Public Employees' Retirement
Association of Colorado

Summary Review of December 31, 2023 Actuarial Valuation Results for the Division Trust Funds

Presentation to the Pension Review Subcommittee, July 26, 2024

Brad Ramirez, FSA, MAAA, FCA, EA
Vice President and Actuary

Segal

6445285 / 14923

Agenda

Comments Regarding PNYX Assumption Review (Final Draft) Report

Pension Division Trust Funds
- **Summary of Valuation Highlights**
- **Membership and Demographics**
- **Valuation Results**
- **40-Year Open Group Projections**

Signal Light Reporting

Appendix

Segal Comments Regarding
PNYX Assumption Review (Final Draft) Report – July 2024

- Process
  - Actuarial audit/review reports are typically shared (in or before the drafting stage) with the firm being audited/reviewed – this was not done with regard to this project.
    - Collaboration on any actuarial audit or review type of work
      - Encouraged by ASOPs and Actuarial Code of Conduct,
      - Common Practice by US actuaries,
      - Was detailed in the RFP for this Assumption Review project
      - Was the practice with GRS for the 2021 Assumption Review
  - Allows for corrections, deeper understanding of issues, and better recommendations
  - Draft Report was unsigned
    - Unknown if work was performed under relevant Actuarial Standards of Practice (ASOPs)

- PNYX conclusion that "Actuarial accrued liability may be 10% higher than reported" is not supported

- Buck Actuarial Audit of Segal's work not referenced
  - Presented to Board of Trustees in October 2022 by Buck LLC
  - Complete replication of December 31, 2021 valuations and review of assumptions
  - Valuations were "*reasonable, based on appropriate assumptions and methods, and the reports generally comply with the Actuarial Standards of Practice (ASOPs).*"

Segal Comments Regarding
PNYX Assumption Review (Final Draft) Report – July 2024

- PNYX references "partial (rather than full) application by Segal Group of the recommendations of the 2021 GRS report" as a source of potential losses
  - Actuarial assumptions are not simply a reflection of previous years but an attempt to predict future outcomes; a blend of past experience and future expectations is appropriate and is common practice, notwithstanding atypical circumstances
  - GRS suggestion to use 2020 and 2021 withdrawal data was considered by Board but not done for a number of reasons
    - Board has a set four-year cycle based upon the current governance policies
    - 2020 and 2021 data was likely to be extraordinary and of limited value in predicting future experience
  - Buck's audit conclusion: *In our opinion, the methodologies used to recommend demographic assumptions (e.g., future rates of mortality, mortality improvement, retirement, and termination of employment) comply with the guidance provided in ASOP 35, and the conclusions drawn concerning these assumptions were appropriate based on the information provided in the experience study.*
  - Segal is currently performing an actuarial experience study for PERA covering all assumptions

Segal Comments Regarding
PNYX Assumption Review (Final Draft) Report – July 2024

- PNYX recommends a "Wealth Fund" for contributions made outside of the System
  - Uncommon in the US state public sector space for a number for reasons:
    - Assets maintained outside of the fund would not be trust-protected
    - Using separate funds with different allocations could work against the overall risk/return balance
    - A new allocation philosophy could simply be applied to a portion of the current fund

- PNYX report stresses $2.7 billion of "shortfall" due to actuarial losses
  - $2.5 billion of this amount is related to new entrants and salary increases being larger than expected
  - Both of these liability increases were accompanied by additional contributions, so the effect on the overall unfunded liability was significantly reduced, if not offset completely

Division Trust Fund Valuations
Key Findings and Take-Aways

- 2023 Investment Rate of Return
  - Market Value
  - Actuarial Value (smoothed asset value)
  - Review of Deferred Asset Gains

- Progress on Paying Off Unfunded Actuarial Accrued Liability (UAAL)
  - Any changes in plan provisions or assumptions
  - Understanding the Gain/Loss Analysis

- Funding Periods – Why they've changed
  - Valuation (or Closed-Group) Basis
  - Projected (or Open-Group) Basis

- Actuarially Determined Contribution (ADC) and how it compares to the Statutory Rates
  - 2023 AAP Assessment

- Membership Changes/Shifts during 2023

Summary of Valuation Highlights – Pension

- **Asset Return**
  - **Market value of assets** returned approximately **13.4%** for the year ended December 31, 2023
  - Gradual recognition of deferred gains and losses resulted in a **6.5%** return on **actuarial value of assets**, compared to 7.25% expected

- **Effective Amortization Periods**

Trust Fund	December 31, 2023	December 31, 2022	Change
State Division	18 years	20 years	−2
School Division	23 years	24 years	−1
Local Government Division	8 years	9 years	−1
Judicial Division	5 years	6 years	−1
DPS Division*	6 years	7 years	−1

- **Funded Percentage**

Trust Fund	December 31, 2023	December 31, 2022	Change
State Division	66.2%	66.5%	−0.3%
School Division	66.7%	67.0%	−0.3%
Local Government Division	90.7%	91.0%	−0.3%
Judicial Division	89.2%	88.5%	+0.7%
DPS Division	89.6%	90.3%	−0.7%

> Despite the double-digit investment return during 2023, the asset smoothing method defers a portion of this gain while continuing to recognize prior losses, which results in valuation metrics that have remained relatively unchanged from the prior valuation.

*   Resulting amortization period assumes declining PCOP offset rate as described in statute.

✶ **Segal**

Summary of Valuation Highlights – Pension

- **Actuarially Determined Contribution Rates**

Trust Fund	December 31, 2023 (ADC for 2025)	December 31, 2022 (ADC for 2024)	Change
State Division	18.78%	19.77%	**−0.99%**
School Division	20.49%	20.58%	**−0.09%**
Local Government Division	8.22%	8.28%	**−0.06%**
Judicial Division	12.20%	12.78%	**−0.58%**
DPS Division	6.08%	6.04%	**+0.04%**

- **Unfunded Actuarial Accrued Liability (UAAL)**

  - The actuarial accrued liability (AAL) increased from $87.2 billion (as of December 31, 2022) to $90.5 billion (as of December 31, 2023)

  - The **UAAL** increased from $26.3 billion to **$27.5 billion**
    - $1.2 billion increase includes an expected decrease of $0.4, offset by $0.4 billion loss from investments and $1.2 billion loss from demographic experience

- **AAP Test**

  - The Automatic Adjustment Provision (AAP) assessment of SB 18-200, performed as of December 31, 2023, yields a **test ratio of 107%** and does not indicate the need to modify contribution rates or the AI cap beginning July 1, 2025.

Membership (Pension) – Actives

Item	State Division General	State Division Safety Officers	School Division	Local Government Division General	Local Government Division Safety Officers	Judicial Division	Denver Public Schools Division
Number (2023)	50,738	2,949	131,188	12,651	49	347	15,626
Number (2022)	48,820	2,072	128,057	12,071	32	340	15,254
% change	+3.9%	+42.3%	+2.4%	+4.8%	+53.1%	+2.1%	+2.4%
Avg. pay (2023)	$65,771	$81,082	$47,083	$66,345	$84,209	$174,657	$57,228
Avg. pay (2022)	$61,864	$79,043	$44,279	$62,784	$75,023	$166,369	$53,127
% change	+6.3%	+2.6%	+6.3%	+5.7%	+12.2%	+5.0%	+7.7%
Avg. age (2023)	45.3	35.3	44.5	44.4	37.2	53.1	41.2
Avg. age (2022)	45.5	36.3	44.5	43.9	37.1	53.3	41.1
Change	−0.2	−1.0	0.0	+0.5	+0.1	−0.2	+0.1
Avg. service (2023)	9.1	4.8	8.9	7.7	1.9	11.6	7.7
Avg. service (2022)	9.2	5.6	9.0	7.8	2.1	11.9	7.6
Change	−0.1	−0.8	−0.1	−0.1	−0.2	−0.3	+0.1

Total active membership increased year-over-year*, with increases of varying degrees across all Divisions (including nearly +5% from Local Government Division).

* 213,548 total actives in 2023 compared to 206,646 in 2022.

★ Segal

Membership (Pension) – Retirees and Survivors

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
Number (2023)	44,517	77,165	9,095	460	7,316
Number (2022)	43,860	75,094	8,829	446	7,256
% change	+1.5%	+2.8%	+3.0%	+3.1%	+0.8%
Avg. annual benefit (2023)	$41,152	$36,931	$38,761	$77,844	$39,275
Avg. annual benefit (2022)	$40,909	$36,798	$38,530	$76,355	$39,250
% change	+0.6%	+0.4%	+0.6%	+2.0%	+0.1%
Avg. age (2023)	73.0	72.7	71.3	75.4	75.1
Avg. age (2022)	72.6	72.4	70.9	75.2	74.9
Change	+0.4	+0.3	+0.4	+0.2	+0.2

Total retiree and survivor membership increased by 2.3%*, with the average benefit amount increasing by approximately 0.4%.

* From 135,485 in 2022 to 138,553 in 2023.

Assets – Pension Division Trust Funds

- The market value of assets for all Funds combined increased from $54.7 billion (as of December 31, 2022) to **$60.0 billion** (as of December 31, 2023)
  - The investment return was approximately **13.4%**, net of investment expenses

- The actuarial value of assets – which smooths investment gains and losses over four years – increased from $60.9 billion (as of December 31, 2022) to **$62.9 billion** (as of December 31, 2023)
  - Return of **6.5%**, net of investment expenses
  - Actuarial value is **104.9% of market value**
  - There is a total of **$2.9 billion of deferred investment losses** that will be recognized in future years

- The annualized returns are:

Time Horizon	Market Value	Actuarial Value
Past 5 Years	10.0%	10.3%
Past 10 Years	7.8%	9.0%
Past 15 Years	9.2%	7.5%
Past 20 Years	7.7%	7.4%
Past 30 Years	8.2%	8.2%

Annualized returns over various historical periods have exceeded the current 7.25% assumption on both a market value and actuarial value basis.

Segal 11

UAAL – Pension Division Trust Funds ($ in millions)

- The following graph shows a reconciliation of the $1,258.3M increase in UAAL from 2022 to 2023
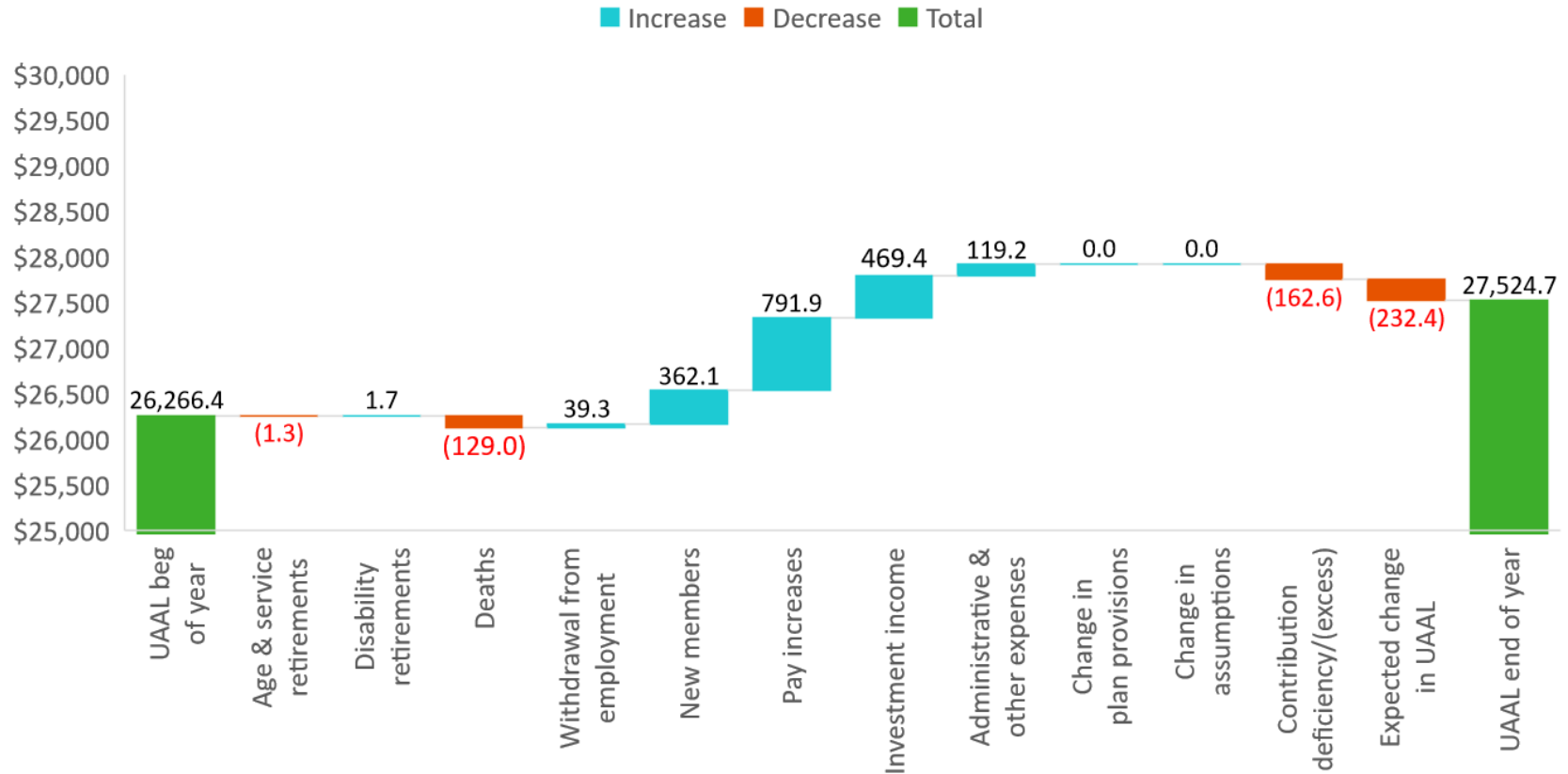
The largest sources of increase were from pay increases that were larger than assumed and recognition of prior investment losses.

UAAL History – Pension ($ in millions)
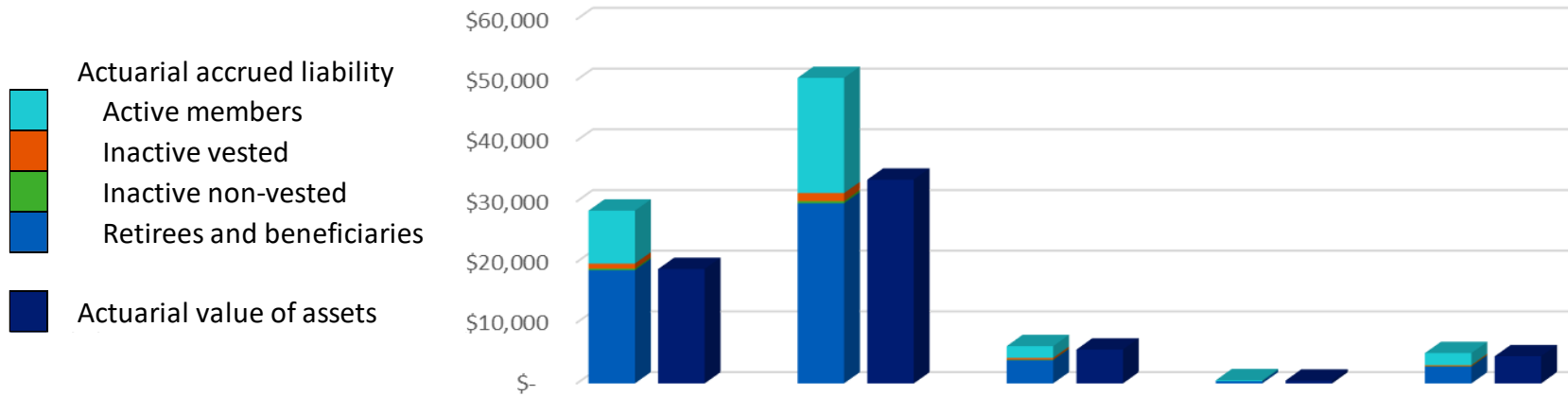
- The following graph shows a reconciliation of the $28,984.4 million increase in UAAL from 2001 to present
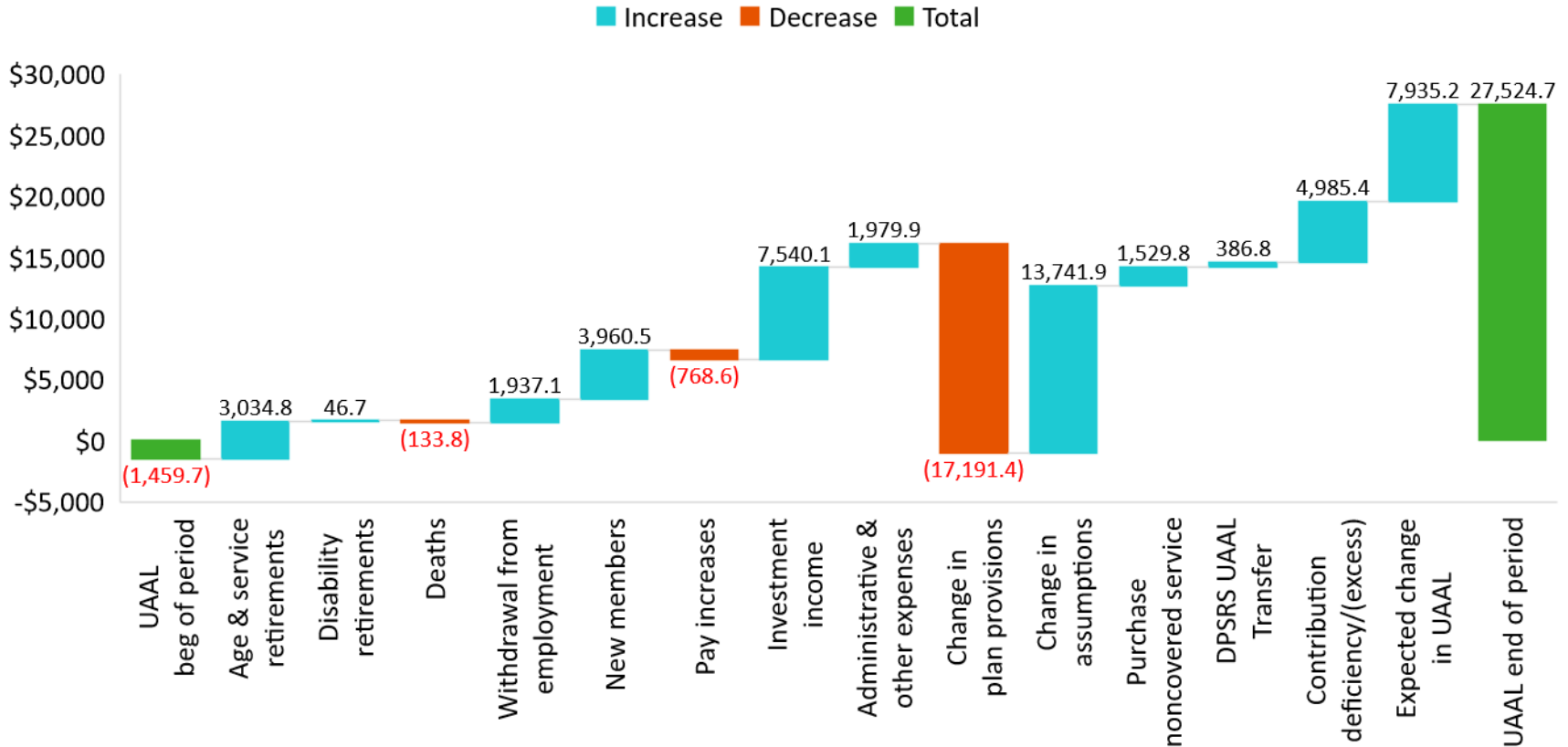
Changes in plan provisions (including decreases to the AI cap from AAP) account for the largest source of decrease in UAAL since a surplus position existed in 2001.

Valuation Results – Pension ($ in millions)

	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
Actuarial accrued liability	$28,461	$50,331	$6,148	$528	$4,997	$90,466
Actuarial value of assets	18,852	33,565	5,576	471	4,476	62,941
Unfunded actuarial accrued liability	**$9,609**	**$16,766**	**$572**	**$57**	**$521**	**$27,525**
Funded ratio	**66.2%**	**66.7%**	**90.7%**	**89.2%**	**89.6%**	**69.6%**
(Prior year)	*66.5%*	*67.0%*	*91.0%*	*88.5%*	*90.3%*	*69.9%*

Actuarial accrued liability
- Active members
- Inactive vested
- Inactive non-vested
- Retirees and beneficiaries

Actuarial value of assets

The actuarial accrued liability for School Division and State Division represents 56% and 31% of PERA's total accrued liability, respectively.

Due to rounding, values shown here may not sum as expected

Valuation Results – Actuarially Determined Contribution Rate – Pension

For the Fiscal Year Ending December 31, 2025

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
A. Actuarially determined contribution rate	18.78%	20.49%	8.22%	12.20%	6.08%
B. DB employer statutory rate*	19.83%	19.74%	12.95%	23.23%	9.94%
(Deficiency)/Excess (B − A)	1.05%	(0.75%)	4.73%	11.03%	3.86%
(Prior year)	0.06%	(0.81%)	4.69%	10.48%	2.84%

Legend:
- Actuarially determined rate
- DB employer statutory rate
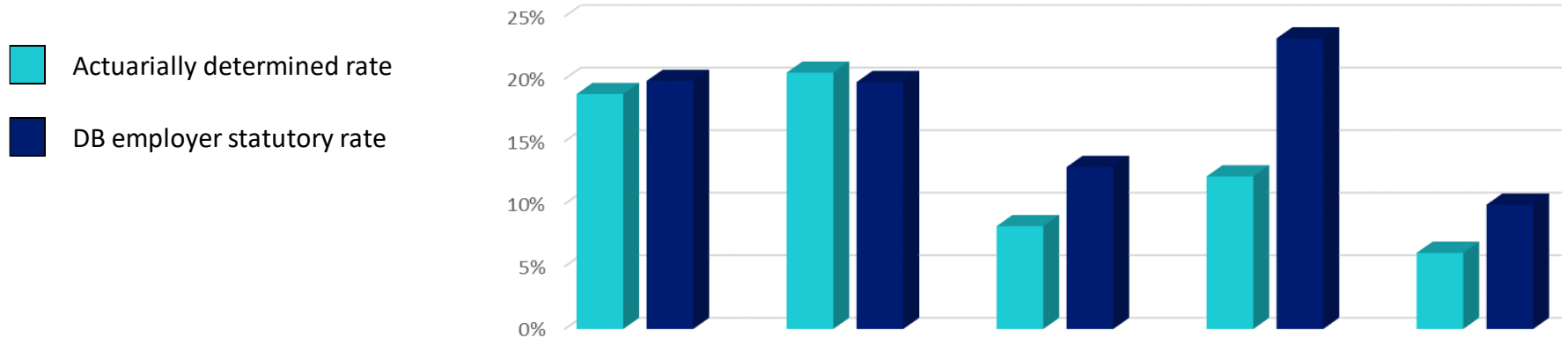
The Actuarially Determined Contribution (ADC) Rate is used in the AAP test, so it is important that the DB employer statutory rate be sufficiently close to (or exceed) the ADC rate.

* Does not include the DC Supplement Rate of 0.23% and 0.11% for the State and Local Government Divisions, respectively.

Automatic Adjustment Provision Summary

- The Automatic Adjustment Provision (AAP) is intended to keep PERA on track to achieve full funding in 30 years (from December 31, 2017)

- The following four components adjust automatically if PERA is ahead or behind the 30-year schedule:

Component	AAP Ratio < 98%	AAP Ratio > 120%	AAP Ratio:
Maximum AI rate ("AI cap")	Decrease by up to 0.25% in one year, not to fall below 0.5%	Increase by up to 0.25% in one year, not to exceed 2%	Ratio of the Blended Total Contribution Rate to the Blended Total Required Contribution
Employer contribution rates	Increase by up to 0.5% in one year, not to exceed an additional 2%	Decrease by up to 0.5% in one year, not to fall below 2018 levels	
Member contribution rates	Increase by up to 0.5% in one year, not to exceed an additional 2%	Decrease by up to 0.5% in one year, not to fall below 2018 levels	
Direct distribution from the State	Increase by up to $20 million in one year, not to exceed $225 million	Decrease by up to $20 million in one year	

Valuation Results – Automatic Adjustment Provision

- Automatic changes are triggered when the ratio of the Blended Total Contribution Rate to the Blended Total Required Contribution is less than 98% (or greater than 120%)
  - As of December 31, 2023, this ratio is equal to **106.52%**
  - No changes to contribution rates or the AI cap are required effective July 1, 2025

	Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total Weighted Average
1	Unfunded actuarial accrued liability as of December 31, 2023 ($ in millions)	$9,608.8	$16,766.1	$571.8	$57.3	$520.7	$27,524.7
2	Member contribution rate	11.14%	11.00%	9.02%	11.00%	11.00%	11.01%
3	Employer contribution rate*	20.06%	19.74%	13.06%	23.23%	9.94%	19.53%
4	Actuarially determined employer contribution rate	18.78%	20.49%	8.22%	12.20%	6.08%	19.35%
5	Direct distribution rate						1.80%
6	Blended total contribution rate: **2 + 3 + 5**						32.34%
7	Blended total required contribution: **2 + 4**						30.36%
8	Ratio of blended total contribution rate to blended total required contribution: **6 ÷ 7**						**106.52%**

* Includes the DC Supplement Rate of 0.23% and 0.11% for the State and Local Government Divisions, respectively.

40-Year Projections – Pension – Projected Years Until 100% Funded

Division Trust Fund	December 31, 2023	December 31, 2022	Change
State Division	23 Years	32 Years	−9
School Division	27 Years	34 Years	−7
Local Government Division	14 Years	23 Years	−9
Judicial Division	8 Years	12 Years	−4
DPS Division	9 Years	13 Years	−4

- Based on the 2023 valuation projections, fully funding the actuarial accrued liability under the PERA revised benefit structure created by SB 18-200 is achievable within a projection period of 27 years.

- Does not reflect any changes to AI cap and contribution rates from potential future AAP adjustments beyond those known as of the valuation date.

The open group projections reflect the full impact of 2023 investment gains over time, which mitigate the delay in the number of years until 100% funding is reached caused by the investment losses from 2022.

Signal Light Reporting

- **Long-Term View**
  - Determines the likelihood of achieving certain full funding targets (Signal Lights) based upon:
    - The 30-year capital market assumptions, provided by the Board's investment consultants in the Asset-Liability Study Follow-Up presentation (September 2019)
    - Sensitivity around other non-investment experience such as demographic gains and losses and increases in total payroll that are more or less than assumed
  - Uses **stochastic methodology** to model Signal Light scenarios

- **Short-Term View**
  - The near-term returns (and the order of those returns) could be impactful to funding progress
    - One-Year: Provides conditions necessary, within a one-year period, that would trigger an AAP assessment failure and thus AAP adjustments (increase contributions and decrease AI cap)
    - Ten-Year: Provides 10-year projection graphs, under a baseline and other economic scenarios, of the likelihood of triggering the AAP adjustments in either direction (i.e., the 98% and 120% thresholds for the AAP test)

Signal Light Definitions – Long-Term View

Status	Definition
Dark Green	100% funded by 2041 (30 years from 2011)
Green	100% funded by 2048 (30 years from 2018)
Light Yellow	100% funded by 2058 (40 years from 2018)
Yellow	100% funded by 2068 (50 years from 2018)
Orange	Solvent but longer than 50 years to reach 100% funded
Red	Insolvent after 2043 (after 20 years)
Dark Red	Insolvent by 2043 (within 20 years)

Signal Light Updates for 2024

- Current Signal Light Reporting (Signal Light 2.0) assumes no future AAP adjustments beyond those known as of the valuation date
  - "Optimistic" scenarios never trigger possible adjustments (contribution decreases and AI cap increases)
  - "Pessimistic" scenarios do not reflect remaining two available adjustments (contribution increases and AI cap decreases)
- Newest iteration (Signal Light 3.0) **dynamically reflects future AAP triggers based on projected ratio tests**

State Division – Signal Light 2.0

Status	Definition	# of Scenarios Meeting *	Probability of Meeting	
Dark Green	100% funded by 2041 (30 years from 2011)	1,884	38%	50%
Green	100% funded by 2048 (30 years from 2018)	608	12%	
Light Yellow	**100% funded by 2058 (40 years from 2018)**	**572**	**11%**	41%
Yellow	100% funded by 2068 (50 years from 2018)	395	8%	
Orange	Solvent but longer than 50 years to reach 100% funded	1,087	22%	
Red	Insolvent after 2043 (after 20 years)	381	8%	9%
Dark Red	Insolvent by 2043 (within 20 years)	73	1%	

| 38% | 12% | 11% | 8% | 22% | 8% |
| 1% |

State Division – Signal Light 3.0

Status	Definition	# of Scenarios Meeting *	Probability of Meeting	
Dark Green	100% funded by 2041 (30 years from 2011)	1,484	30%	43%
Green	100% funded by 2048 (30 years from 2018)	644	13%	
Light Yellow	**100% funded by 2058 (40 years from 2018)**	**654**	**13%**	54%
Yellow	100% funded by 2068 (50 years from 2018)	555	11%	
Orange	Solvent but longer than 50 years to reach 100% funded	1,499	30%	
Red	Insolvent after 2043 (after 20 years)	140	3%	3%
Dark Red	Insolvent by 2043 (within 20 years)	24	0%	

| 30% | 13% | 13% | 11% | 30% | 3% |

* Based on 5,000 simulations of investment portfolio returns only; does not reflect non-investment experience

✦ **Segal**

Signal Light 3.0 – State Division Illustrations

- In the "valuation" (i.e., Signal Light 2.0) baseline, the State Division reaches 100% funded in 23 years (2046)

- Under Signal Light 3.0, the <98% AAP is expected to be triggered in 2035 and 2044, which advances when the State Division reaches 100% funded by 1 year (2045)
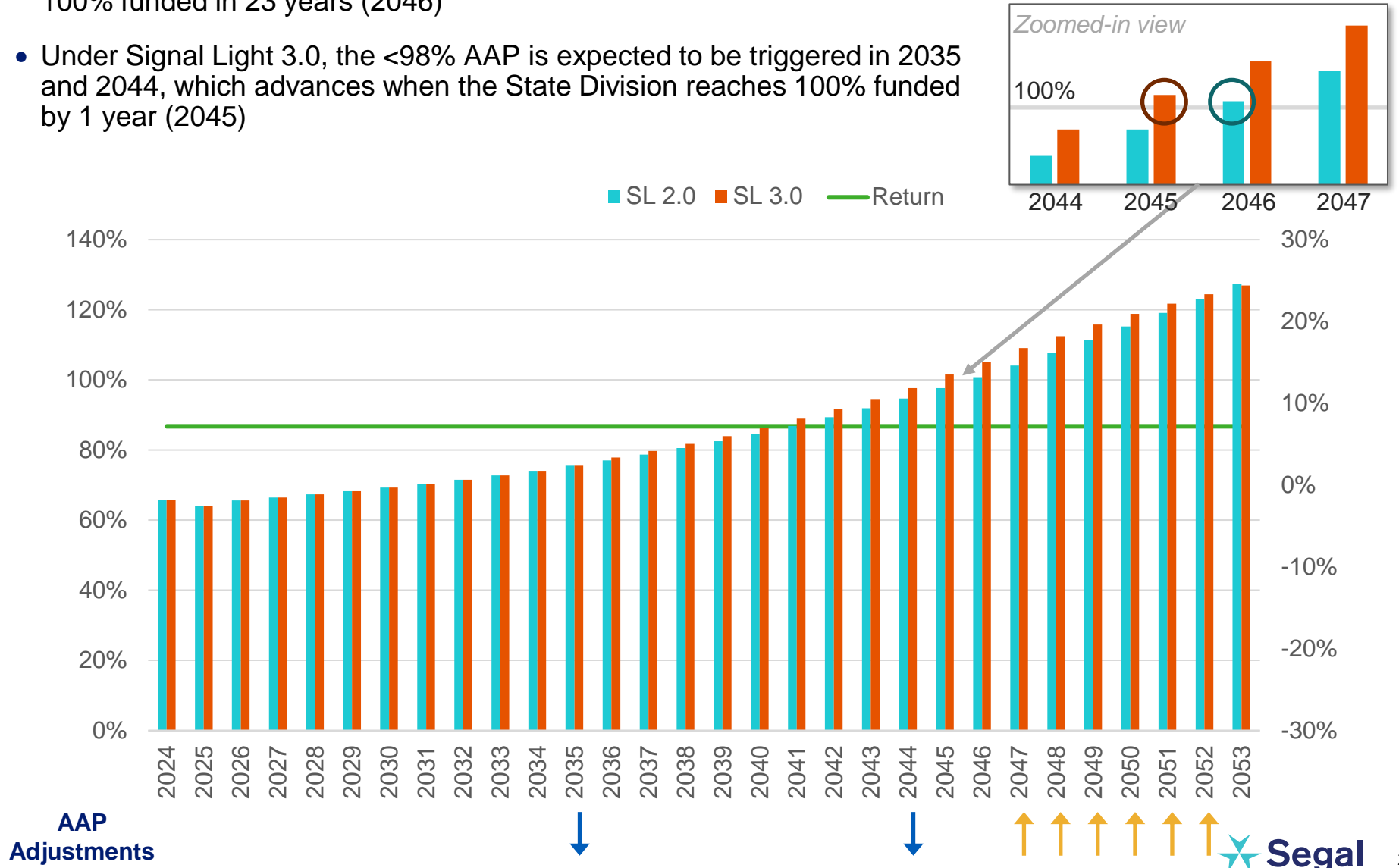
Signal Light 3.0 – State Division Illustrations

- Under Signal Light 2.0 in a "pessimistic" trial, where investment returns average 2.4% over the first ten years, the State Division funded percentage is projected to decline to 30% and struggle to recover

- Under Signal Light 3.0 in the same "pessimistic" trial, two consecutive <98% AAP triggers occur almost immediately, which yield a 39-percentage point improvement in projected funded percentage in 30 years (85% compared to 46%)


AAP Adjustments
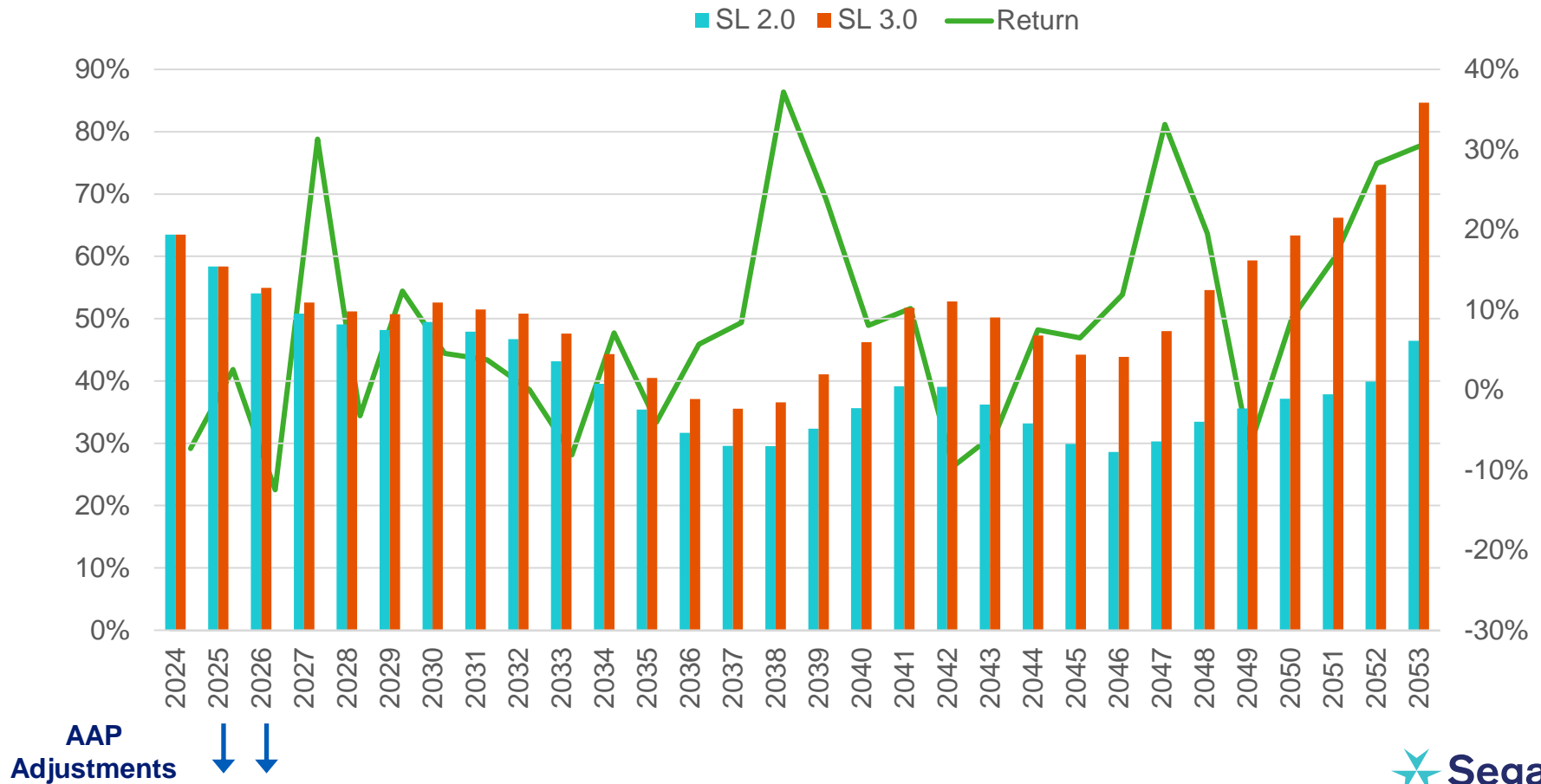
Signal Light 3.0 – State Division Illustrations

- Under Signal Light 2.0 in an "optimistic" trial, where investment returns average 9.2% over the first 25 years, the State Division funded percentage is smash 100% and continue to climb

- Under Signal Light 3.0 in the same "optimistic" trial, multiple >120% AAP triggers occur during the first 15 years, which dial back contribution rates and increase the AI cap while still being on track to meet PERA's funding goals
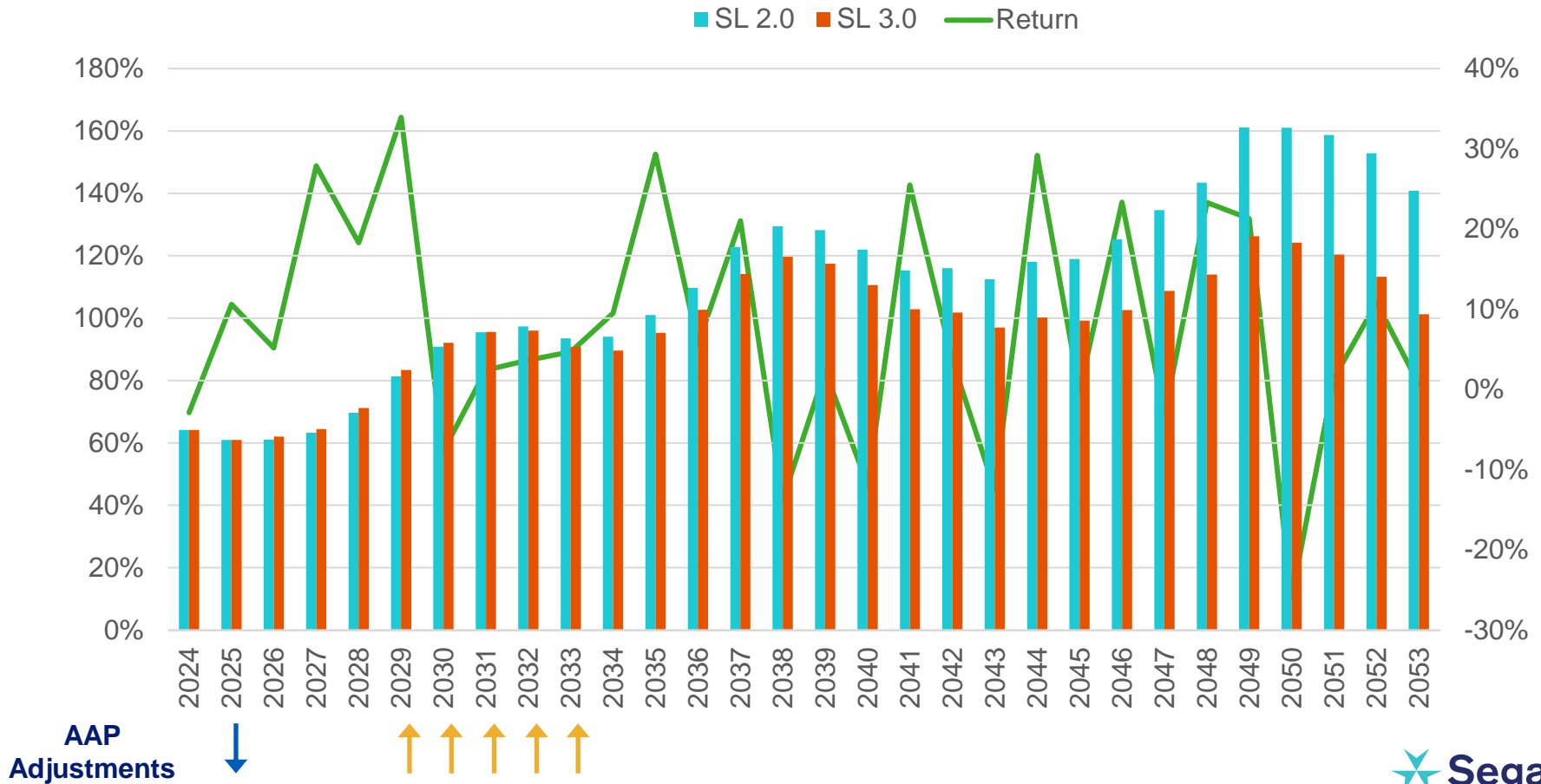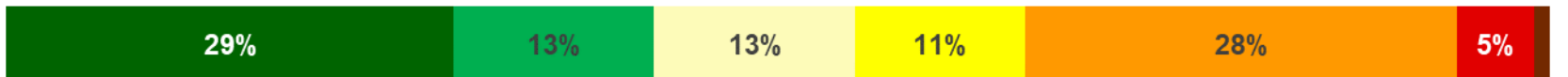
Signal Light Results – Long-Term View

State Division
Stochastic Modeling of Investment Return – Open Group Projection Basis
Assumes Active Membership Grows by 0.25% per Year – Based on All Assumptions*

Status	Definition	# of Scenarios Meeting **	Probability of Meeting	
Dark Green	100% funded by 2041 (30 years from 2011)	1,473	29%	42%
Green	100% funded by 2048 (30 years from 2018)	652	13%	
Light Yellow	**100% funded by 2058 (40 years from 2018)**	**637**	**13%**	52%
Yellow	100% funded by 2068 (50 years from 2018)	530	11%	
Orange	Solvent but longer than 50 years to reach 100% funded	1,411	28%	
Red	Insolvent after 2043 (after 20 years)	256	5%	6%
Dark Red	Insolvent by 2043 (within 20 years)	41	1%	

29%	13%	13%	11%	28%	5%

53%

1%

*   Investment return, demographic gain/loss, total payroll growth; all stochastically simulated independent from one another
** Based on 5,000 simulations

Segal

25

Signal Light Results – Long-Term View

School Division

Stochastic Modeling of Investment Return – Open Group Projection Basis
Assumes Active Membership Grows by 1.00% per Year – Based on All Assumptions*

Status	Definition	# of Scenarios Meeting **	Probability of Meeting	
Dark Green	100% funded by 2041 (30 years from 2011)	1,225	25%	36%
Green	100% funded by 2048 (30 years from 2018)	548	11%	
Light Yellow	100% funded by 2058 (40 years from 2018)	551	11%	56%
Yellow	**100% funded by 2068 (50 years from 2018)**	**495**	**10%**	
Orange	Solvent but longer than 50 years to reach 100% funded	1,762	35%	
Red	Insolvent after 2043 (after 20 years)	386	7%	8%
Dark Red	Insolvent by 2043 (within 20 years)	33	1%	

25%	11%	11%	10%	35%	7%

1%

53%

* Investment return, demographic gain/loss, total payroll growth; all stochastically simulated independent from one another
** Based on 5,000 simulations

Segal

26

Signal Light Results – Projected Years Until 100% Funded

Division Trust Fund	"Valuation Basis" December 31, 2023	"Signal Light 3.0" December 31, 2023	Difference
State Division	23 Years	22 Years	−1
School Division	27 Years	26 Years*	−1
Local Government Division	14 Years	11 Years	−3
Judicial Division	8 Years	8 Years	--
DPS Division	9 Years	9 Years	--

- If all assumptions emerge as expected, a "<98%" AAP test trigger is expected in Year 2035 (12 years after the current valuation) and again in Year 2044

- In Year 2047 – once the legacy UAL base is fully amortized and all Divisions Trust Funds are 100% funded – a series of consecutive ">120%" AAP tests trigger, which dial back contribution rates and increase the AI cap

Signal Light 3.0 generates an alternate "baseline" projection of the number of years until 100% funded, which contemplates changes from future AAP triggers.

* Projected to be 99.94% in 25 years

Summary of Results – Long-Term View

- The number of years to reach full funding has decreased due to favorable investment returns in 2023

- Division Trust Funds have an aggregate funded ratio of **69.6%** based on Actuarial Value of Assets as of December 31, 2023, which remains essentially unchanged from last year
  - Deferred assets losses of **$2.9 billion** will be recognized in future years

- Based on modeling all assumptions, two Division Trust Funds are not expected to reach full funding by 2048 (within 30 years of 2018) with 50% probability

Signal Light Status – Based on All Assumptions*

Division	December 31, 2023	December 31, 2022
State	Light Yellow	Yellow
School	Yellow	Yellow
Local Government	Green	Light Yellow
Judicial	Dark Green	Dark Green
DPS	Dark Green	Dark Green

* Investment return, demographic gain/loss, total payroll growth; all stochastically simulated independent from one another

28

Signal Light Results – Short-Term View

ONE-YEAR ANALYSIS

- The one-year projection of the AAP ratio can be modeled with three key variables for experience during the year:
  - Market value investment return for the year – baseline assumption is 7.25%
  - Increase in total payroll for the year – baseline assumption is 3.00%
  - Level of demographic gain/loss for the year – baseline assumption is 0.00%

- By rolling forward the December 31, 2023, actuarial valuation results and relying on the baseline assumptions outlined above for experience during 2024, the expected AAP ratio as of December 31, 2024, is 104.4%.

Variable	AAP Ratio of 98% or Less	AAP Ratio of 120% or More
Market value investment return	Worse than −23.5%	Better than 70.2%
Year-over-year change in total payroll	Lower than 8.1% decrease	Higher than 35.0% increase
Demographic experience	More than 4.7% loss	More than 9.5% gain

For context, only one time has any variable outlined above occurred in a single year in the last 30 years and that was a −26.0% market value investment return in 2008.
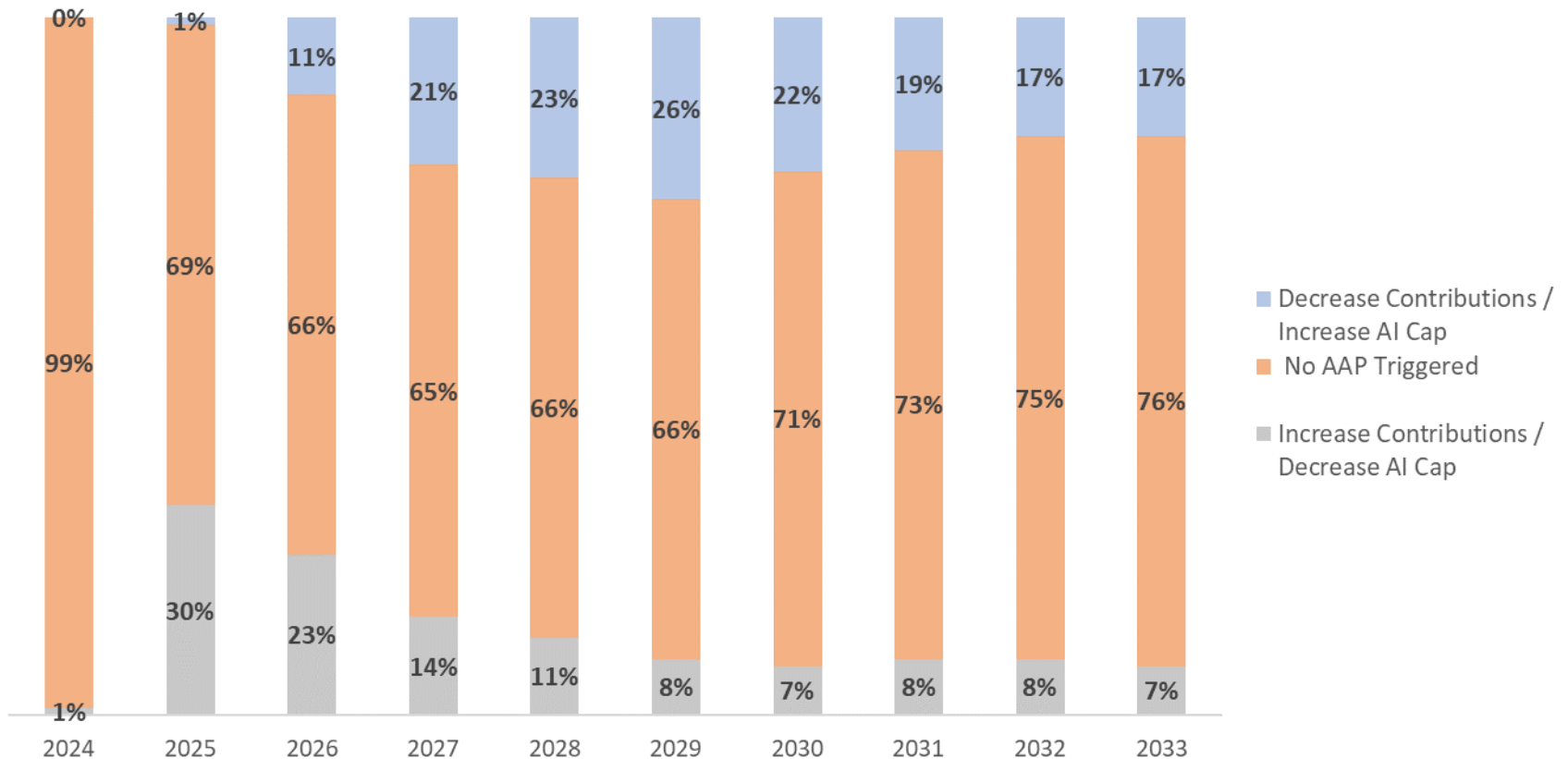
Signal Light Results – Short-Term View

TEN-YEAR ANALYSIS

- Using the 5,000 stochastically modeled investment return simulations and the baseline open group liability projection results

- Projecting the probability in each year of the AAP test triggering contribution increases and a reduction in the AI cap (from an AAP ratio exceeding 120%) or triggering contribution decreases and an increase in the AI cap (from an AAP ratio below 98%)

- The probabilities shown in any one year consider the impact of any potential AAP changes that may have triggered in any prior

  - For example, as shown on the next slide, the 23% probability of triggering the 98% (lower) boundary of the AAP assessment in the 2026 valuation year considers that 30% of trials triggered an AAP adjustment increasing contributions and lowering the AI cap in the prior valuation year

Signal Light Results – 10-Year Short-Term View

Likelihood of Triggering Automatic Adjustment Provision
Baseline Liability Forecast

As the remining 2022 investment loss is reflected over the next two years, the probability of triggering a "<98%" AAP adjustment diminishes while the probability of triggering a ">120" AAP begins to increase.

Signal Light Results – 10-Year Short-Term View

Likelihood of Triggering Automatic Adjustment Provision

Baseline Liability Forecast Reflecting a −5.75% Investment Return for 2024

Legend:
- ■ Increase Contributions / Decrease AI Cap
- ■ No AAP Triggered
- ■ Decrease Contributions / Increase AI Cap
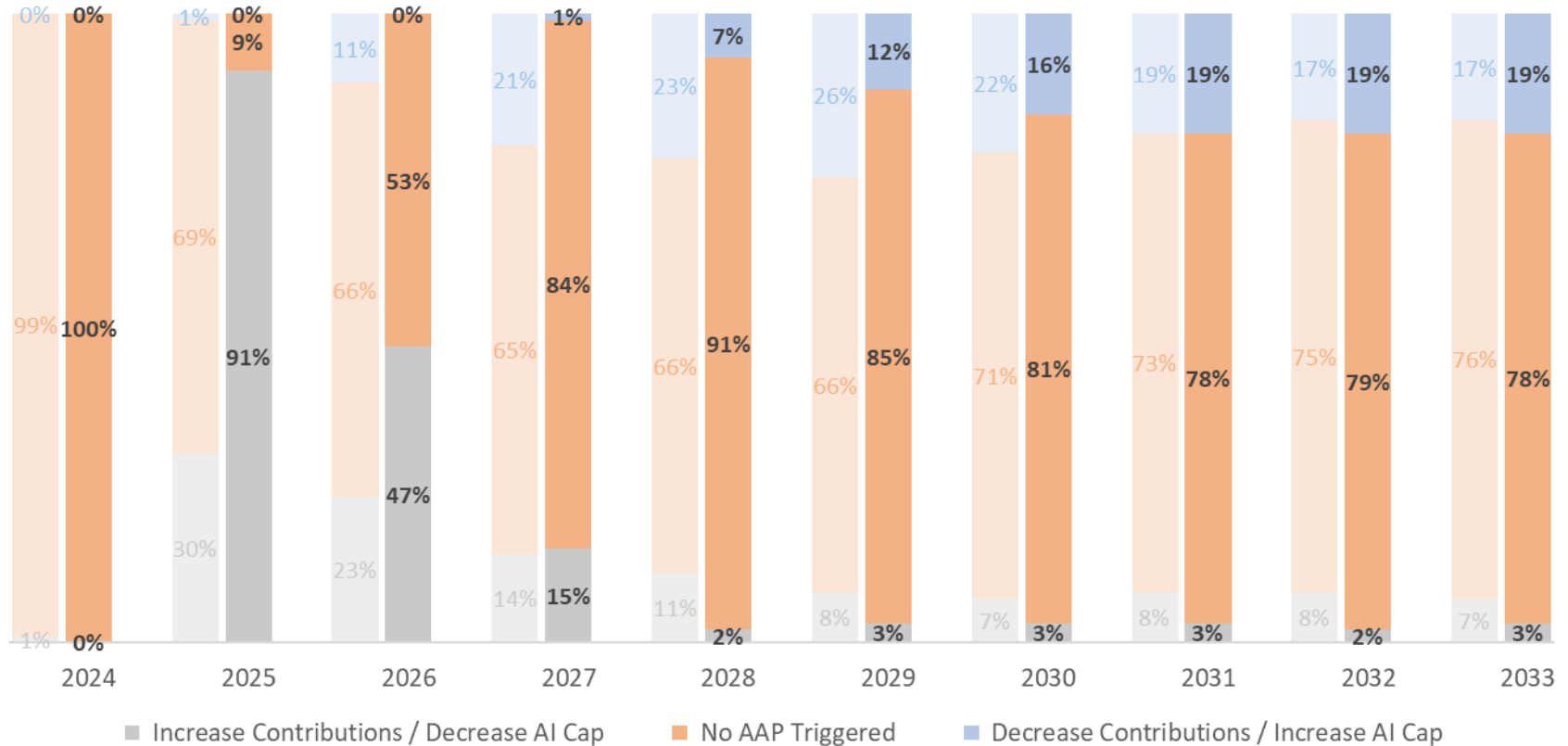
If a 5.75% investment loss is experienced in 2024, the probability of triggering an AAP adjustment increases to 91% by the 2025 valuation.

Key Findings and Take-Aways

- 2023 Investment Rate of Return – Market and Actuarial Value
  - Market Value: **13.4%**
  - Actuarial Value (smoothed asset value): **6.5%**
  - Deferred Assets Losses: **$2.9 billion**

- Progress on Paying Off Unfunded Actuarial Accrued Liability (UAAL)
  - **UAAL increased by $1.3 billion**
  - **Stalled progress predominantly due to recognizing prior investment losses and losses on salaries**
  - **No other significant demographic losses and a mortality gain**
  - **"Contribution excess" of $163 million in 2023; cumulative deficiency $5.0 billion for the last 23 years**

- Funding Periods – Reasons they've moved
  - Valuation (or Closed-Group) Basis: **23 years (from 24 years)**
  - Projected (or Open-Group) Basis: **27 years (from 34 years)**

- Actuarially Determined Contribution (ADC) and how it compares to the Statutory Rates
  - **Actual contribution rates in-line with ADC**
  - **2023 AAP Assessment is better than 98%; therefore, no adjustments scheduled as of July 1, 2025**

- Significant risks remain, including market volatility, contribution risk due to payroll fluctuations, and continuing long-term effects of COVID-19 on demographics, all adding to volatility of conditions that could trigger AAP adjustments.

★ Segal

Appendix – Pension

- Changes since the prior valuation

- Membership – Total Pension

- Historical information:
  - Active and Retired Membership
  - Payroll and Benefits
  - Market and Actuarial Values of Assets
  - Asset Returns
  - Contributions vs Disbursements

- Allocation of the Statutory Employer Rate

- Actuarially Determined Contribution Rate

- Statutory Employer Contributions

- AED and SAED Contribution Rates

- 40-Year Deterministic Projections – Pension (methods & assumptions)

- Signal Light Reporting:
  - Long-Term View – Local Government, Judicial, and DPS Divisions
  - 30-Year Long-Term View – Likelihood of Triggering AAP

Changes Since Prior Valuation – Pension

- **Plan Provisions**

Item	Description	Impact
HB 24-1044	Increases the number of retirees that can be designated under the "140-day provision" and places a 6-year cap on the total years a retiree may be designated under this provision.	No material impact in the short-term
SB 24-099	Adds superintendents and principals to the list of service retirees* that may be hired by a rural school district and employed without a reduction in retirement benefits.	No material impact in the short-term
SB 24-169 and SB 24-186	Modifies the definition of "state trooper" to include a duly sworn employee of the division of fire prevention and control in the department of public safety and employees of a local government division employer classified as a coroner or deputy coroner who were elected, reelected, or appointed on or after January 1, 2021, which includes the Boulder County Coroner.	No material impact in the short-term

* Along with teachers, school bus drivers, food services cooks, school nurses and paraprofessionals

Membership – Total Pension

Type	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division	Total
Retirees and survivors	44,517	77,165	9,095	460	7,316	138,553
Terminated members entitled to future benefits	9,887	24,561	3,174	29	3,364	41,015
Inactive members	94,780	159,333	31,426	9	17,173	302,721
Active members	53,687	131,188	12,700	347	15,626	213,548
Total	**202,871**	**392,247**	**56,395**	**845**	**43,479**	**695,837**

Active and Retired Membership

Since 2014, the number of active members has increased by 0.6% per year while the number of retirees and survivors has increased by 2.9% per year.

Payroll and Benefits ($ in millions)

Since 2014, total payroll has increased by 4.5% per year
and total benefits have increased by 3.5% per year.

Market and Actuarial Values of Assets ($ in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
■ Actuarial Value of Assets	$42,719	$44,026	$44,688	$45,614	$46,046	$48,375	$52,342	$57,172	$60,911	$62,941
■ Market Value of Assets	$44,069	$42,464	$43,149	$48,341	$44,540	$51,281	$57,639	$64,797	$54,685	$60,014
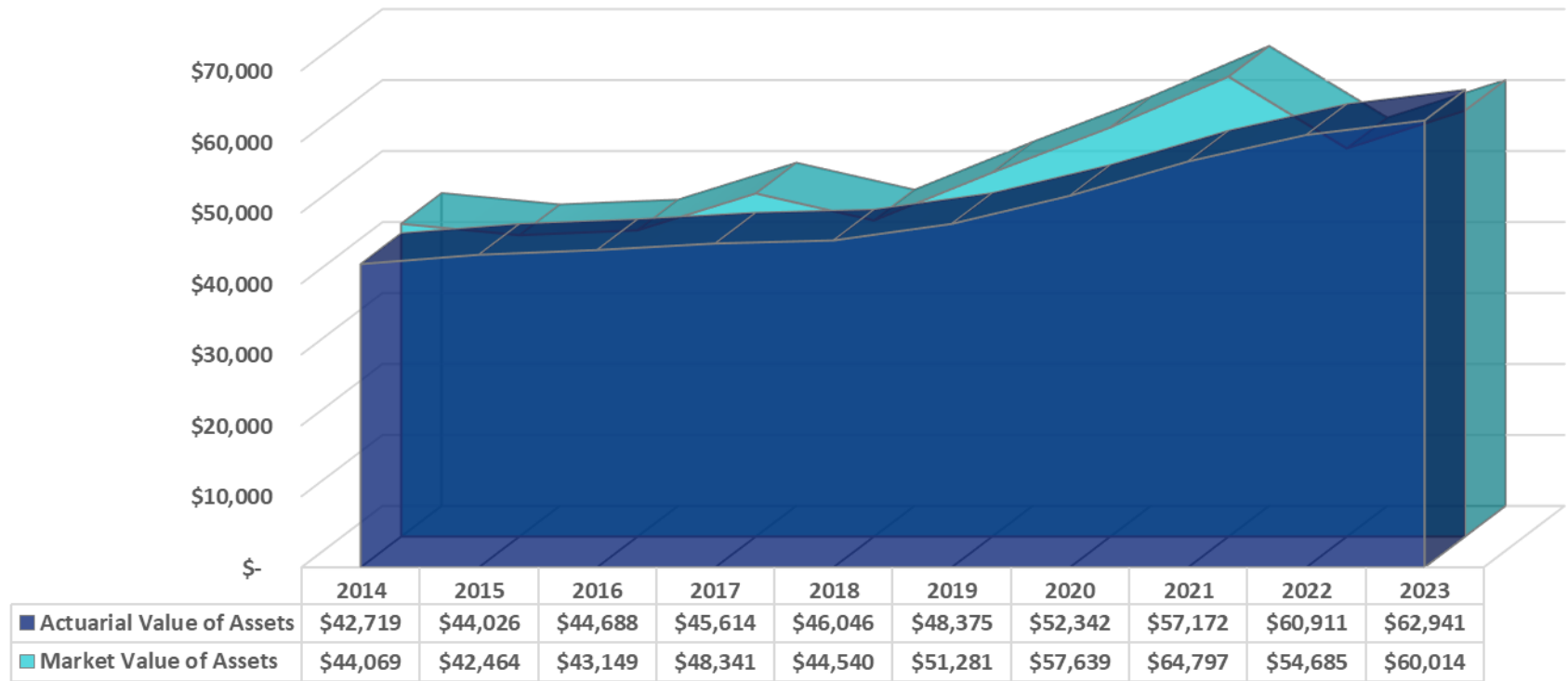
Asset Returns
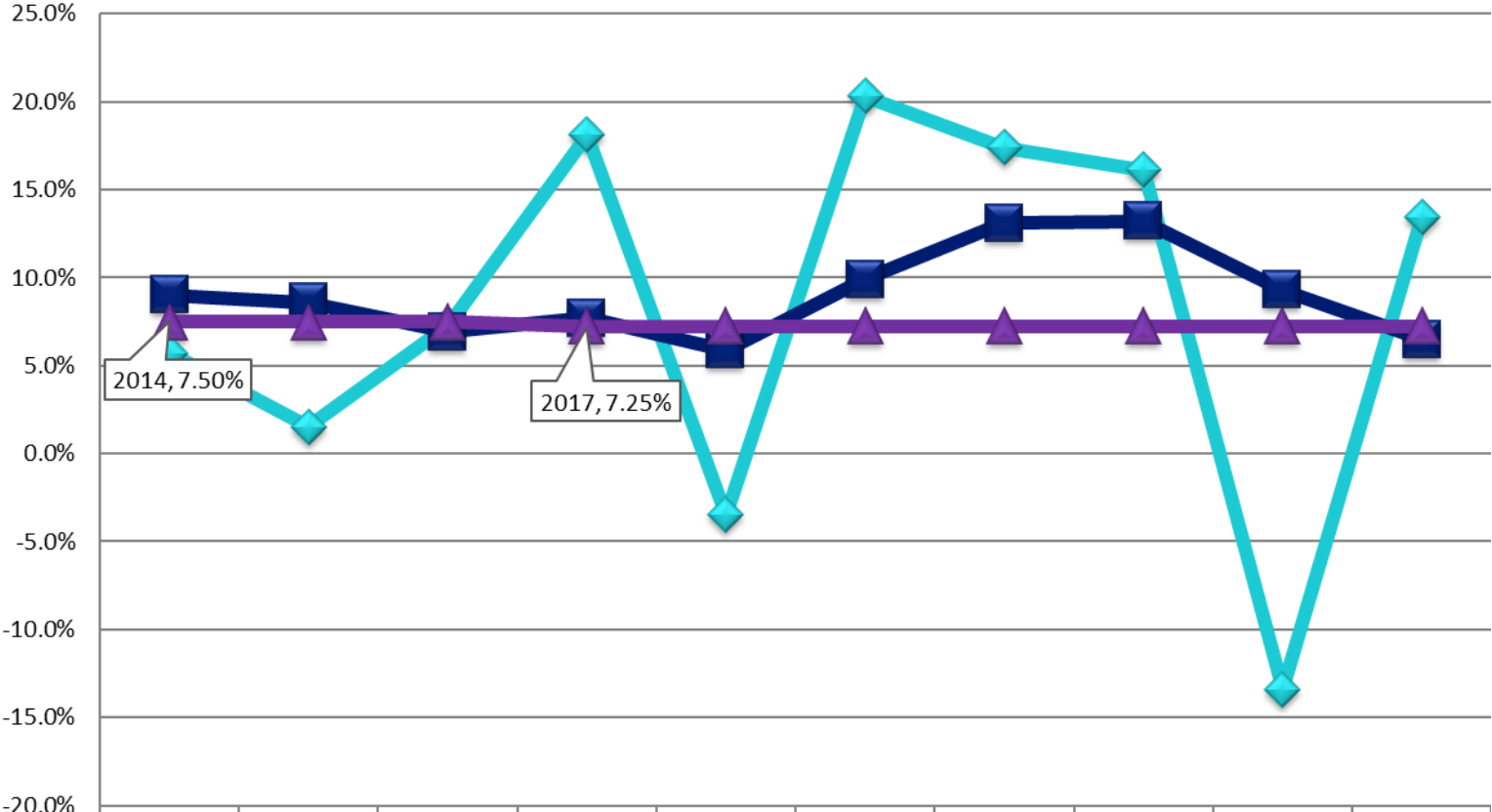
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Market Value of Assets	5.7%	1.5%	7.3%	18.1%	-3.5%	20.3%	17.4%	16.1%	-13.4%	13.4%
Actuarial Value of Assets	9.0%	8.6%	6.9%	7.7%	5.9%	9.9%	13.1%	13.2%	9.3%	6.5%
Assumed Rate of Return	7.50%	7.50%	7.50%	7.25%	7.25%	7.25%	7.25%	7.25%	7.25%	7.25%

Contributions vs Disbursements ($ in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
■ Contributions*	$2,077	$2,028	$2,157	$2,292	$2,628	$2,820	$2,822	$3,302	$3,932	$3,738
■ Disbursements**	$4,103	$4,295	$4,474	$4,694	$4,842	$4,930	$5,036	$5,231	$5,422	$5,587
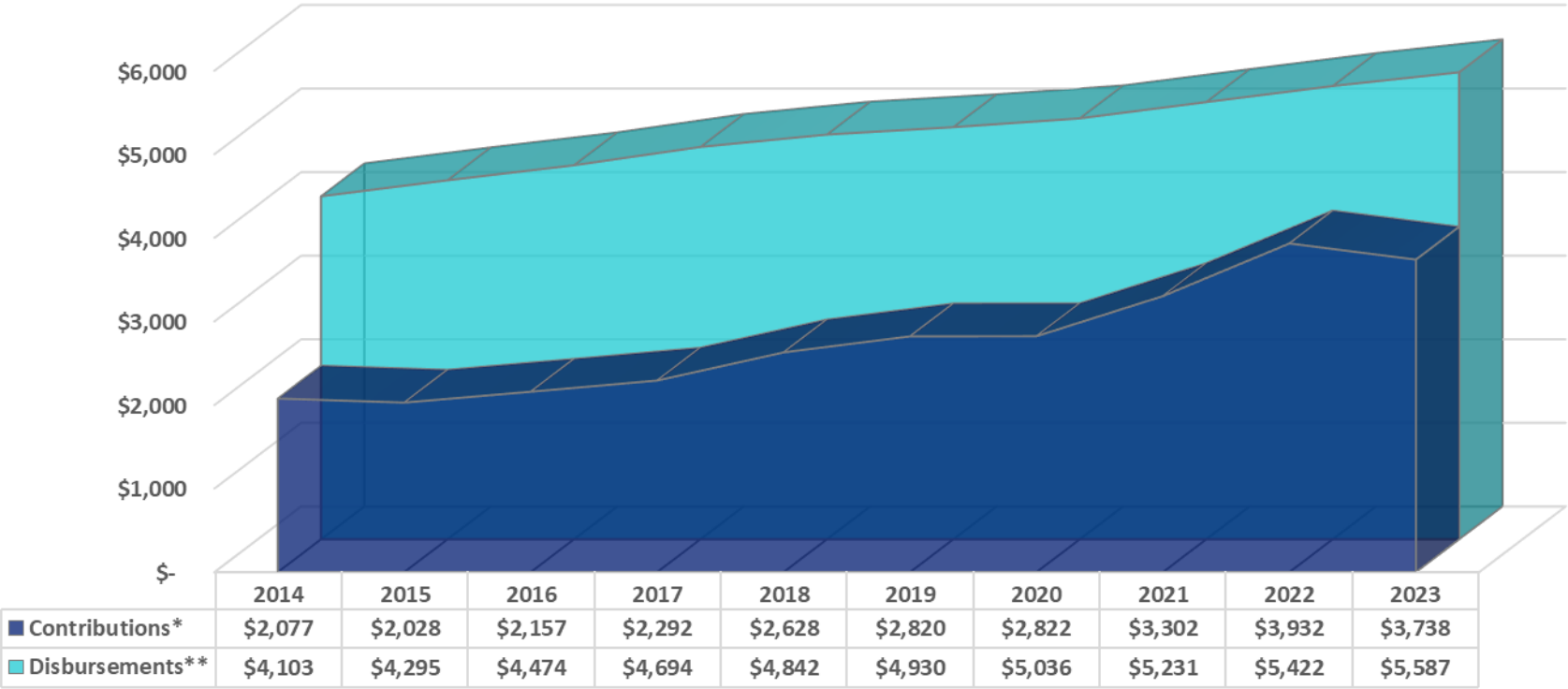
* Includes member, employer and other contributions

** Includes benefit payments and administrative expenses

★ Segal   41

Allocation of the Statutory Employer Rate

For the Fiscal Year Ending December 31, 2025

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
Total statutory employer rate	11.58%[1]	11.40%	11.02%[1]	14.91%	11.40%
AED	5.00%	4.50%	2.20%	5.00%	4.50%
Supplemental AED	5.00%	5.50%	1.50%	5.00%	5.50%
Less Health Care Trust Fund	(1.02%)	(1.02%)	(1.02%)	(1.02%)	(1.02%)
Less Annual Increase Reserve	(0.73%)	(0.64%)	(0.75%)	(0.66%)	(0.75%)
Less PCOP[2] credit	N/A	N/A	N/A	N/A	(9.69%)
A. DB employer statutory rate[3]	**19.83%**	**19.74%**	**12.95%**	**23.23%**	**9.94%**
Total normal cost	12.99%	14.60%	12.89%	17.01%	13.39%
Member contributions	(11.14%)[1]	(11.00%)	(9.02%)[1]	(11.00%)	(11.00%)
B. Employer normal cost	**1.85%**	**3.60%**	**3.87%**	**6.01%**	**2.39%**
Percentage available to amortize UAAL (A − B)	**17.98%**	**16.14%**	**9.08%**	**17.22%**	**7.55%**
Effective amortization period	18 years	23 years	8 years	5 years	6 years

[1] Blended Statutory Rate
[2] Pension Certificates of Participation
[3] An additional DC Supplement Rate of 0.23% and 0.11% for State and Local Government Divisions, respectively, is applied to DB and DC payroll in those divisions.

Actuarially Determined Contribution Rate

For the Fiscal Year Ending December 31, 2025

Item	State Division	School Division	Local Government Division	Judicial Division	Denver Public Schools Division
Total normal cost	12.99%	14.60%	12.89%	17.01%	13.39%
Member contributions	(11.14%)	(11.00%)	(9.02%)	(11.00%)	(11.00%)
Employer normal cost	1.85%	3.60%	3.87%	6.01%	2.39%
Payment on the UAAL	16.93%	16.88%	4.36%	6.19%	3.69%
A. Actuarially determined contribution rate	**18.78%**	**20.49%**	**8.22%**	**12.20%**	**6.08%**
B. DB employer statutory rate	**19.83%**	**19.74%**	**12.95%**	**23.23%**	**9.94%**
(Deficiency)/Excess (B − A)	**1.05%**	**(0.75%)**	**4.73%**	**11.03%**	**3.86%**

Due to rounding, values shown here may not sum as expected

The payment on the UAAL for the actuarially determined contribution rate is based on the Board's funding policy, which amortizes "legacy" UAAL* through 2047 and new sources of UAAL due to experience gains and losses over closed 30-year periods.

Statutory Employer Contributions

	Employer Contribution Rate	
Division Trust Fund	**In Effect on December 31, 2023**	**Effective July 1, 2024**
State (Other than Safety Officers)	11.40%	11.40%
State (Safety Officers)	14.10%	14.10%
School	11.40%	11.40%
Local Government (Other than Safety Officers)	11.00%	11.00%
Local Government (Safety Officers)	14.10%	14.10%
Judicial	14.91%	14.91%
Denver Public Schools	11.40%	11.40%

- 1.02% of the statutory rate is allocated to the Health Care Trust Funds for active members

- The DC Supplement provisions increase employer contribution rates by 0.23% for State and 0.11% for Local Government effective January 1, 2025

- 1.00% of each statutory rate is allocated to the Annual Increase Reserve on behalf of members who began membership on or after January 1, 2007

AED and SAED Contribution Rates

Division Trust Fund	2024 AED Rate	2024 SAED Rate
State	5.00%	5.00%
School	4.50%	5.50%
Local Government	2.20%	1.50%
Judicial	5.00%	5.00%
Denver Public Schools	4.50%	5.50%

- The AED and SAED are paid by all employers and will continue until the Division's actuarial funded ratio achieves or exceeds 103%, at which time each of the rates will be reduced by 0.5% of payroll

- If, subsequently, the Division's actuarial funded ratio falls below 90%, each of the rates will be increased by 0.5% of payroll, subject to the rate maximum

- For the Local Government and Judicial Divisions, if the Division's actuarial funded ratio achieves or exceeds 90% and subsequently falls below 90%, each of the rates will be increased by 0.5% of payroll, subject to the rate maximum

- The statutory rates (including AED and SAED contributions) for the Denver Public Schools Division are offset annually by an amount equivalent to that which Denver Public Schools pays to finance principal and interest payments on Pension Certificates of Participation (PCOPs)

40-Year Deterministic Projections – Pension

- Deterministic projections are based upon an open group population
  - Simulate future actuarial valuation results for the next 40 years by estimating membership, assets and liabilities for each year in the projection period
  - Active members expected to retire, terminate or die based upon the actuarial assumptions are replaced by new members who will earn benefits under a lower cost benefit structure
  - Liabilities and normal cost reflect the changing membership

- The 40-year projections are based upon the following assumptions (as directed by PERA):
  - All actuarial assumptions are realized, including achieving the assumed investment return of 7.25% each year
  - Active membership growth of:
    - 1.00% each year for School, Local Government and Denver Public Schools
    - 0.25% each year for State and Judicial
  - New entrants have the same demographic mix as new hires over the last three years
  - Projected Payroll for new entrants is assumed to grow at 3.00% per year

Signal Light Results – Long-Term View

Local Government Division
Stochastic Modeling of Investment Return – Open Group Projection Basis
Assumes Active Membership Grows by 1.00% per Year – Based on All Assumptions*

Status	Definition	# of Scenarios Meeting **	Probability of Meeting	
Dark Green	100% funded by 2041 (30 years from 2011)	2,434	49%	58%
Green	**100% funded by 2048 (30 years from 2018)**	**457**	**9%**	
Light Yellow	100% funded by 2058 (40 years from 2018)	510	10%	39%
Yellow	100% funded by 2068 (50 years from 2018)	421	8%	
Orange	Solvent but longer than 50 years to reach 100% funded	995	21%	
Red	Insolvent after 2043 (after 20 years)	174	3%	3%
Dark Red	Insolvent by 2043 (within 20 years)	9	0%	

49%	9%	10%	8%	21%	3%

53%

*   Investment return, demographic gain/loss, total payroll growth; all
    stochastically simulated independent from one another
** Based on 5,000 simulations

Signal Light Results – Long-Term View

Judicial Division
Stochastic Modeling of Investment Return – Open Group Projection Basis
Assumes Active Membership Grows by 0.25% per Year – Based on All Assumptions*

Status	Definition	# of Scenarios Meeting **	Probability of Meeting	
Dark Green	**100% funded by 2041 (30 years from 2011)**	**2,833**	**57%**	65%
Green	100% funded by 2048 (30 years from 2018)	416	8%	
Light Yellow	100% funded by 2058 (40 years from 2018)	442	9%	33%
Yellow	100% funded by 2068 (50 years from 2018)	311	6%	
Orange	Solvent but longer than 50 years to reach 100% funded	887	18%	
Red	Insolvent after 2043 (after 20 years)	110	2%	2%
Dark Red	Insolvent by 2043 (within 20 years)	1	0%	

57%	8%	9%	6%	18%	

53%

2%

* Investment return, demographic gain/loss, total payroll growth; all stochastically simulated independent from one another
** Based on 5,000 simulations

⭐ **Segal**

Signal Light Results – Long-Term View

Denver Public Schools Division
Stochastic Modeling of Investment Return – Open Group Projection Basis
Assumes Active Membership Grows by 1.00% per Year – Based on All Assumptions*

Status	Definition	# of Scenarios Meeting **	Probability of Meeting	
Dark Green	**100% funded by 2041 (30 years from 2011)**	**2,744**	**55%**	67%
Green	100% funded by 2048 (30 years from 2018)	582	12%	
Light Yellow	100% funded by 2058 (40 years from 2018)	527	11%	33%
Yellow	100% funded by 2068 (50 years from 2018)	398	8%	
Orange	Solvent but longer than 50 years to reach 100% funded	745	14%	
Red	Insolvent after 2043 (after 20 years)	4	0%	0%
Dark Red	Insolvent by 2043 (within 20 years)	0	0%	

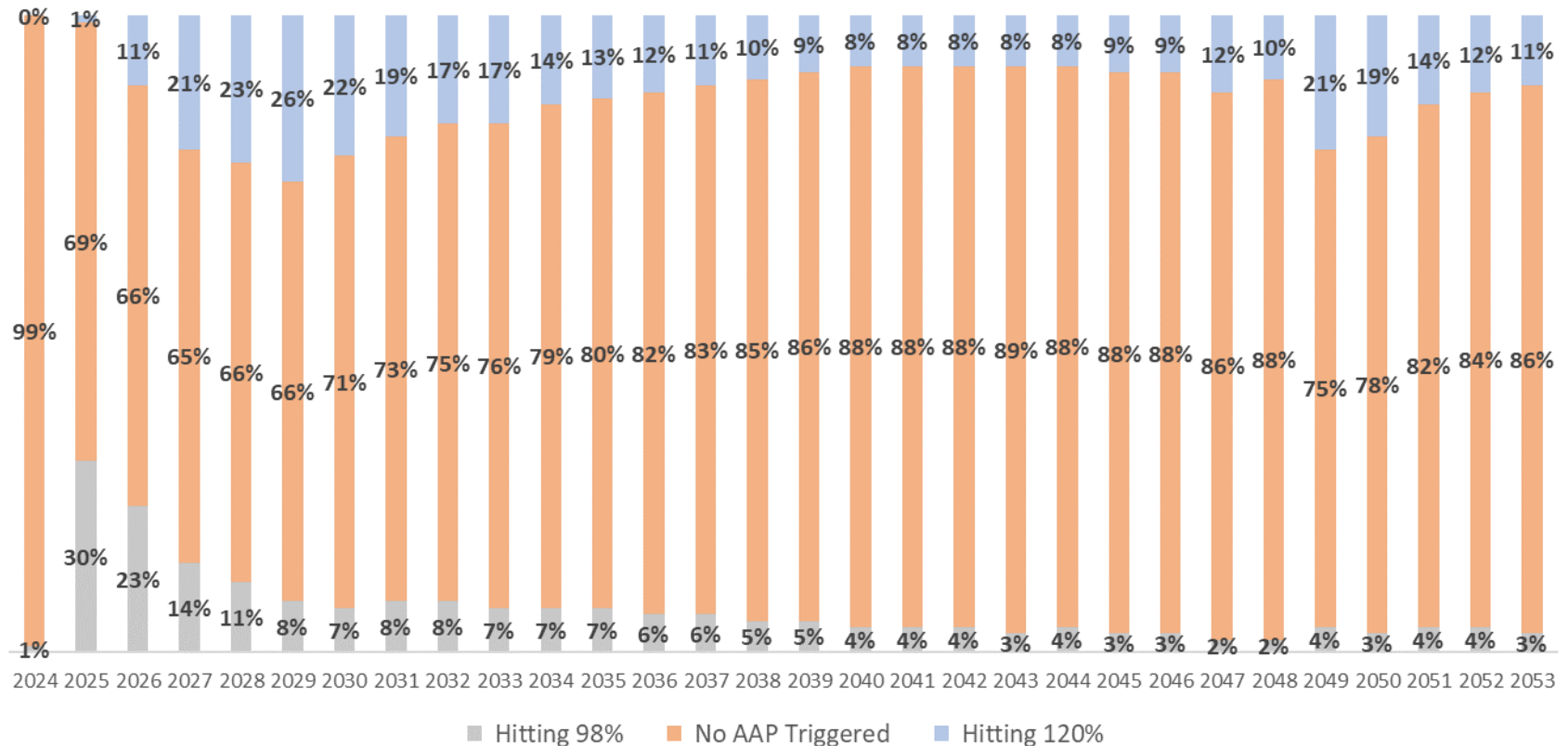| 55%	12%	11%	8%	14%

53%

* Investment return, demographic gain/loss, total payroll growth; all stochastically simulated independent from one another
** Based on 5,000 simulations

★ **Segal**

49

Signal Light Results – 30-Year Long-Term View

Likelihood of Triggering Automatic Adjustment Provision
Baseline Liability Forecast

Legend: Hitting 98% | No AAP Triggered | Hitting 120%

After the legacy UAL base is fully amortized (2047), the probability of triggering ">120%" AAP changes begins to increase considerably.

Additional Considerations

Given the above, the user of Segal's actuarial valuation (or other actuarial calculations) needs to keep the following in mind:

○ The actuarial valuation is prepared for use by the PERA Board. It includes information for compliance with federal filing requirements and for the plan's auditor. Segal is not responsible for the use or misuse of its report, particularly by any other party.

○ An actuarial valuation is a measurement at a specific date — it is not a prediction of a plan's future financial condition. Accordingly, Segal did not perform an analysis of the potential range of financial measurements, except where otherwise noted.

○ Critical events for a plan include, but are not limited to, decisions about changes in benefits and contributions. The basis for such decisions needs to consider many factors such as the risk of changes in employment levels and investment losses, not just the current valuation results.

○ Segal does not provide investment, legal, accounting, or tax advice. This valuation is based on Segal's understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The PERA Board should look to their other advisors for expertise in these areas.

○ While Segal maintains extensive quality assurance procedures, an actuarial valuation involves complex computer models and numerous inputs. In the event that an inaccuracy is discovered after presentation of Segal's valuation, Segal may revise that valuation or make an appropriate adjustment in the next valuation.

○ Segal's report shall be deemed to be final and accepted by the PERA Board upon delivery and review. PERA should notify Segal immediately of any questions or concerns about the final content.

○ As Segal has no discretionary authority with respect to the management of assets of the Plan, it is not a fiduciary in its capacity as actuaries and consultants with respect to the Plan.