Public Pension Case Study

Presented by: RyanALM & Sage Advisory Services

October 5, 2025

Ryan ALM
Asset/Liability Management

SAGE | INVEST WITH WISDOM™

Biographies

Russ Kamp

President

Russ Kamp is the CEO of Ryan ALM, a specialist fixed-income firm focused on cash flow-driven investing (CDI) for defined benefit (DB) pension systems. With over 43 years in investment management and retirement services, Kamp has championed asset-liability matching strategies that aim to reduce funding costs and preserve pension solvency.

Before joining Ryan ALM, Kamp founded Kamp Consulting Solutions in 2011, a full-retainer consulting firm serving Taft-Hartley, private, and public DB plans, as well as endowments and high-net-worth individuals. His earlier career includes leadership roles at Invesco, where he served as CEO of the Quantitative Strategies Group, managing up to $38 billion in AUM, and as a partner at Evaluation Associates.

Kamp holds a BS in Business from Fordham University and has been deeply involved in community service, including roles on education boards, mental health foundations, and local government. He resides in Midland Park, NJ, with his wife Laurie, and they have a large family including five children and eleven grandchildren.

Sean F. McShea

Executive Vice President

Sean McShea is Executive Vice President and Director of Institutional Business at Sage Advisory. In this role, he collaborates with Sage's investment professionals to deliver investment management and liability advisory services to institutional clients. With over 25 years of experience, Sean brings a strong background in portfolio management, business development, and quantitative research.

He began his career in 1987 as a Management Consultant at Accenture, focusing on financial services. In 1993, he joined Ryan Labs Asset Management and rose to become the company's President, helping shape its strategic direction and growth in fixed-income solutions.

Sean holds an MBA from Columbia Business School with concentrations in finance and accounting, and a B.S. with Distinction in Industrial Engineering from Worcester Polytechnic Institute.

What is the investment horizon of a Pension Plan?

1. Long-Term
2. Medium-Term
3. Short-Term

What is the Top Priority of our Retirement Plan?

1. Meet the Expected Return on Assets
2. Secure The Benefit Obligations
3. Beat the Peer Group
4. Manage Liquidity

Preferred Strategy to Secure Plan Funding

Growth Strategies

To be able to equal or exceed future Liability increases

Downside Protection Strategies

To minimize/offset asset return variability and protect liquidity

Need Both Strategies

Need both strategies to take care of current employees and current retirees (including deferred vested)

Secure the promised benefits at a reasonable cost and with prudent risk

*Contrary to popular belief, it is **NOT** a return objective, which guarantees volatility of returns and not success.*

Traditional Asset Allocation?

Problem: Actuarial Funding Equation only works ex-post

$$C + \boxed{I} = B + E$$

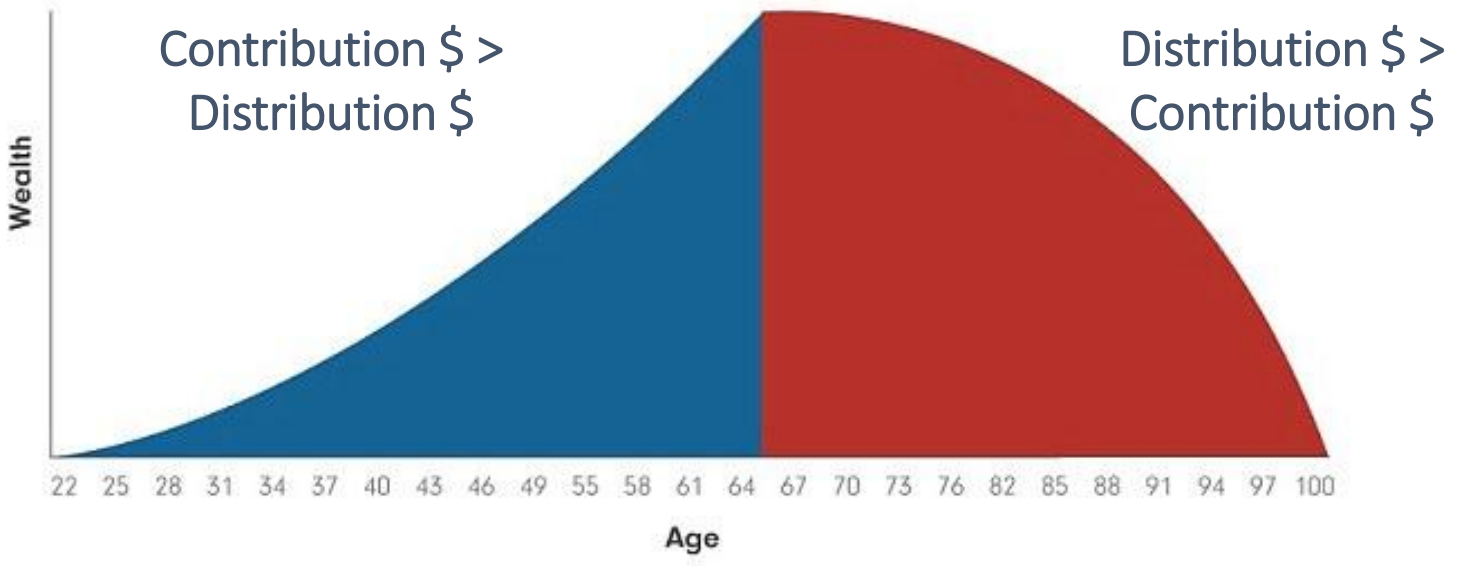
Contributions + Income = Benefits + Expenses

$$\boxed{V} = H + P$$

Cost of Vacation = Hotel Expense + Poker Losses (winnings)

The Risks can be hard to see

Accumulation vs. Decumulation : $1.00 Out | $1.00 In



Objectives During Accumulation:

- Maximize Asset Return
- Minimize Portfolio Volatility

Objectives During Decumulation:

- Maximize Certainty of Outcome

Pension Metrics & Formulas

Risk Metric	Funding Ratio	Hudson Ratio	Non-Investment Cash Flow as % of Market Value Assets (Net Cash Flow)
Formula	$\frac{\text{Assets}}{\text{Liabilities}}$	**Distribution $:Contributions $**	$\frac{\text{Net Cash Flow (C-B-E)}}{\text{Market Value Assets}}$
Purpose	Solvency Test	**Accumulation : Decumulation** $1 Out : $2 In (Green) $1 Out : $1 In (Yellow) $4 Out : $1 In (Red)	**Investment Horizon** Less than 0.5%: Long Term >0.5% to <-5.0%: Med Term Greater than -5%: Short Term

(C) = Contributions, (B) = Benefits , (E) = Expenses

Net Cash Flow as a % of Asset Market Value

Pension Plan	Pension Assets	Funding (%)	Contributions	Distributions	NCF/AMV (%)
Pension Plan J	$1,486,932,333	93%	69,537,298	105,155,273	-2%
Pension Plan M	$2,191,853,854	44%	1,724,810,316	233,761,398	68%
Pension Plan O	$697,812,937	79%	38,875,574	57,121,207	-3%
Pension Plan T	$208,355,939	82%	$8,291,400	21,108,029	-6%

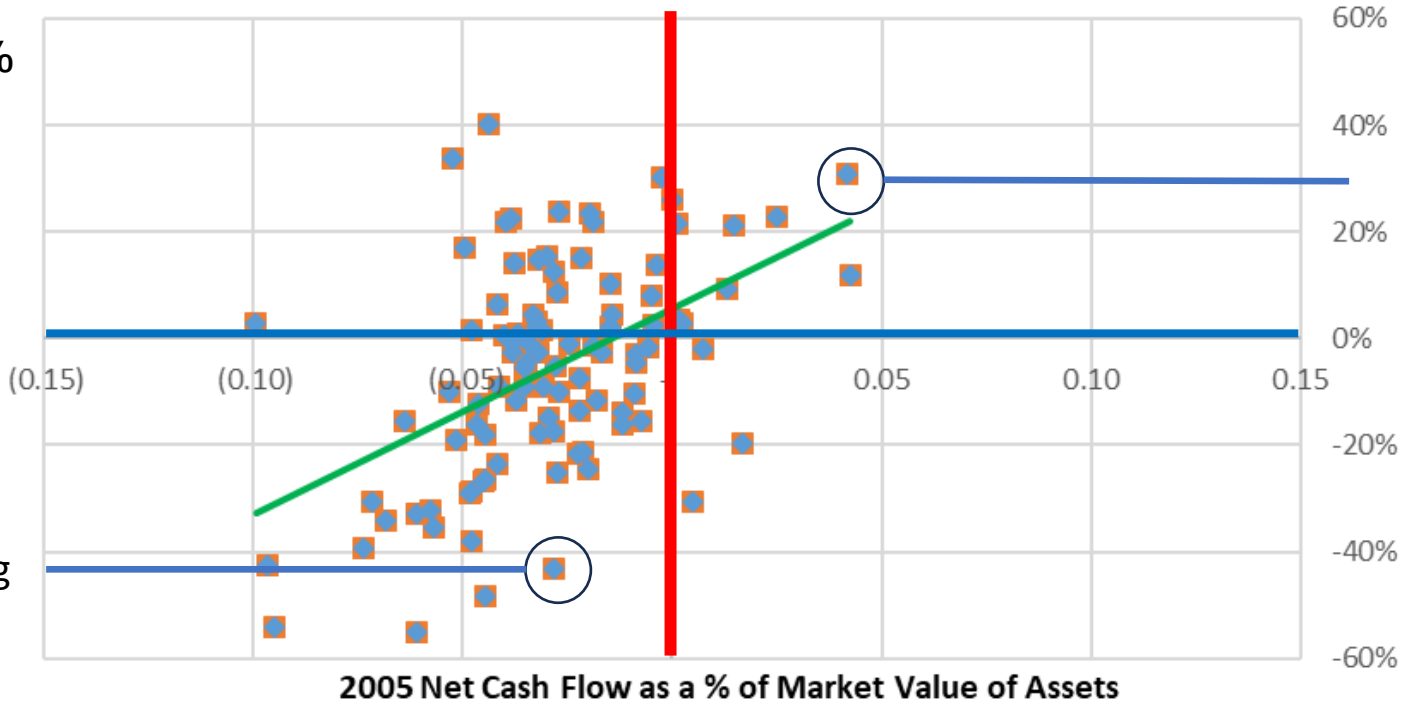
Funding Level is a snapshot in time;

Non-Investment Cash Flow as % of Market Value Assets

captures the maturity of the plan

Change in Funding Ratio from 2005 to 2020

(X-Axis)
Cash Flow %
of MVA



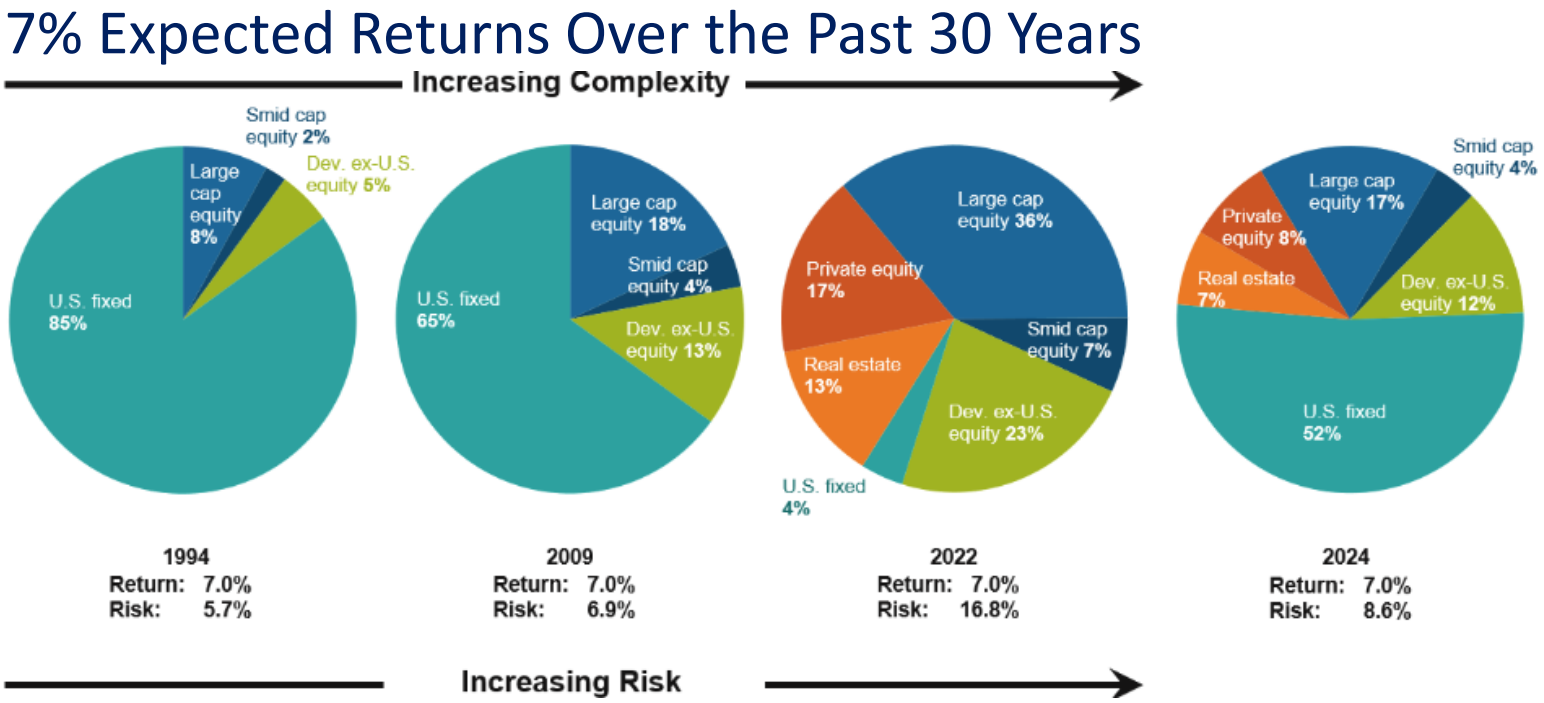
+4%
Ending
Funding
+ 30%

-3%
Ending Funding
- 42%

*Selected plans are the 100 largest multiemployer pension plans by asset size in 2005

Universe: Top 100 largest Funds

Public Pension Asset Allocation



Source: Callan

XYZ County Employees' Retirement System

Sequence of Returns

			SCENARIO 1		SCENARIO 2		SCENARIO 3	
Year	**Benefit Pmts**	**Contributions**	**Return**	**MV**	**Return**	**MV**	**Return**	**MV**
0				$ 631,452		$ 631,452		$ 631,452
1	($ 37,110)	$ 24,482	7.3%	$ 664,153	20.5%	$ 746,831	-9.3%	$ 560,586
2	($ 37,476)	$ 24,914	7.3%	$ 699,294	20.4%	$ 885,044	-6.4%	$ 512,444
3	($ 37,847)	$ 25,160	7.3%	$ 736,855	20.0%	$ 1,047,969	-10.1%	$ 448,521
4	($ 38,157)	$ 25,408	7.3%	$ 777,074	20.0%	$ 1,243,398	7.2%	$ 467,417
5	($ 38,276)	$ 25,616	7.3%	$ 820,301	13.6%	$ 1,398,854	8.2%	$ 492,494
6	($ 38,232)	$ 25,697	7.3%	$ 866,791	8.2%	$ 1,500,271	-0.5%	$ 477,440
7	($ 38,122)	$ 25,667	7.3%	$ 916,735	-0.5%	$ 1,480,078	-2.0%	$ 455,728
8	($ 37,876)	$ 25,593	7.3%	$ 970,477	7.2%	$ 1,573,267	24.5%	$ 553,661
9	($ 37,674)	$ 25,428	7.3%	$ 1,028,155	3.7%	$ 1,618,811	8.2%	$ 586,548
10	($ 37,290)	$ 25,292	7.3%	$ 1,090,271	-6.4%	$ 1,503,279	20.0%	$ 690,603
11	($ 36,736)	$ 25,034	7.3%	$ 1,157,197	13.4%	$ 1,692,437	13.6%	$ 771,969
12	($ 36,066)	$ 24,662	7.3%	$ 1,229,284	8.2%	$ 1,820,046	3.7%	$ 788,823
13	($ 35,352)	$ 24,213	7.3%	$ 1,306,871	24.5%	$ 2,253,466	7.6%	$ 837,192
14	($ 34,538)	$ 23,734	7.3%	$ 1,390,430	-2.0%	$ 2,198,497	20.0%	$ 992,618
15	($ 33,617)	$ 23,187	7.3%	$ 1,480,435	7.6%	$ 2,354,691	20.4%	$ 1,183,194
16	($ 32,658)	$ 22,568	7.3%	$ 1,577,318	-9.3%	$ 2,125,670	8.0%	$ 1,266,812
17	($ 31,627)	$ 21,925	7.3%	$ 1,681,625	1.5%	$ 2,146,817	1.5%	$ 1,275,466
18	($ 30,503)	$ 21,233	7.3%	$ 1,793,943	6.2%	$ 2,270,798	13.4%	$ 1,436,659
19	($ 29,317)	$ 20,478	7.3%	$ 1,914,850	8.0%	$ 2,442,212	20.5%	$ 1,721,001
20	($ 28,079)	$ 19,682	7.3%	$ 2,044,980	-10.1%	$ 2,186,925	6.2%	$ 1,819,395
Annualized Return			**7.25%**		**7.25%**		**7.25%**	
Annualized Volatility			**0.00%**		**10.00%**		**10.00%**	

S1 : S3 Difference: 37%

Liability Cash Flow: Accrued Liability | All amounts are in thousands of dollars

XYZ County Employees' Retirement System

Sequence of Returns Scenario: 50% Cash Match / 50% Return-Seeking

Cash Match Portfolio			Return-Seeking Portfolio						
				SCENARIO 1		SCENARIO 2		SCENARIO 3	
Year	Benefit Pmts	LDI	Net Ctbts	Return	MV	Return	MV	Return	MV
0		$ 315,726			$ 315,726		$ 315,726		$ 315,726
1	($ 37,110)	$ 294,536	$ 24,482	7.3%	$ 363,969	20.5%	$ 407,216	-9.3%	$ 309,619
2	($ 37,476)	$ 271,836	$ 24,914	7.3%	$ 416,158	20.4%	$ 517,425	-6.4%	$ 313,843
3	($ 37,847)	$ 247,541	$ 25,160	7.3%	$ 472,386	20.0%	$ 648,359	-10.1%	$ 305,911
4	($ 38,157)	$ 221,627	$ 25,408	7.3%	$ 532,947	20.0%	$ 805,737	7.2%	$ 354,101
5	($ 38,276)	$ 194,203	$ 25,616	7.3%	$ 598,114	13.6%	$ 942,520	8.2%	$ 409,718
6	($ 38,232)	$ 165,358	$ 25,697	7.3%	$ 668,089	8.2%	$ 1,046,364	-0.5%	$ 433,226
7	($ 38,122)	$ 135,080	$ 25,667	7.3%	$ 743,106	-0.5%	$ 1,066,545	-2.0%	$ 450,128
8	($ 37,876)	$ 103,434	$ 25,593	7.3%	$ 823,486	7.2%	$ 1,169,352	24.5%	$ 588,950
9	($ 37,674)	$ 70,302	$ 25,428	7.3%	$ 909,522	3.7%	$ 1,238,364	8.2%	$ 663,941
10	($ 37,290)	$ 35,790	$ 25,292	7.3%	$ 1,001,656	-6.4%	$ 1,183,329	20.0%	$ 824,306
11	($ 36,736)	($ 0)	$ 25,034	7.3%	$ 1,100,202	13.4%	$ 1,368,698	13.6%	$ 962,991
12			($ 11,404)	7.3%	$ 1,168,156	8.2%	$ 1,469,628	3.7%	$ 986,889
13			($ 11,140)	7.3%	$ 1,241,311	24.5%	$ 1,817,207	7.6%	$ 1,050,304
14			($ 10,805)	7.3%	$ 1,320,117	-2.0%	$ 1,770,809	20.0%	$ 1,248,307
15			($ 10,430)	7.3%	$ 1,405,025	7.6%	$ 1,894,512	20.4%	$ 1,490,921
16			($ 10,089)	7.3%	$ 1,496,440	-9.3%	$ 1,708,371	8.0%	$ 1,599,012
17			($ 9,703)	7.3%	$ 1,594,884	1.5%	$ 1,723,448	1.5%	$ 1,612,498
18			($ 9,270)	7.3%	$ 1,700,913	6.2%	$ 1,821,096	13.4%	$ 1,818,894
19			($ 8,839)	7.3%	$ 1,815,075	8.0%	$ 1,956,745	20.5%	$ 2,181,469
20			($ 8,397)	7.3%	$ 1,937,972	-10.1%	$ 1,750,621	6.2%	$ 2,308,505
Annualized Return				**7.25%**		**7.25%**		**7.25%**	
Annualized Volatility				**0.00%**		**10.00%**		**10.00%**	

S1 : S3 Difference: 18%

Liability Cash Flow: Accrued Liability | All amounts are in thousands of dollars

Case Study Ending August 31, 2025

LBP Summary

	ASC 715	LBP Model	Cost Savings ($ and %) *	
Future Value	**$227,580**	**$227,580**		
Present Value	**$147,168**	**$144,495**	**$83,085**	**36.51%**
YTM	**4.75%**	**5.02%**		
MDuration	**7.48**	**7.41**		
LBP Model Efficiency		**100.50%**		
Total Assets		**$146,248**		

* Cost Savings $ = FV – PV, Cost Savings % = (Cost Savings $)/ FV

Case Study: Liability Beta Portfolio Summary

	ASC 715	LBP Model
Future Value Benefits/LBP Cash Flow	**$227,580**	**$228,729**
Present Value/Market Value of Assets	**$147,167**	**$146,248**
LBP YTW/Spot Rate Weighted Yield	**4.75%**	**5.02%**
MDuration	**7.48**	**7.41**
Average Rating	**AA**	**A-**

LBP Holdings (% of LBP):

Largest Sectors		Largest Issuers		Largest Issues	
Pharmaceuticals	7.61%	US TREASURY BILL	2.70%	B 0.000% 12/26/2025	2.70%
P&C	6.45%	NUCOR CORP	1.99%	COP 5.900% 05/15/2038	1.84%
Tobacco	4.71%	PFIZER INC	1.96%	OGS 5.100% 04/01/2029	1.80%

LBP Rating Distribution *		LBP Maturity Distribution	
AAA	2.07%	0.01 - 1.00	4.08%
AA+	2.70%	1.00 - 3.00	8.29%
AA	0.00%	3.00 - 5.00	7.90%
AA-	1.38%	5.00 - 7.00	10.48%
A+	1.48%	7.00 - 10.00	16.19%
A	16.89%	10.00 - 15.00	27.30%
A-	26.08%	15.00 - 20.00	25.75%
BBB+	49.41%	20+	0.00%
BBB	0.00%		
BBB-	0.00%		

Total Benefit Payments Paid

$0

*** Composite (Moody, SP, Fitch)**

Asset/Liability Management | Cash Matched Liability Beta Portfolio

Case Study: Liability Beta Portfolio Cash Flow Summary Ending August 31, 2025

Payment Year	Cashflow Principal	Cashflow Coupon	Reinvestment Principal	Reinvestment Coupon	Total Cash Flow	Benefit Payment	Cumulative Difference
04/01/2028	1,000	1,664	2	4	2,670	3,172	722
01/01/2028	2,000	1,661	4	7	3,671	3,172	1,224
10/01/2027	1,000	1,670	0	4	2,674	3,141	725
07/01/2027	1,000	1,680	3	7	2,690	3,141	1,192
04/01/2027	1,000	1,689	0	4	2,693	3,141	1,642
01/01/2027	1,000	1,701	5	7	2,713	3,141	2,090
10/01/2026	1,000	1,704	0	4	2,708	3,157	2,517
07/01/2026	1,000	1,715	0	7	2,722	3,157	2,966
04/01/2026	1,000	1,729	0	4	2,733	3,157	3,402
01/01/2026	4,000	2,960	3	21	6,983	3,157	3,826
Cash	0	0	0	0	0	0	0
	148,400	79,605	437	286	228,727	227,580	

Final Thoughts One

- Expectations for Returns, Volatility, Correlations
  - *Connect the liabilities to the asset allocation*
- Pension funding is the primary goal
  - *Ultimate target is solvency and paying benefits*
- Modeling Actuarial Expected Return
  - *Substitute variable returns for uniform returns*
- Solvency
  - *Solvency has no time horizon*

Final Thoughts Two

- Peer Group "Comfort"
  - *Better to focus on your own liabilities*
- Rating Agency Concerns
  - *Don't make the plan a problem for the Sponsor*
- Utility of Economics
  - *Contributions, benefit management, asset allocation*

Prevailing Practice vs. Best Practice

Final Thoughts Three

	Prevailing	Best Practice
	PREVAILING PRACTISE	**BEST PRACTISE**
Plan Objective	**Return Driven (EROA)**	**Funding, then Performance**
Asset Allocation	**Assets vs. Assets**	**Assets vs Liabilities**
Performance	**Assets vs Asset Benchmarks,** **Time Weighted**	**Assets vs Liabilities,** **Custom Liability Index**
Discount Rate	**Expected Return On Assets (EROA)**	**Yield Curve on Retired Lives** **EROA on Active Lives**
Scorekeeping	**Smoothed, amortized** **Contributions as % of payroll**	**Mark to Market, Time Weighted, Dollar Weighted,**
Rebalancing	**Rule based**	**Dynamic, during up markets**

Final Thoughts Four

Dual Objectives: Fund the plan and deliver strong investment performance by aligning assets with liabilities.

Match Assets to Liabilities: Use fixed income to support retiree obligations and growth assets for active employees.

Lower Risk: Focus on reducing risk for both the plan and the plan sponsor.

Stay Sustainable: Long-term solvency and sustainability are essential for success.

Conclusion: Benefits of Cash Flow Matching

Benefits:

- Promised benefit payments are now more secure
- Glide-path to improved funded status & lower risk
- Liquidity to meet benefit payments is improved
- Growth assets have extended investing horizon
- Less volatility of the funded status
- More stable contribution costs

Assumptions and Methods

General

1. Sage Advisory Services, Ltd. Co. ("Sage") has been retained by the Client to analyze the Plan. This analysis is appropriate for the Client only.
2. The study outputs are intended to be merely informational, not guidelines for asset allocation, and as such should be used to facilitate the Client's judgment and not as a substitute for the exercise of that judgment.
3. No Statement of Actuarial Opinion or any other actuarial findings are stated or implied in this report. The results shown in this report are estimates only and may vary significantly from actual experience due to deviations from assumptions and changes in valuation methods, regulations, market conditions, etc. Due to the nature of these calculations, a range of results, potentially different from those presented in this report, could be considered reasonable.

Discount Rates

1. The I.R.C.§430(h)(2) Corporate Yield Curve (the "IRS Corporate Curve") is published by the Secretary of the Treasury every month and reflects the monthly average yields on corporate bonds rated A or higher. The Corporate Curve serves as one of the two liability discount mechanisms applicable to corporate pension plans under the Pension Protection Act (PPA). The Corporate Curve allows Sage to use the most recent market conditions to value the Plan's pension obligations.

Liability Data

1. The study relies on the liability schedules from the actuary (the "Actuary"). The liability schedules were computed on an accrued liability basis (unit credit).

Duration and Dollar Duration

1. The duration of liabilities is the sensitivity of the present value of liabilities to changes in interest rates. Specifically, it is the expected percent decrease (increase) in the present value of the liabilities given a 1% increase (decrease) in interest rates along the entire term structure of the curve used to value the liabilities. Given the origins of the duration measure as the time-weighted present value of cash flows, it is quoted in years. A similar definition applies to fixed income portfolios.
2. The dollar duration of liabilities is the dollar value of the sensitivity of the present value of liabilities to changes in interest rates. Specifically, it is the expected dollar amount decrease (increase) in the present value of the liabilities given a 1% increase (decrease) in interest rates along the entire term structure of the curve used to value the liabilities. A similar definition applies to fixed income portfolios.

Estimated Impact of Market Movements Methodology

1. The measurements of the changes in present value of liabilities and assets are calculated at an instantaneous horizon.
2. It is assumed that a parallel shift in the yield curve occurs when interest rate shift +/- 1%.
3. The movements in liability due interest rate shifts are estimated by the liabilities' effective duration and convexity. A similar approach is used to calculate the movements in the fixed income assets.

Glossary

Accumulated Benefit Obligation (ABO)
An actuarial measurement of the Plan's liabilities by considering current salary and current service. This term is often used in relation to financial accounting reports.

Corporate Bond Yield Curve (the "IRS Corporate Curve")
Published by the Secretary of the Treasury every month and reflects the month-end yields on corporate bonds rated A or higher. The IRS Curve serves as one of the two liability discount mechanisms applicable to corporate pension plans under the Pension Protection Act (PPA). The IRS Curve allows Sage to use the most recent market conditions to value the Plan's pension obligations (I.R.C.§430(h)(2)).

De-Risking Glidepath
A systematic process of reducing the Plan's risk profile as funded status improves. As the Plan's funded status meet certain "trigger points," allocation to liability-hedging assets are increased while allocation to return-seeking assets are decreased.

Discount Rate
The single equivalent rate in which the cost of future pension obligations are valued. This is synonymous to an "effective rate."

Dollar Duration
The dollar value of the sensitivity of the present value of assets or liabilities to changes in interest rates. Specifically, it is the expected dollar amount decrease (increase) in the present value given a 1% increase (decrease) in interest rates along the entire term structure of the curve.

Duration
The sensitivity of the present value of assets or liabilities to changes in interest rates. Specifically, it is the expected percent decrease (increase) in the present value given a 1% increase (decrease) in interest rates along the entire term structure of the curve. Given the origins of the duration measure as the time-weighted present value of cash flows, it is quoted in years.

Employee Benefit Obligation (EBO)
An actuarial measurement of the Plan's liabilities by considering projected salary and projected service. This is synonymous to "PVB" or "PVFB."

FTSE Pension Discount Curve
Published by FTSE Russell every month and consists of yields on US corporate bonds rated Aa as of the last business day of the month. The FTSE Curve is often used to value pension obligations under US and international accounting standards. Plan sponsors typically report the projected benefit obligation (PBO) in the accounting valuations.

Funding Volatility
The amount of variation or dispersion of a set of outcomes in the Plan's funded status, as projected 12 months from the measurement date. This is expressed as the 1 standard deviation of the set of outcomes.

Funding Yield Curve Segment Rates (the "ARP Funding Rates")
Modified by the American Rescue Plan Act of 2021, the ARP Funding Rates are used as alternative discount mechanisms to determine annual minimum required contributions (I.R.C.§430).

Glossary

Hedge Ratio
The ratio of the dollar duration of assets to the dollar duration of the liabilities; it is a measure of the fraction of liability interest rate risk (measured in dollar terms) that is hedged by the assets.

Normal Cost
Generally represents the portion of the cost of projected benefits allocated to the current plan year. This is similar to the "service cost" used in financial accounting.

Pension Protection Act (PPA)
In term of actuarial cost method, the measurement of the Plan's liabilities under PPA considers current salary and current service. This term is often used in relation to funding valuation reports.

Present Value of Liabilities
The current worth of the series of future payable amounts, adjusted for probabilities of payment and interest.

Projected Benefit Obligation (PBO)
An actuarial measurement of the Plan's liabilities by considering projected salary and current service. This term is often used in relation to financial accounting reports.

Standard Deviation
A measure of volatility. Standard deviation is a useful and widely used measure because it has the interesting characteristic that, for a normal distribution, 68% of the observations fall within +/- 1 standard deviation and 95% fall within two standard deviation. Since it is usually reasonable to suggest that distributions in finance are normal, standard deviation is a good estimate of the dispersion of returns around its average.

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