\text{Individual portfolio volatility target (as defined by manager investment guidelines)}}$$

The calculated volatility-adjusted risk parity composite return is an asset-weighted return based on beginning of period portfolio market value and volatility adjusted return. The total Fund return reflects the actual (not volatility-adjusted) risk parity return capturing the performance impact of actual volatility of underlying portfolios during the measurement period.

Note: Risk Parity also has a non-volatility adjusted return which is the primary reported return. Volatility adjusted Risk Parity reporting is for supplemental purposes only.

**d. Investment Management Fees/Fund Expenses**

The System is committed, to the extent possible, to consider all applicable investment fees and other expenses incurred in calculating and reporting performance. Therefore, Staff shall direct the Custodian Bank to post accruals for investment management fees and for performance fees to each applicable portfolio account.

While performance is reported on net of fee basis, the Investment Consultant also calculates gross of fee returns for total Fund, asset class/composite and individual accounts. The performance calculation incorporates actually paid fees as sourced from the Custodian Bank and incentive fee accruals where applicable. For these External Portfolio Managers' mandates that have an incentive fee component, the incentive fee accrual is calculated on a monthly basis. Staff reviews the incentive fees as provided by the External Portfolio Manager, then sends the incentive fee accrual to the Investment Consultant who uses the data to apply an incentive fee accrual in the calculation of net performance for these accounts. Staff informs the Investment Consultant of any changes in External Portfolio Manager accounts for which an incentive fee accrual is applied. Liquid Public Markets Funds' gross and net of fee returns are the same since the base and incentive fees are deducted directly from the fund.

**e. New/Terminated Accounts**

Performance for new/terminated accounts is reflected in the performance of the asset class/total Fund at the time of funding/terminations. The performance for the new/terminated account will be shown for the full month, consistent with the performance of the benchmark. Accounts funded during the month will not show performance for the intra-month period, but will show a NAV as of month-end in the reports. Accounts that are terminated will be indicated as such; for accounts being completely liquidated during the month the report will not show performance for intra-month period of termination but will show any residual NAV balance as of month-end. Any exceptions to the rule will be fully discussed and documented in the appropriate reports. Consistent with composite return calculation as described above, partial period account performance is reflected into the performance of the composite and total Fund.

**f. Policy Benchmarks**

The Total Fund Policy Benchmark is constructed using the policy asset allocation weights and indices as specified in the System's Investment Policy Statement (IPS). On a quarterly basis, asset class weights are provided by Staff for the calculation of the System's Total Fund Policy Benchmark. The Investment Consultant verifies the provided data and updates the policy benchmark accordingly at the beginning of each quarter. The weights for the Public Markets and Private Markets policy benchmarks are determined each quarter following the calculation as specified in the IPS (Policy Index).

The Public Markets Policy Benchmark is calculated monthly, while the Private Markets Policy Benchmark is calculated quarterly due to the illiquid nature of the asset classes and frequency of the

underlying indices. The monthly-linked quarterly return of the Public Markets Policy Benchmark is used in the calculation of the quarterly performance of the Total Fund Policy Benchmark.

The Private Markets Policy Benchmark is updated *retroactively* for the past 20 quarters in order to reflect more accurate measure of changes in constituents of such benchmark. This methodology results in a restatement of Total Fund Policy Benchmark return from quarter to quarter; as a result, the return for a specific quarter may differ from the return for that quarter reported in an earlier report. Any material changes to the returns of the Total Fund Policy Benchmark as a result of this methodology are expected to be documented accordingly.

The source of returns for the Private Markets Policy Benchmark is the System's Specialty Consultants. The Specialty Consultant will review the calculations and send the returns to the Investment Consultant. Staff will review the calculation as well. Any differences or changes in the returns will be resolved between the Specialty Consultant, Staff and the Investment Consultant. This review of the indices is done quarterly, consistent with the reconciliation and review process.

#### **IV. Reconciliation Process**

##### **a. Separate Accounts**

The Investment Consultant reconciles the calculated rates of returns for Separate Accounts on a monthly basis with the Custodian Bank and Investment Managers.

External Portfolio Managers fill out the Investment Consultant provided template for monthly performance (gross and net) and market value and provide to the Investment Consultant as soon as monthly data is finalized.

The Investment Consultant reconciles monthly returns for the System's internally managed portfolios with those provided by Staff. Given the use of the same sources for inputs and similarity in the performance calculation methodology employed by Investment Consultant and Staff, it is the expectation that there will be no differences in returns as calculated by the Investment Consultant and Staff (i.e., monthly tolerance target is set at less than 1 basis point).

The Investment Consultant reconciliation performance tolerance targets on a monthly/quarterly basis are as follows:

##### **i. Externally Managed Portfolios**

###### **Monthly Flash Report**

Public equity accounts: 5 basis points

Fixed income accounts: 5 basis points

High Yield/Absolute return accounts: 5 basis points

Notional Currency return accounts: 5 basis points

### **Quarterly Total Fund Report**

Public equity accounts: 15 basis points  
Fixed income accounts: 15 basis points  
High Yield/Absolute return accounts: 15 basis points  
Notional Currency return accounts: 5 basis points

### **ii Internally Managed Portfolios**

#### **Monthly Flash Report**

The System's internally managed accounts: 1 basis point

#### **Quarterly Total Fund Report**

The System's internally managed accounts: 1 basis point

Any significant discrepancies in returns are discussed with Staff. Reasons for deviations are documented accordingly. Investment Managers will provide daily NAVs when needed to reconcile differences.

The Investment Consultant reconciles market value and performance with the Custodian Bank's Performance Reporting Group on monthly and quarterly basis. The Custodian Bank will provide a spreadsheet with NAVs and returns which the Investment Consultant will reconcile with their NAVs and returns. Any differences in these amounts will be worked out between the Custodian and Investment Consultant. Any exceptions and discrepancies deemed material will be brought to the attention of Staff. Reasons for deviations are documented accordingly.

### **b. Liquid Public Market Funds (Commingled Funds)**

The Investment Consultant reconciles the calculated rates of returns for Commingled Funds on a monthly basis with the Specialty Consultant and Staff. The Specialty Consultant will provide a spreadsheet with NAVs and returns which the Investment Consultant will reconcile with their NAVs and returns. Any differences in these amounts will be resolved between the Consultants. Any exceptions and discrepancies deemed material will be brought to the attention of Staff. Reasons for deviations are documented accordingly.

### **c. Illiquid LP Structures (Private Markets Investments)**

The Investment Consultant reconciles the calculated rates of returns for non-marketable accounts on a quarterly basis with Staff, PSERS' Private Market Team, and the Specialty Consultants. ((For more information on the process, see section II.c Illiquid LP Structures (Non-Marketable - Private Markets Investments) -Quarterly Reporting Only)).

### **d. Cash Flows**

Since the modified Dietz TWRs are sensitive to the timing and magnitude of cash flows, in instances where a cash flow is greater than 10% of an account market value and daily valuation for that

portfolio is available, the Investment Consultant applies the TWRs daily valuation method and calculates a time-weighted return by geometrically linking the sub period returns using an interim (intra month) market value (when available). For example, if the large (defined as greater than 10% of beginning market value) cash flow occurs on the 10<sup>th</sup> day of the month, the Investment Consultant calculates a TWR from the first of the month to the 10<sup>th</sup> of the month using an ending market value as of the 10<sup>th</sup> day of the month ("interim market value"). The Investment Consultant then uses that same interim market value as the beginning market value to calculate a TWR for the period of the 11<sup>th</sup> day to the end of the month. To calculate a full monthly TWR, the Investment Consultant geometrically links the two sub-period returns above. Sources for interim market value in the TWR daily valuation calculation are Staff (specifically as it pertains to internally managed/daily valued portfolios), Custodian Bank, and/or External Portfolio Managers. The Investment Consultant proactively identifies sources and dates to perform calculations.

For any cash flow where the cash is transferred out in one month and not invested into the fund until the following month (subscription/settlement date), the cash flow date on the Investment Consultant's records will be the last day of the month (with the cash flow) to minimize the impact on performance. This adjustment is necessary because the cash is not invested in the fund until the subscription date (so the cash does not start earning a return until the subscription date).

#### **V. Review and Verification Process**

1. The Investment Consultant provides initial draft of monthly/quarterly report to Staff for initial review after completing reconciliation reviews with Custodian Bank/Investment Managers/Specialty Consultants (within 23-25 business days after month end).
2. Staff distributes the initial report with a timeframe to the Internal Portfolio Managers, Investment Office Directors, and CIO for review. Staff reviews and reconciles any differences between IOS, the Custodian Bank, the Investment Consultant and Specialty Consultants (within 3 business days of receipt of initial draft report).
3. Staff notifies the Investment Consultant of any additional account restatements, terminated and new accounts, and/or changes in performance benchmarks (26-28 business days after month end).
4. Upon final reconciliation and review of reports by Staff, the Investment Consultant finalizes monthly/quarterly report and distributes to PSERS (within 28-30 business days after month end for Monthly Report and within 35-38 business days for Quarterly Report).

For more information on detailed timeline of review and verification process, see Addendum section d.

## Addendum

### a. GASB 67 Reporting

Given the reporting requirements under GASB 67, the Investment Consultant will assist Investment Accounting (IA) with the calculation of an annual money-weighted return for each fiscal year-end and a long term expected total return based on the Public School Employees' Retirement Fund's (Fund) long term Asset Allocation.

1. Money-weighted return (MWR), which is also called an internal rate of return (IRR), incorporates the size and timing of cash inflows (contributions) and outflows (withdrawals) into or out of an investment portfolio. The internal rate of return (IRR) is a money-weighted return calculation that represents the constant compounded rate of growth for all money invested in the account.

#### Calculation Formula:

$$MVE = MVB * (1+IRR) + CF_1 * (1+IRR)^1 \dots CF_N * (1+IRR)^N$$

Where:

MVB: Market value beginning

MVE: Market value ending

CF: amount of cash flow

N: weight of the CF for the period

The data requirements for IRR are beginning and end of the evaluation period valuations and all month-end external cash flows. IRR's are calculated for each period since inception (or interim periods as defined) and do not link across periods. Per requirements, inputs for an annual IRR are total Fund valuations at the beginning and end of fiscal year (period ending June 30) and monthly total Fund external cash flows.. For the purpose of the money-weighted return calculation, all external cash flows during a month are aggregated and the next external cash flow is treated as a single net in/outflow assumed to occur at the end of the month during the defined period. Per GASB 67 requirement, an annual history of total Fund annual IRRs will be built with each year (Starting for FY'2014) for a schedule of ten years.

2. Long term expected (nominal and real) return for the total Fund will be based on the target Asset Allocation of the Fund and Investment Consultant's 30 year forward-looking capital market assumptions. A description of the methodology in arriving at the long term expected return will also be provided.

### b. Onboarding

The investment structure, asset class/composite definition was established in PARis after the review and approval of PSERS staff. While the Investment Consultant received historical data for inactive/closed accounts, the investment structure as set up and established included only active accounts and composites as of June 30, 2013. However, historical data for composites was loaded in PARis to be able to report on longer period performance.

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### Sourcing Historical Data

The Investment Consultant has sourced the historical data (market values and returns) prior to June 30, 2013 for individual accounts, composites, and asset class blended policy benchmarks from the prior consultant. The historical data for Public Markets accounts and composites was provided primarily monthly in frequency, both on a net and gross of fee basis. The historical data for the total Fund and Private Markets accounts and composites was provided on a quarterly basis. Individual account and asset class benchmarks were created using the formulas and historical descriptions provided to the Investment Consultant by the prior Investment Consultant.

In the process of setting up and populating the accounts with historical data, the Investment Consultant observed several differences in longer term returns of composites and individual accounts based on the prior Investment Consultant's report vs the Investment Consultant calculated returns based on the Prior Investment Consultant's data streams. As a result, the Investment Consultant sourced the historical return data for total Fund and total Private Markets composites from the System. The return differences (between what was provided and reported) were minimal.

Since Inception Performance: PARis may also show since inception dates on non-quarter ending months (i.e. April 19xx) which yielded differences in since-inception returns given the differences in since inception dates. The Investment Consultant reported since inception date of an account and composite is based on the month of first data point.

Quarterly vs. Monthly Data Series: The historical returns for the Public Markets Blended Policy benchmark were provided on a monthly and quarterly frequency. For purposes of consistency going forward, the Investment Consultant has set up the calculation of this blended benchmark on a monthly basis to be used in both the monthly and quarterly reports as well as to roll up consistently into the calculation of the total Fund Policy benchmark.

Historical Data: The Investment Consultant was not provided with the historical returns for the following accounts: U.S. Long Treasuries Composite (levered) and PSERS Gold Fund (levered). The Investment Consultant was provided the historical data for the blended policy benchmarks for the following composites: Commodities, EM Equity, Private Market, PTRES, Public Market, US Equity, Total Equity, Total Fixed income, Total Non-US Equity, Total Plan, Total US FI, Total Real Estate, Risk Parity, and Private Equity (Thomson ONE Median). For the remainder blended benchmarks for both individual managers and asset class/composites as currently reporting on, the Investment Consultant created these blended benchmarks based on the provided historical description.

### **c. Investment Consultants**

Current Investment Consultant: Aon Hewitt Investment Consulting, f/k/a Hewitt EnnisKnupp Inc. (September 2013 to current)

Prior Investment Consultant: Wilshire Associates (prior to September 2013)

Specialty Consultants: Aksia LLC, Portfolio Advisors LLC, and Courtland Partners Ltd.

**d. Monthly/Quarterly Reporting Detailed Timeline**

<b>Task</b>	<b>Description</b>	<b>Duration of Task (bus. day)</b>
<b>Data Collection</b>	Investment Consultant downloads Custodian Bank data --- typically available online 8 calendar days after month-end (Absolute Return Funds usually updated by 24 <sup>th</sup> calendar day).	1 day
	Investment Consultant collects all available Investment Manager/administrator statements and update NAVs for High Yield, Absolute Return Funds, and other select fixed income accounts. Investment Consultant collects account balance and returns by Investment Manager and finalizes reconciliations. Investment Consultant collects fee accrual data.	5 days
<b>Accounting</b>	Investment Consultant loads Custodian Bank data into PARis and calculates all account and composite returns.	4 days
	Investment Consultant enters accruals into PARis as they are received; updates all custom benchmark returns in PARis, and completes additional calculations (ex. Risk Parity Vol Adj composites).	
<b>Reconciliation</b>	Investment Consultant completes reconciliation with Custodian Bank Performance Group: <ul style="list-style-type: none"> <li>- Investment Consultant sends preliminary accounting results to Custodian Bank.</li> <li>- Custodian Bank generates reconciliation spreadsheet comparing Investment Consultant's data to Custodian Bank's.</li> <li>- Investment Consultant investigates any discrepancies. If necessary, Investment Consultant sends Custodian Bank updated data for the completion of revised reconciliation.</li> </ul>	5 days
	Manager reconciliation process: <ul style="list-style-type: none"> <li>- Investigate any discrepancies between managers and Investment Consultant/Custodian Bank/Specialty Consultant.</li> </ul>	4 days
<b>Initial Review by the System</b>	<b>Provide initial draft for the System's review (to Krista Roessler)</b>	1 day
<b>Initial Draft Distributed to the System</b>	<b>Investment Consultant sends Initial Monthly Report to the System's team for a review (Within 23 to 25 business days after month end)</b>	

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<b>Staff Review</b>	Staff reviews and reconciles any differences between IOS, the Custodian Bank, the Investment Consultants	3 days
<b>Finalization</b>	Investment Consultant incorporates edits/changes as provided by the System	2 days
<b>Final Monthly Report to the System</b>	<b>Investment Consultant provides Final Monthly Report to the System within 26-28 business days after month end.</b>	
<b>Quarterly Reporting (Additional Tasks)</b>		
<b>Accounting</b>	<p>Investment Consultant reconciles and updates performance for HY/Absolute Return Fund accounts based on final Investment Manager/administrator statements as received throughout the prior three months</p> <p>Investment Consultant calculates performance for Private Markets investments based on data provided by the System</p> <p>Investment Consultant calculates and reconciles total Fund, Private Markets policy benchmark with Private Markets staff (<i>private benchmark data available and provided from IOS to Investment Consultant typically 45 calendar days or 32 business days after quarter end</i>)</p> <p>Investment Consultant provides initial draft for Staff review (to Krista Roessler)</p>	35 days
<b>Initial Review by Staff</b>	<b>Investment Consultant provides a draft to Staff for Initial Review</b>	1 day
<b>Finalization</b>	<b>Investment Consultant finalizes and incorporates changes</b>	1 day
<b>Final Quarterly Report to the System</b>	<p><b>Final Quarterly Report provided to PSERS within 35-38 business days after quarter end.</b></p> <p><b>Final Quarterly Performance Presentation provided within 2-3 business days after issuing Quarterly Report.</b></p>	

*Notes on Table: Please note duration of tasks shown above refers to how long it takes to complete the specific task which could also be completed in parallel (not necessarily consecutively) to other tasks.*

The Investment Consultant Performance Policy has been reviewed and accepted by the PSERS' Investment Office.

The policy shall be reviewed and signed at the end of each of fiscal year by the CIO and Senior Management.

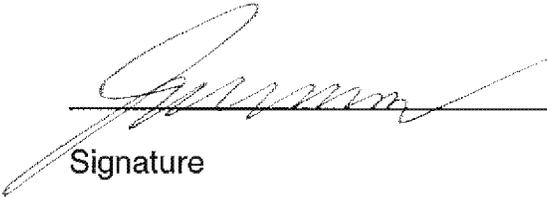
At any time throughout the fiscal year, changes or updates to the Policy shall be submitted and reviewed by the Risk Group and approved by the CIO and Senior Management.

### Pennsylvania Public School Employees' Retirement System

  
\_\_\_\_\_  
Signature Date 12/21/2016

**James H. Gressman, Jr.**  
**Chief Investment Officer**  
\_\_\_\_\_  
Type or Print Name

\_\_\_\_\_  
Title

  
\_\_\_\_\_  
Signature Date

Joseph W. Sheva  
\_\_\_\_\_  
Type or Print Name

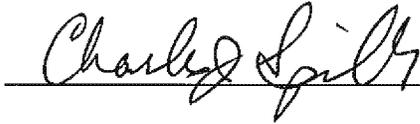
Risk manager  
\_\_\_\_\_  
Title

Amended 12/21/2016

  
\_\_\_\_\_  
Signature Date 12/21/16

Robert Devine  
\_\_\_\_\_  
Type or Print Name

Managing Director of Fixed Income  
\_\_\_\_\_  
Title

  
\_\_\_\_\_  
Signature Date

Charles J. Spiller  
\_\_\_\_\_  
Type or Print Name

Deputy CIO, Non-Traditional  
Investments  
\_\_\_\_\_  
Title

Thomas Bauer 12/21/16  
Signature Date

THOMAS BAUER  
Type or Print Name

DEPUTY CIO, TRADITIONAL INVESTMENTS  
Title

J. B. Kemp 12/21/16  
Signature Date

JOHN B KEMP  
Type or Print Name

M.D.  
Title