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Investment and Operational Due Diligence Summary

Pennsylvania Public School Employees' Retirement System

Executive Summary and Overall Assessment: Operational Review

- PSERS Board engaged Verus to provide an assessment of the operational policies, processes and procedures followed by the PSERS Investment Office (IO).
- This assessment focused on the following 12 functional areas:

Cash Processing	Operational Due Diligence	Trading: Derivatives	Information Technology
Investment Compliance	Trading: Equities	Broker and Counterparty Selection	Risk Management
Organizational Compliance	Trading: Fixed Income	Investment Accounting and Valuation	Performance Reporting

- Overall, Verus found that the Investment Office Professionals (IOPs) have generally implemented solid processes and controls that align with industry best practices.
- PSERS IO has credentialed staff with the relevant industry experience and/or tenure with the organization to provide the appropriate level of oversight and expertise to fulfill the operational responsibilities of this group.
- Verus also notes areas for improvement that could further strengthen PSERS operational policies, processes and procedures.
- Specific highlights of strengths and potential areas for improvement are provided on the following slides.

Executive Summary and Overall Assessment: Investment Due Diligence Review

- The investment due diligence assessment concentrated on four distinct asset class reviews:
 - Traditional Investments
 - Absolute Return
 - Private Credit
 - Private Equity
- Each respective PSERS IO team provided detail on a specific investment transaction from sourcing to funding.
- Overall, Verus finds that PSERS IO has implemented a thorough and consistent investment due diligence process across assets classes, and this process aligns with industry best practices.
- The investment staff demonstrated a high level of knowledge and investment expertise in their respective asset classes, and the due diligence process used by each respective team aligned to the process developed in the due diligence policy documents.
- More specific details relating to each area can be found on the following slides with summaries of strengths and areas for improvement.

Operational Review Summary

Operational review summary

Assessment Item	Strengths	Potential Areas for Improvement
Cash Processing	<ul style="list-style-type: none"> • Initiator/reviewer process for all wires has been implemented • Multiple layers of review for each capital call • Same individual cannot input and authorize the same transaction • Wire verification process to validate initial wires/changes 	<ul style="list-style-type: none"> • Consider requiring a follow up email with the manager for confirmation that the wired funds have been received and applied
Investment Compliance	<ul style="list-style-type: none"> • Third party (Constellation) was hired to assist with the development and monitoring of Board investment policies • SMAs, both external and internal, are monitored monthly for adherence to established separate account portfolio guidelines • Compliance monitoring is primarily automated through use of BlackRock Solutions risk package 	<ul style="list-style-type: none"> • Implement process and procedures for the daily monitoring of pre and post trade compliance of internally traded portfolios • More staff resources in this area may be required for enhanced trade monitoring • Compliance group's policies and procedures should be documented and adopted by the appropriate oversight group • Compliance should consider managing the restricted list instead of PM teams
Organizational Compliance	<ul style="list-style-type: none"> • Proper workplace complaint channels • Compliance training for new hires • Employees can access compliance resources, policies, and training via internet 	<ul style="list-style-type: none"> • PSERS should consider developing a more robust policy for monitoring personal securities trading • Employees should report brokerage statements and trade reports no less than quarterly • Credit checks on new hires should be considered

Operational review summary (continued)

Assessment Item	Strengths	Potential Areas for Improvement
Operational Due Diligence	<ul style="list-style-type: none"> • ODD team was created in 2019 to help strengthen due diligence efforts • Internal and external resources assist with ODD 	<ul style="list-style-type: none"> • Isolate duplicate ODD efforts from third parties to streamline process • Increase team size - team of one results in key-person risk • Develop formalized ODD procedures detailing ODD processes and expectations (currently being drafted by PSERS) • Implement own background checks instead of relying on consultant team's reports
Trading: Equities	<ul style="list-style-type: none"> • Open culture for collaboration and communication • Transactions reviewed by senior team members • Successful contingency plan implemented during pandemic 	<ul style="list-style-type: none"> • Consider implementing automated pre-trade compliance checks within the order management system ("OMS"). These help ensure each trade is within allocation guidelines • Add hard coded rules for all securities listed on the restricted list into the OMS so they cannot be inadvertently entered • Creation of a formal valuation policy for the portfolio management groups • Develop and implement formal trade error policy

Operational review summary (continued)

Assessment Item	Strengths	Potential Areas for Improvement
Trading: Fixed Income	<ul style="list-style-type: none"> • Cohesive open culture for collaboration • Successful contingency plan implemented during pandemic 	<ul style="list-style-type: none"> • Consider pre-trade compliance checks • Develop restricted list created and maintained outside of trading group • Hard-coded rules for securities on restricted list • Create formal trade error policy
Trading: Derivatives	<ul style="list-style-type: none"> • Reconciliation processes and controls for the validation of daily margin variance 	<ul style="list-style-type: none"> • Automate reconciliation and collateral management processes to improve efficiency and reduce the likelihood of a manual error • Consider engaging a third-party with specialized knowledge of derivatives trading and operations to recommend improvements to PSERS manual processes • Increase staffing • Create formal trade error policy • Save email verifications to specified locations on server
Broker and Counterparty Selection	<ul style="list-style-type: none"> • Provides an additional layer of independence in broker selection 	<ul style="list-style-type: none"> • Evaluate the need for 24 trading brokers as it makes due diligence more time consuming

Operational review summary (continued)

Assessment Item	Strengths	Potential Areas for Improvement
Investment Accounting and Valuation	<ul style="list-style-type: none"> Multi-faceted process for the valuation of private assets with contributions from four independent groups, internal and external 	<ul style="list-style-type: none"> Consider developing and implementing a formal valuation policy to provide clear roles and responsibilities during the valuation process
Information Technology	<ul style="list-style-type: none"> Following best practices by implementing Multi-Factor Authentication (MFA) protocols Mandatory cybersecurity training Formal IT policy that employees must acknowledge 	<ul style="list-style-type: none"> Periodic technology due diligence should be conducted on the custodian bank in conjunction with Treasury

Operational review summary (continued)

Assessment Item	Strengths	Potential Areas for Improvement
Risk Management	<ul style="list-style-type: none"> All investment related policies as well as staff related policies such as gifting policy, code of conduct, and disaster recovery are posted to the intranet for all staff to access Various risk reports are provided to assess portfolio risk and risk decomposition 	<ul style="list-style-type: none"> No recommendations
Performance Reporting	<ul style="list-style-type: none"> Processes and procedures well-documented and detailed with clear lines of responsibility 	<ul style="list-style-type: none"> Consider adding a dedicated senior performance professional to coordinate and reconcile all performance activity Establish more formal reconciliation process to minimize the possibility of future performance calculation errors <ul style="list-style-type: none"> Independently calculate returns through the investment book of records (IBOR) Once implemented, reconcile total fund returns with ABOR and third parties Expedite IBOR implementation Seek an independent third-party valuation source for the SIP and Currency Hedge investments Avoid retroactively modifying composite structure. Apply changes prospectively

Investment Due Diligence Summary

Investment due diligence summary

Assessment Item	Strengths	Potential Areas for Improvement
Traditional Assets	<ul style="list-style-type: none"> Quantitative analysis of portfolios focuses on several factors, including active risk, downside risk and portfolio fit Fee negotiations in this area have been successful 	<ul style="list-style-type: none"> Process is heavily weighted to bottom-up manager due diligence - incorporating a top-down view may be beneficial to the overall portfolio structure
Absolute Return	<ul style="list-style-type: none"> High level of internal research expertise Due diligence is thorough and conducted independently by PSERS and the consultant (Aksia in this case) Fee negotiations in this area have been successful 	<ul style="list-style-type: none"> Process is heavily weighted to bottom-up manager due diligence - incorporating a top-down view may be beneficial to the overall portfolio structure
Private Credit	<ul style="list-style-type: none"> High level of internal expertise Broad channel of external sourcing options, including both Aksia and Hamilton Lane These firms also assist with due diligence 	<ul style="list-style-type: none"> More staff resources in this area may be beneficial May be beneficial to incorporate broad targets at the strategy, sector/industry, and geography level to avoid overconcentration
Private Equity	<ul style="list-style-type: none"> High level of internal expertise Independent due diligence conducted by PSERS and Hamilton Lane 	<ul style="list-style-type: none"> More staff resources in this area may be beneficial