NORTH DAKOTA
RETIREMENT AND
INVESTMENT OFFICE
Teachers' Fund for Retirement
State Investment Board

North Dakota Teachers'
Fund for Retirement

Actuarial Valuation as of July 1, 2021

October 27, 2021

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This document has been prepared by Segal for the benefit of the Employee Benefits Programs Committee and is not complete without the presentation provided at the October 27, 2021, Committee meeting.

Segal

Discussion Topics

Agenda

- Overview of Valuation Process
- Valuation Results and Projections

The Valuation Process

Input

Member Data

Asset Information

Benefit Provisions

Actuarial Assumptions

Funding Methodology

Results

Actuarial Value of Assets

Normal Cost and Actuarial Liability

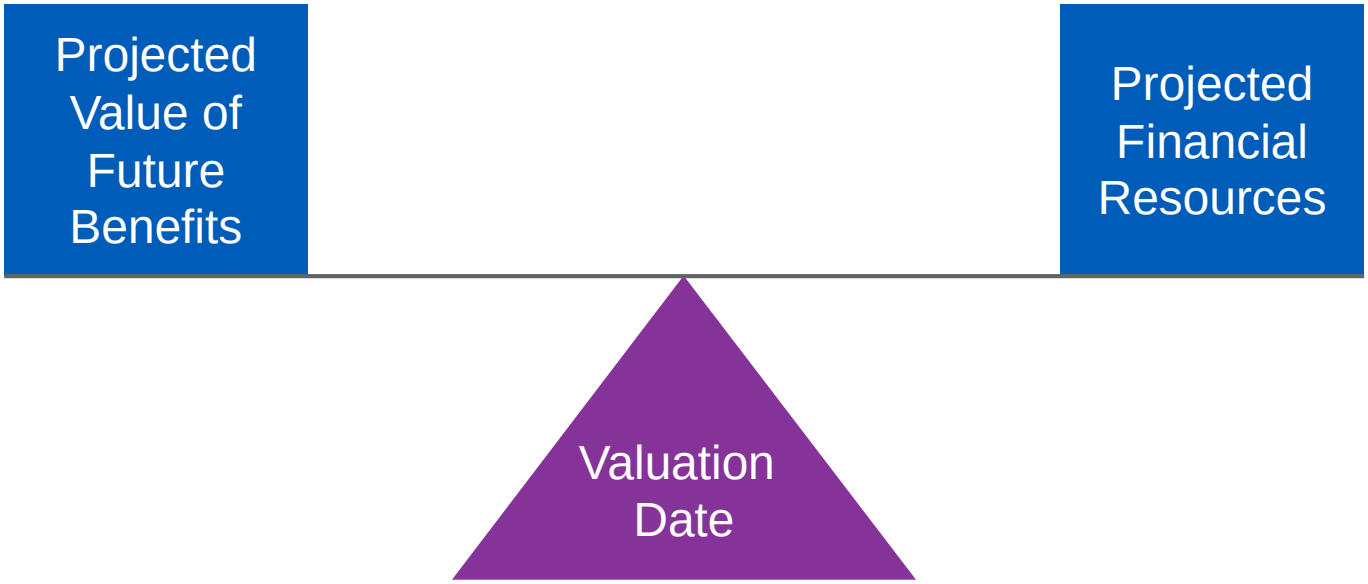
Unfunded Liability and Funded Ratio

Funding Period

Actuarially Determined Employer Contribution

Accounting Results

Actuarial Balance



Over the life of a pension system,

Benefits + **E**xpenses = **C**ontributions + **I**nvestment Return

Or: Contributions = Benefits + Expenses - Investment Return

Actuarially Determined Contribution vs. Funding Period

Actuarially Determined Contribution (ADC)

- Equal to the normal cost plus amortization of the unfunded actuarial accrued liability (UAAL)
- The funding policy components:
  - Asset valuation method
  - Cost method
  - Amortization period

Funding Period or Effective Amortization Period

- Number of years that the UAAL is expected to be amortized based upon the fixed member and employer contribution rates
- Funding period is compared to the ADC's amortization period to assess the progress toward amortizing the unfunded accrued liability

The employer contribution rate is compared to the ADC as a measure of the adequacy of the employer (and member) contribution rates.

Actuarial Assumptions

Two types:

Demographic	Economic
• Retirement • Disability • Death in active service • Withdrawal • Death after retirement	• Inflation – 2.30% • Investment return – 7.25% • Salary increases – 14.80% for new members to 3.80% for members with 30+ years • Payroll growth – 3.25%

Actuaries make assumptions as to when and why a member will leave active service, and estimate the amount and duration of the pension benefits paid.

Actuarial Methods

Asset Valuation Method (Actuarial Assets)

- Investment gains and losses recognized over a number of years
- TFFR uses a five-year smoothing method
- A 20% market value corridor is applied – actuarial value of assets must fall within 80% to 120% of market value

Cost Method

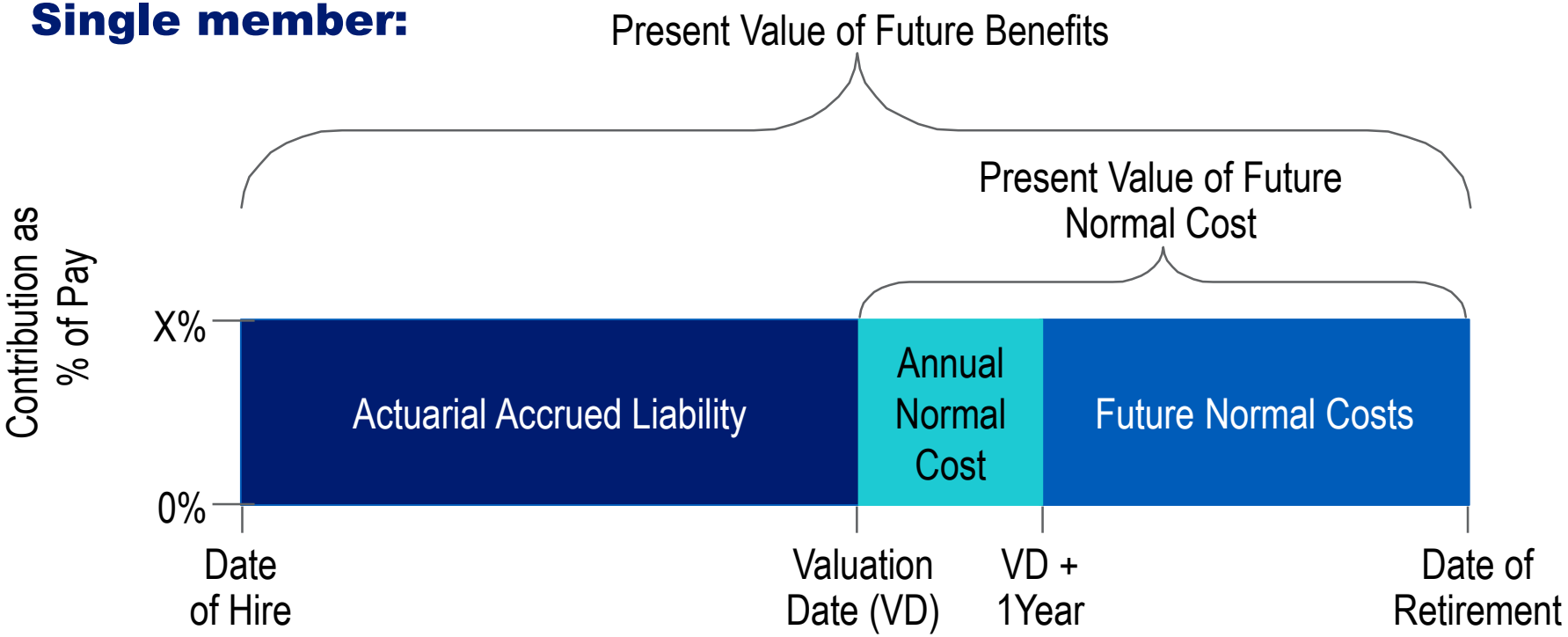
- Allocation of liability to past and future service
- TFFR uses the entry age normal cost method
  - Allocates cost of member's retirement benefit over expected career as a level % of salary
  - Most common cost method among public sector retirement systems
  - Required by GASB for financial statement reporting purposes

Amortization Method

- Relies on two inputs:
  - Number of years to amortize the UAL
  - Level dollar or level percentage of payroll approach
- TFFR's amortization method:
  - 30-year closed period that began July 1, 2013
  - 22 years remaining
  - Level percentage of payroll

Funding Process

Single member:

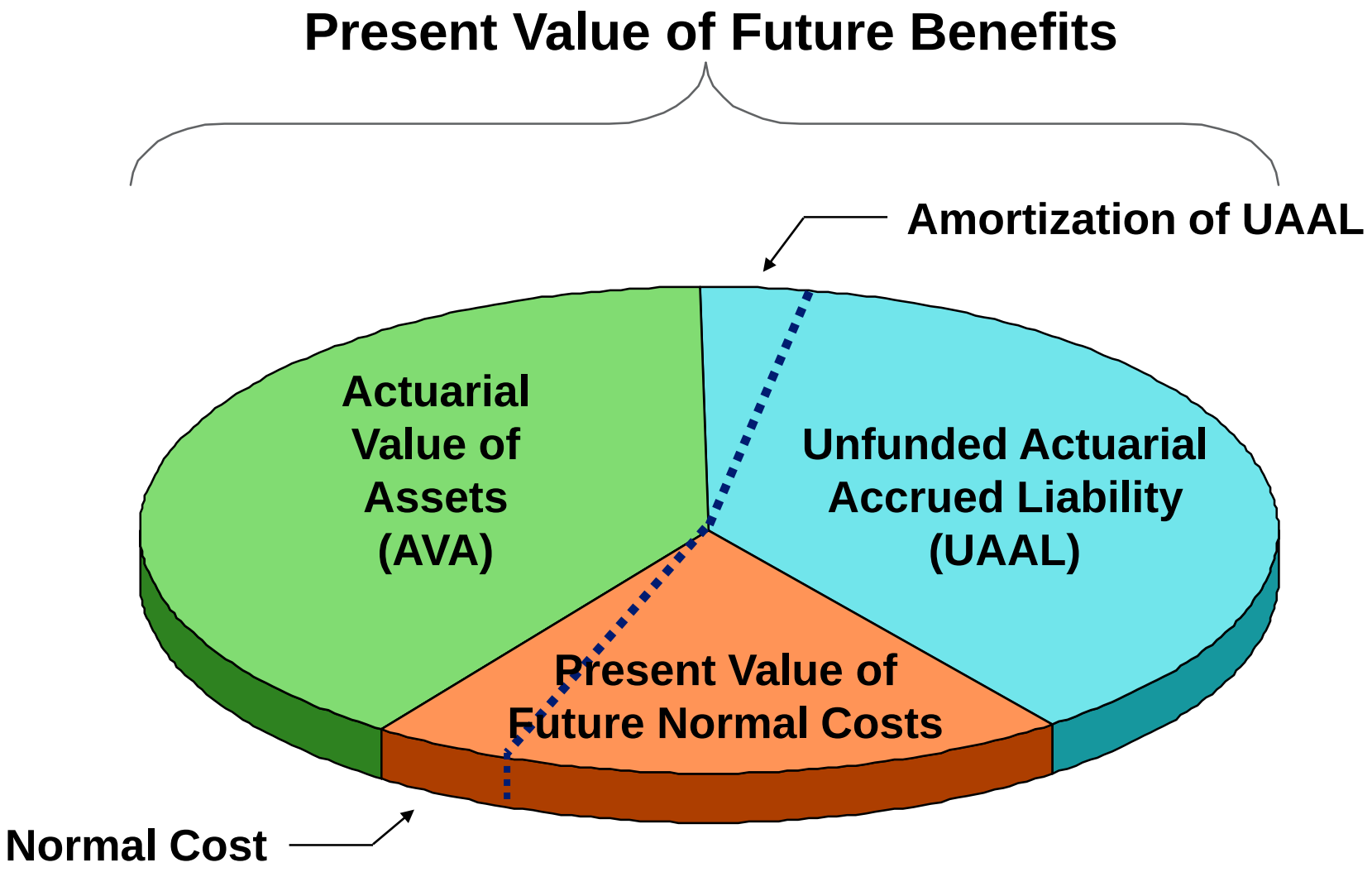


Entry Age cost method: Allocates cost between past and future service

- **Normal Cost:** Cost of annual benefit accrual as a level percent of salary
- **Actuarial Accrued Liability:** Represents accumulated value of past normal costs (or difference between total cost and present value of future normal costs)
- **Unfunded Actuarial Accrued Liability:** Actuarial accrued liability minus actuarial value of assets

Actuarially Determined Contribution

Entire group:



Summary of Valuation Highlights

July 1, 2021 Actuarial Valuation

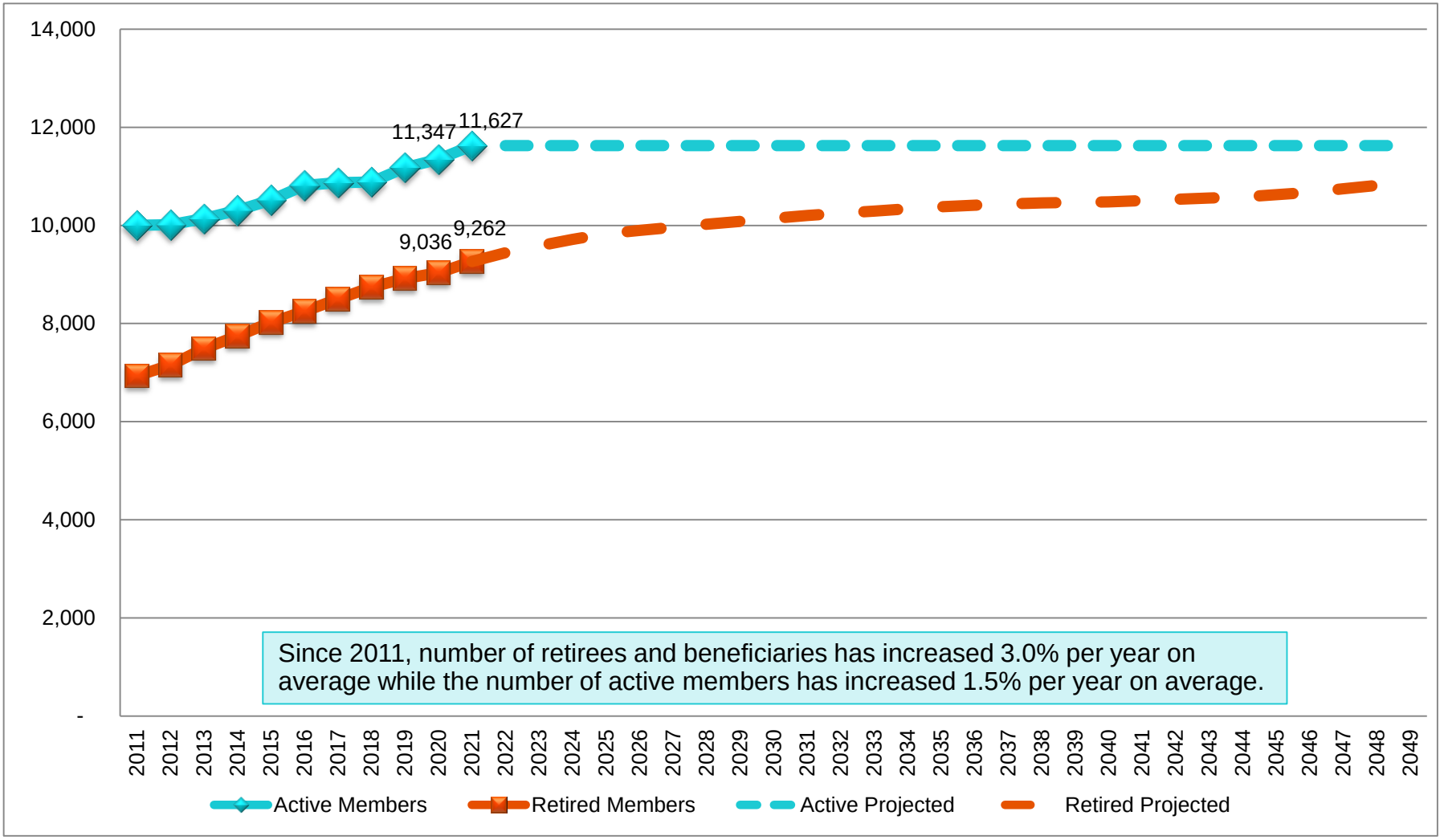
- The return on the market value of assets for the year ending June 30, 2021, was **26.1%***
  - Gradual recognition of deferred losses resulted in **10.3%** return on actuarial value of assets
- Funded ratio increased from 65.7% (as of 7/1/2020) to **68.6%** (as of 7/1/2021)
- Effective amortization period decreased from 24 years to 21 years
- Net impact on actuarially determined contribution (ADC) was a decrease from 13.19% of payroll to **12.37%** of payroll
  - Based on the employer contribution rate of 12.75%, the contribution deficiency has decreased from 0.44% of payroll to a margin of 0.38% of payroll
- GASB Net Pension Liability decreased from $1.53 billion as of 6/30/2020, to $1.05 billion as of 6/30/2021

* Based on Segal's calculation

Membership

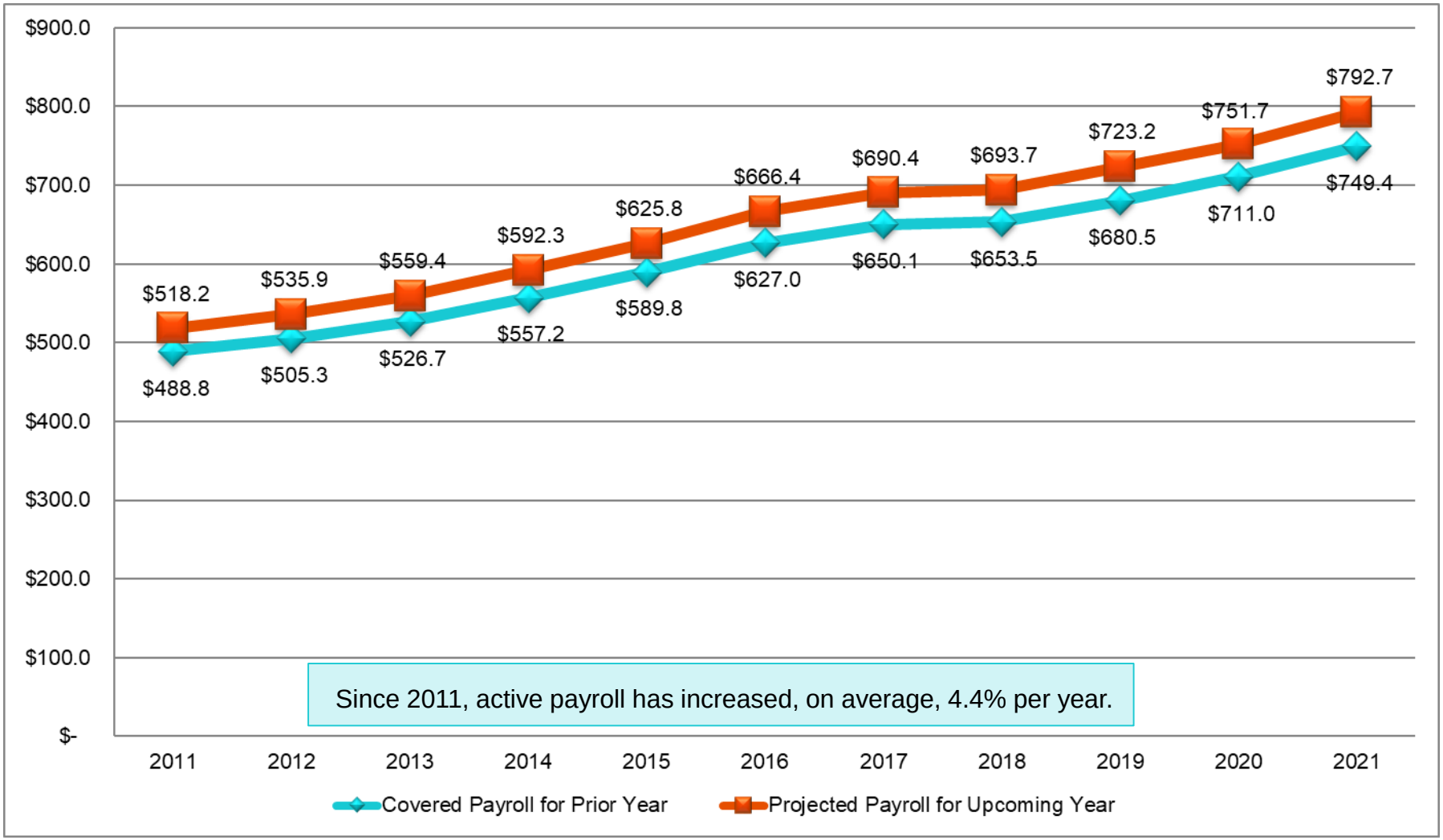
	2020	2021	Change
Active			
• Number	11,347	11,627	+2.5%
• Payroll (annualized)	$711.0 mil	$749.4 mil	+5.4%
• Average Age	41.8 years	41.4 years	-0.4 years
• Average Service	11.7 years	11.4 years	-0.3 years
Retirees and Beneficiaries			
• Number	9,036	9,262	+2.5%
• Total Annual Benefits	$229.4 mil	$241.4 mil	+5.2%
• Average Monthly Benefit	$2,116	$2,172	+2.6%

Active and Retired Membership

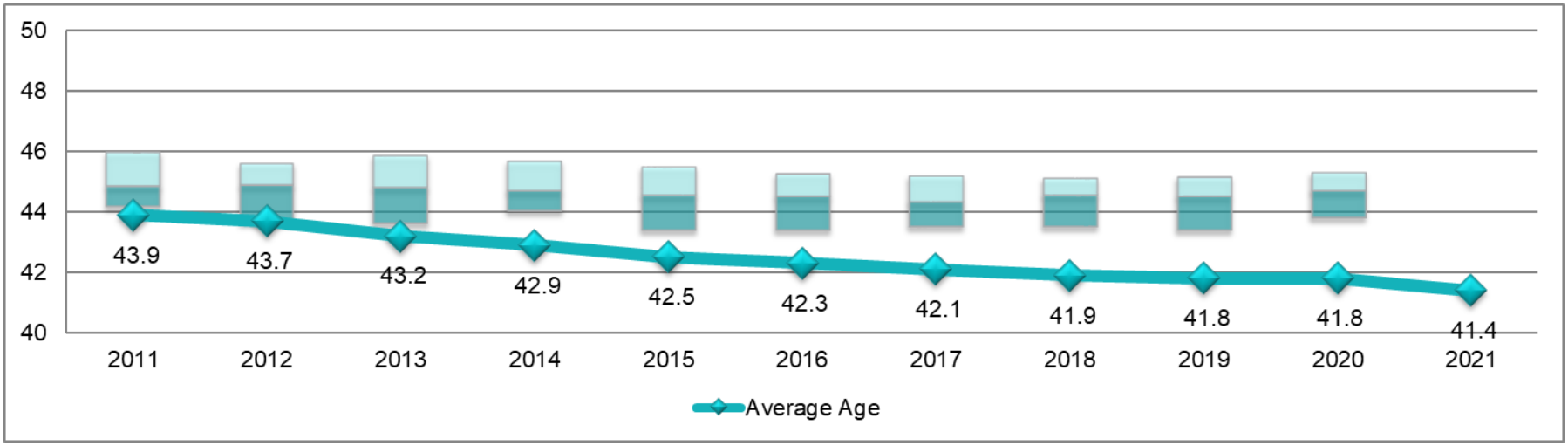


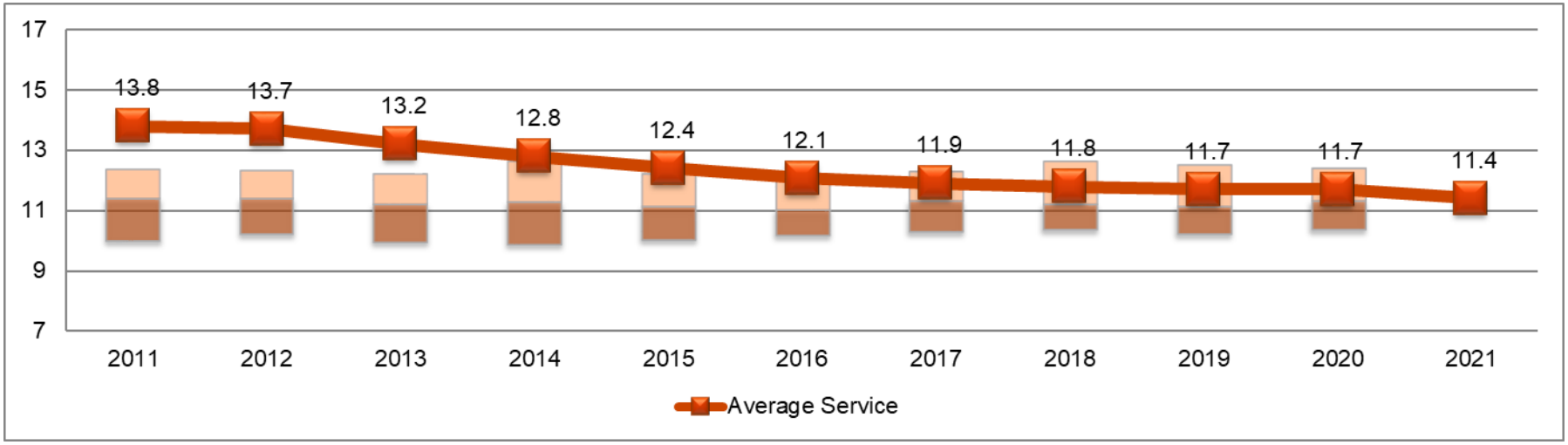
Active Payroll

$ Millions



Average Age and Service of Active Members

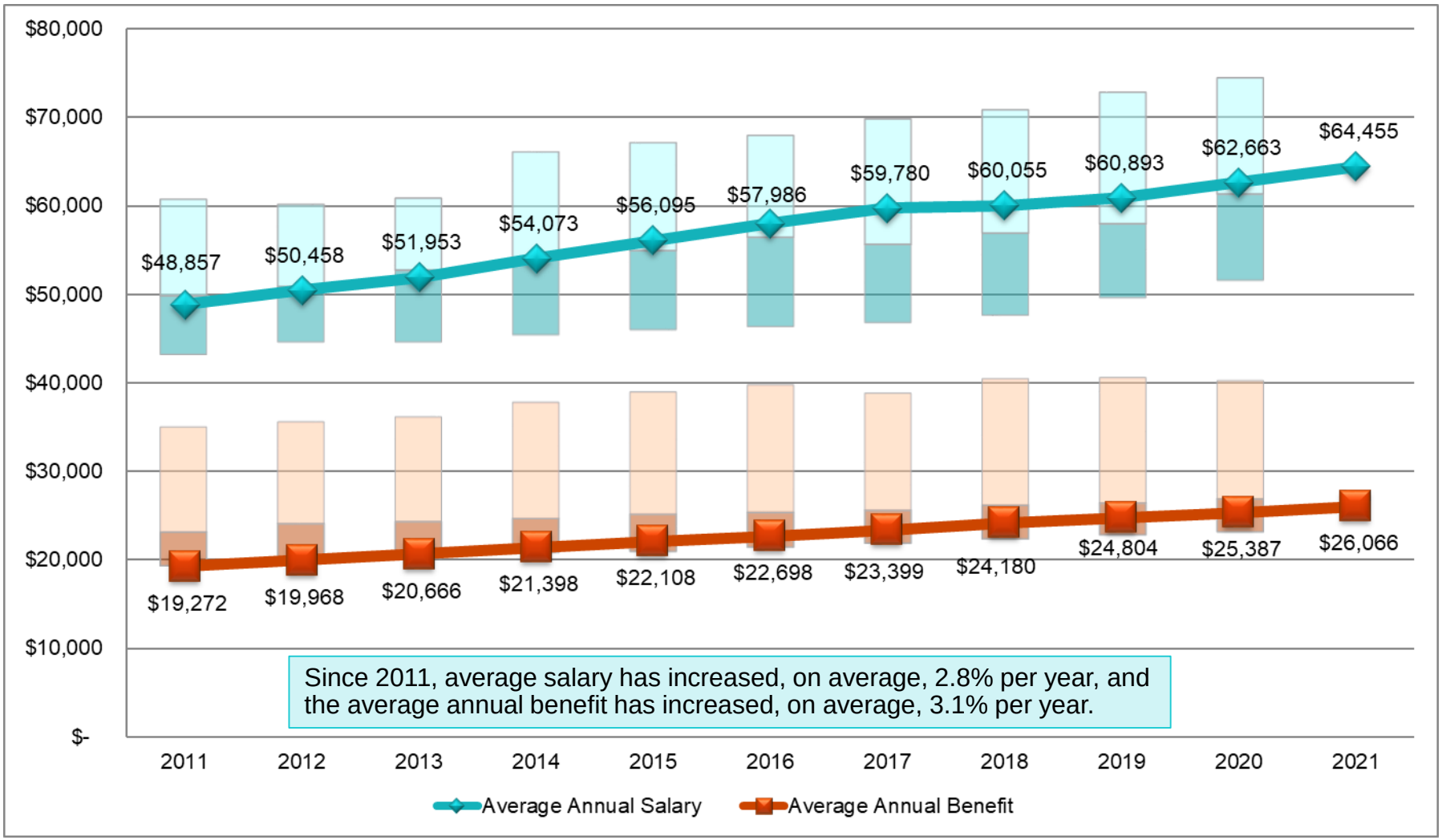




For context, historical data is compared to 38 systems in the Public Plans Data* that primarily cover teachers. The top marker represents the 2nd quartile (50th to 75th percentile) and the lower marker represents the 3rd quartile (25th to 75th percentile), where the middle line indicates the median.

* Public Plans Data. 2001-2020. Center for Retirement Research at Boston College, MissionSquare Research Institute, and National Association of State Retirement Administrators.

Average Salary and Average Benefit



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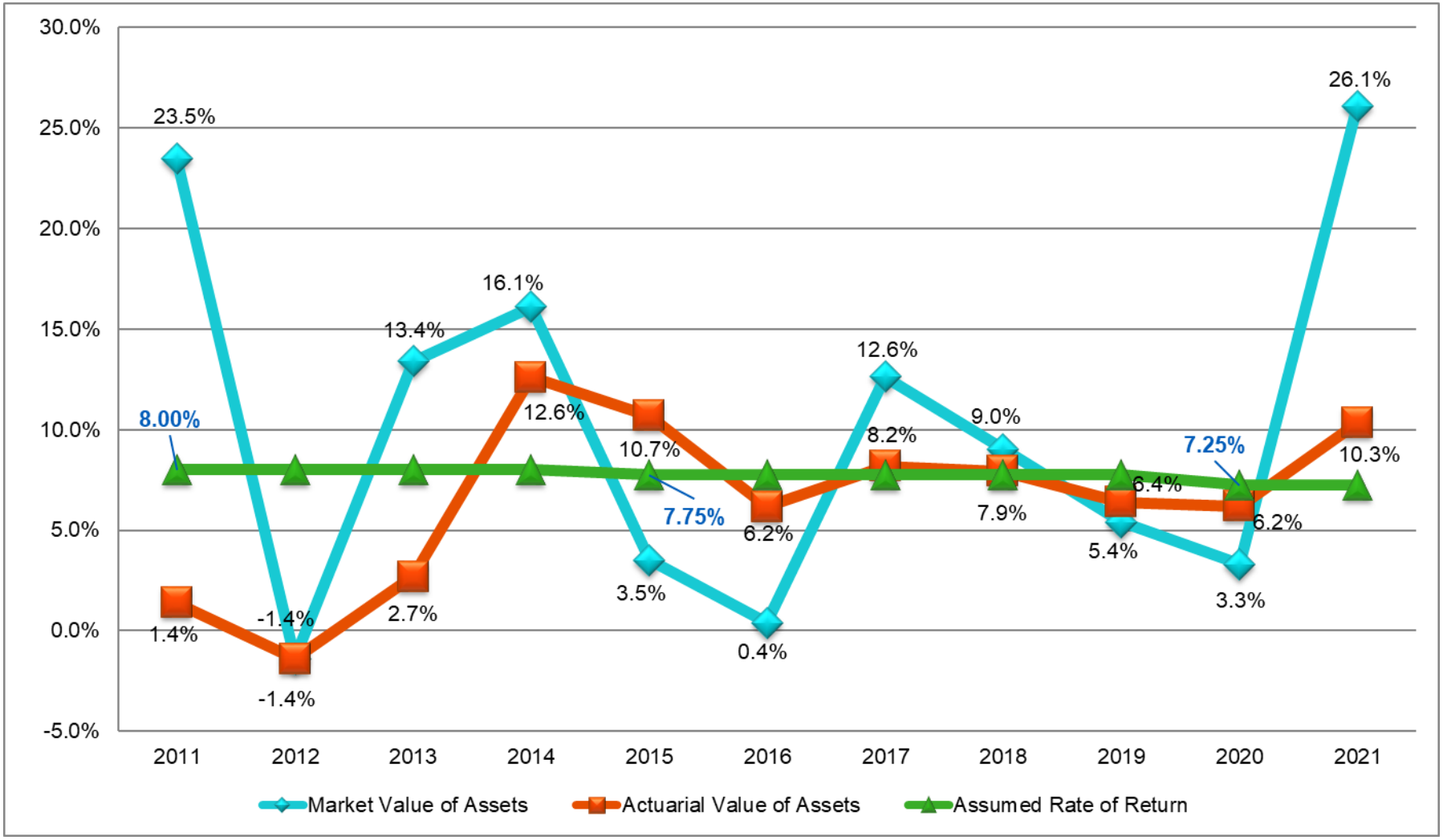
Assets

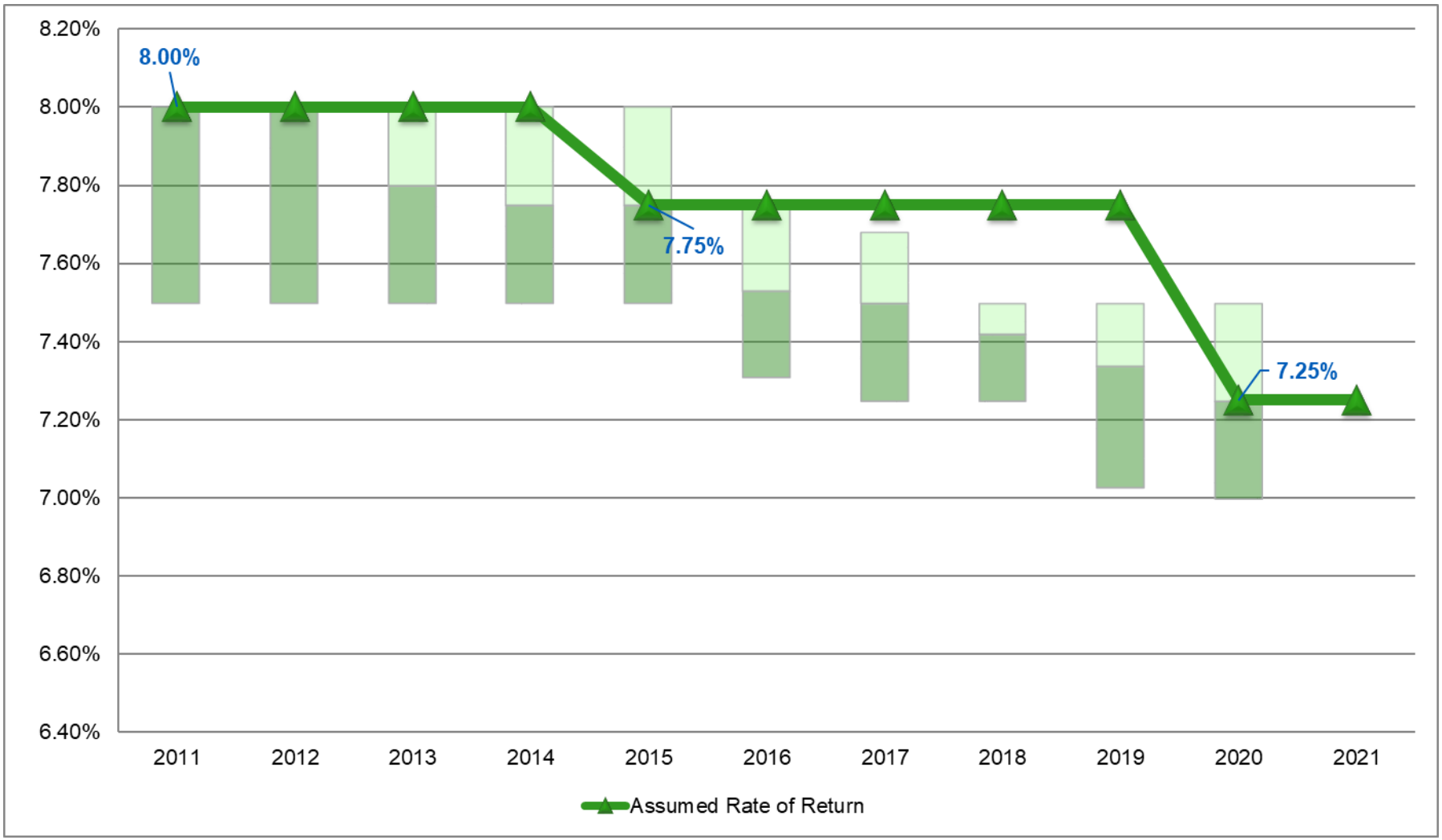
- The market value of assets increased from $2.65 billion (as of 6/30/2020) to $3.28 billion (as of 6/30/2021)
  - Segal estimated the investment return at 26.07%, net of investment expenses
- The actuarial value of assets increased from $2.75 billion (as of 6/30/2020) to $2.97 billion (as of 6/30/2021)
  - Investment return of 10.33%, net of investment expenses
  - Compared to the return assumption of 7.25%
  - Actuarial value is 90.6% of market
  - There is a total of $308.7 million of deferred net investment gains that will be recognized in future years
- Average annual returns are:

	Market Value	Actuarial Value
10-year average	8.6%	6.9%
20-year average	6.9%	5.7%
30-year average	8.0%	7.2%

Asset Returns



Investment Return Assumption



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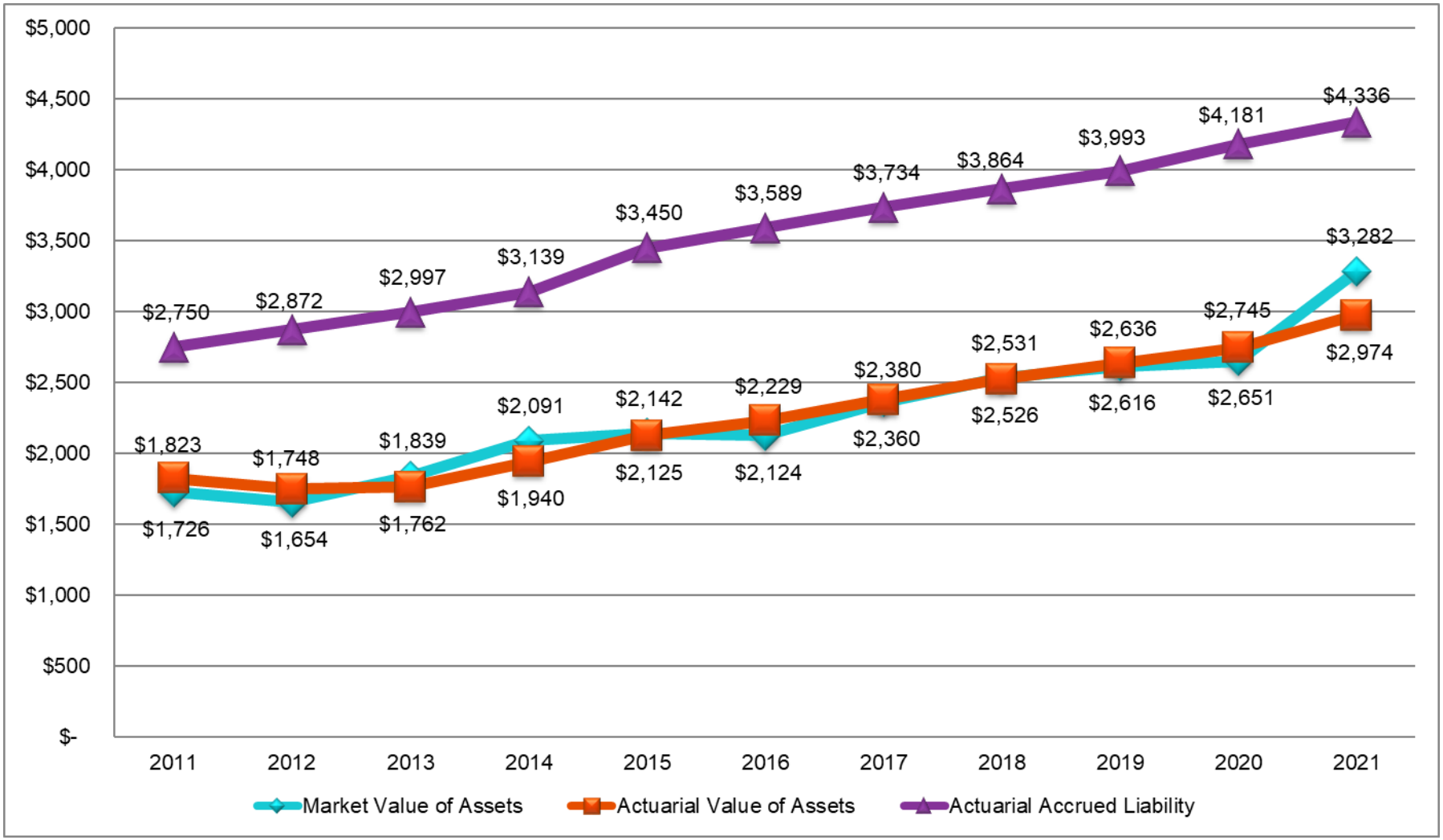
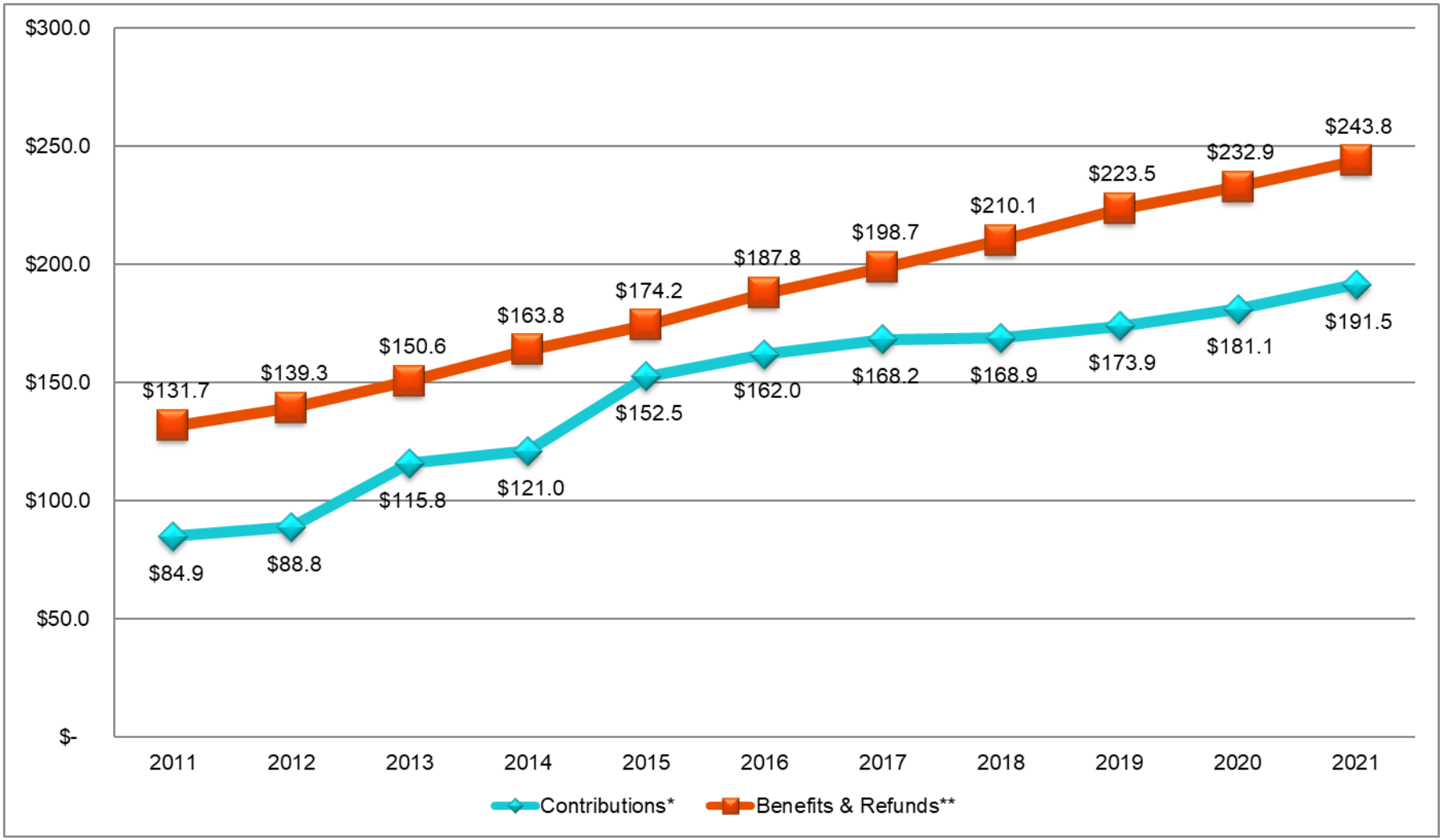
Market and Actuarial Values of Assets Compared to Actuarial Accrued Liability

$ Millions



Contributions vs. Benefits and Refunds

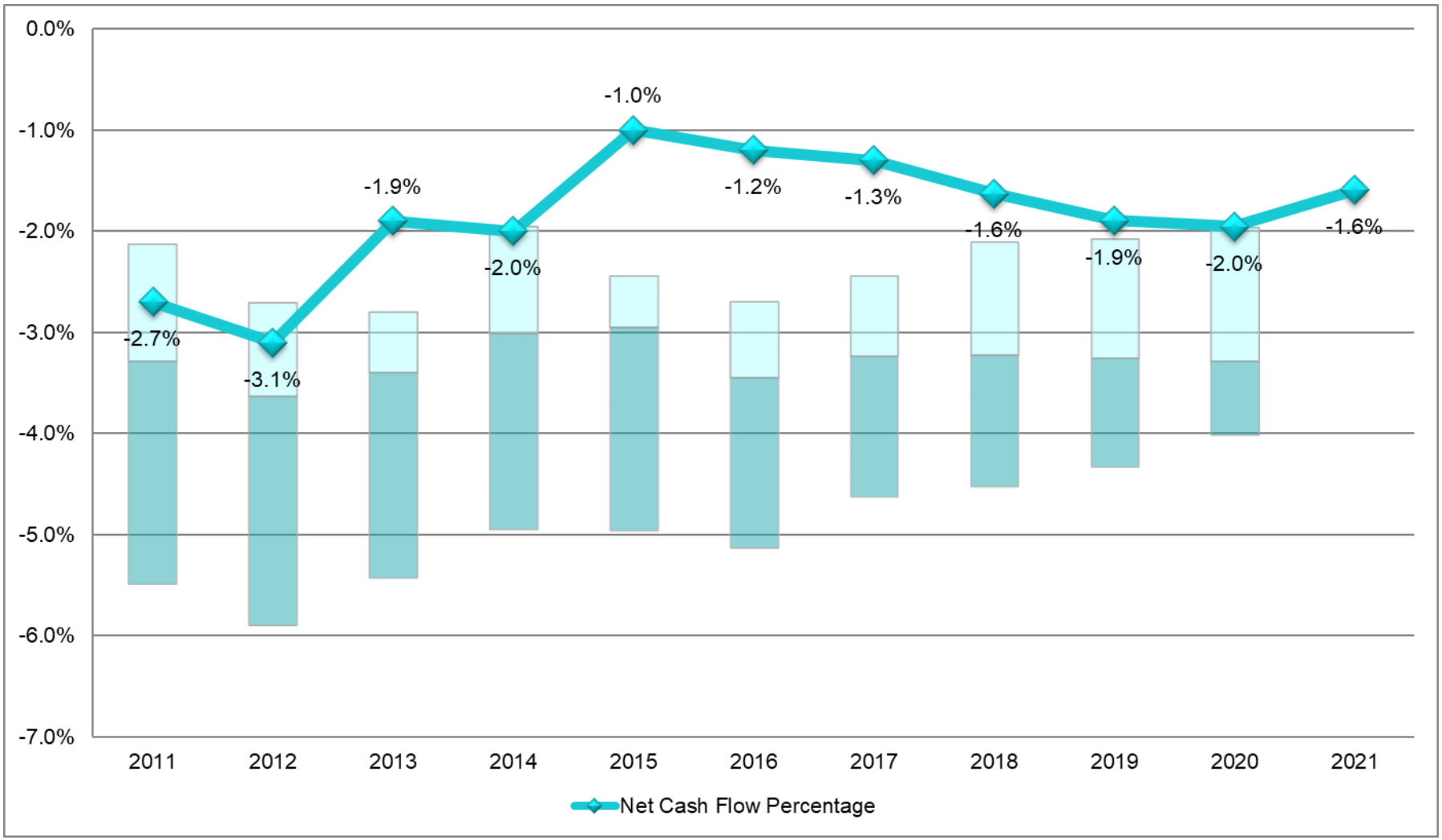
$ Millions



* Includes member and employer contributions, and service purchases

** Includes administrative expenses

Net Cash Flow as a % of Market Value



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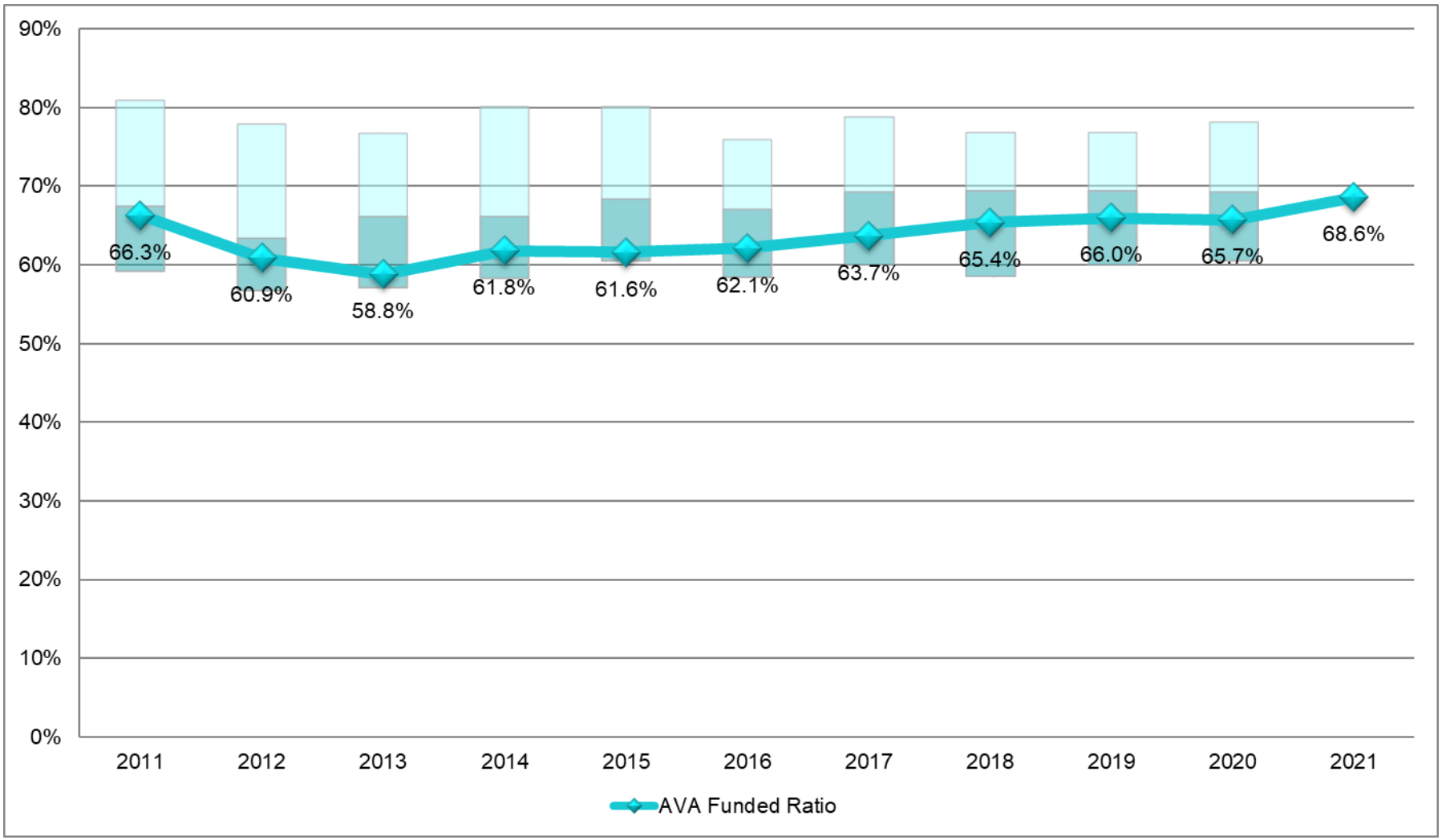
Valuation Results ($ in millions)

	July 1, 2020	July 1, 2021
Actuarial Accrued Liability:		
• Active Members	$1,660	$1,690
• Inactive Members	124	131
• Retirees and Beneficiaries	2,398	2,515
Total	**$4,181**	**$4,336**
Actuarial Value of Assets	2,745	2,974
Unfunded Accrued Liability	$1,436	$1,362
Funded Ratio	65.7%	68.6%
Market Value of Assets	2,651	3,282
Unfunded Liability, Market Basis	$1,530	$1,054
Funded Ratio, Market Basis	63.4%	75.7%

Note: numbers may not add due to rounding

Funded Ratio, AVA Basis



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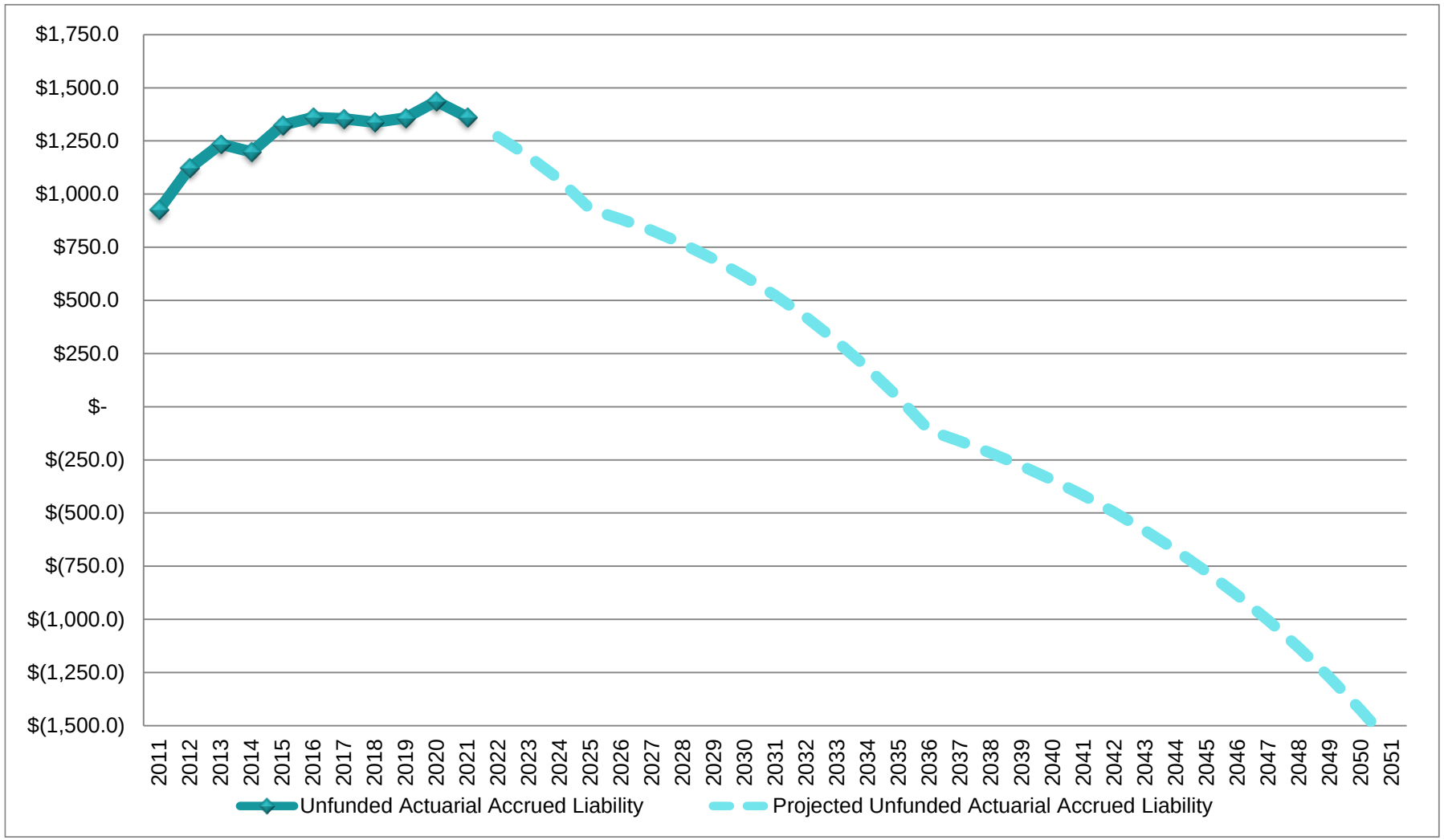
Actuarially Determined Contribution

	For the Year Beginning	
	July 1, 2020	**July 1, 2021**
Normal Cost Rate	12.28%	12.41%
Member Rate	(11.75%)	(11.75%)
Employer Normal Cost Rate	0.53%	0.66%
Amortization of UAAL	12.66%	11.71%
Actuarially Determined Contribution	13.19%	12.37%
Statutory Employer Rate	12.75%	12.75%
Contribution Sufficiency/(Deficiency)	(0.44%)	0.38%

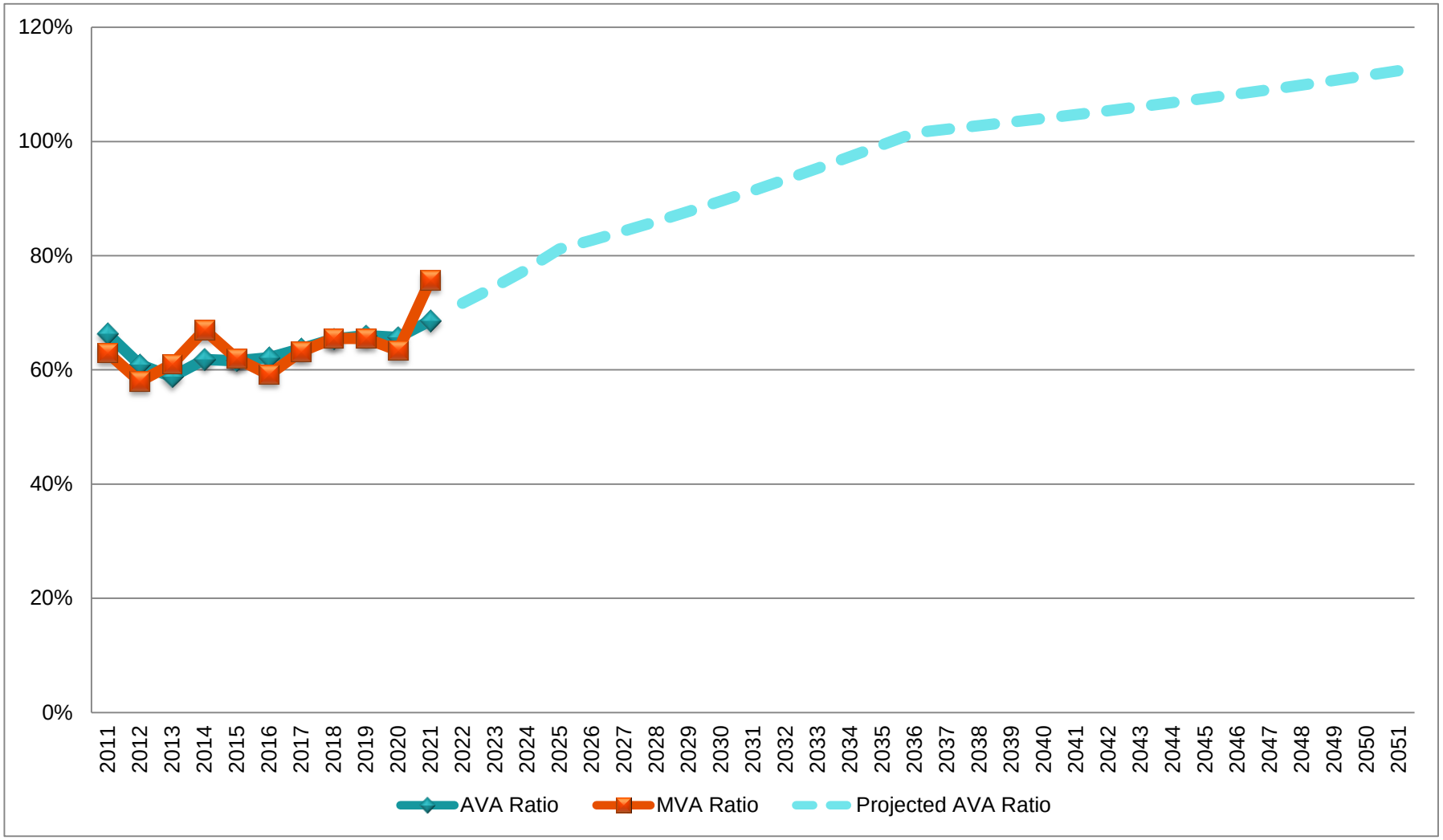
Unfunded Actuarial Accrued Liability

$ Millions



Projection based on all assumptions, including 7.25% investment return, realized as expected

Funded Ratio

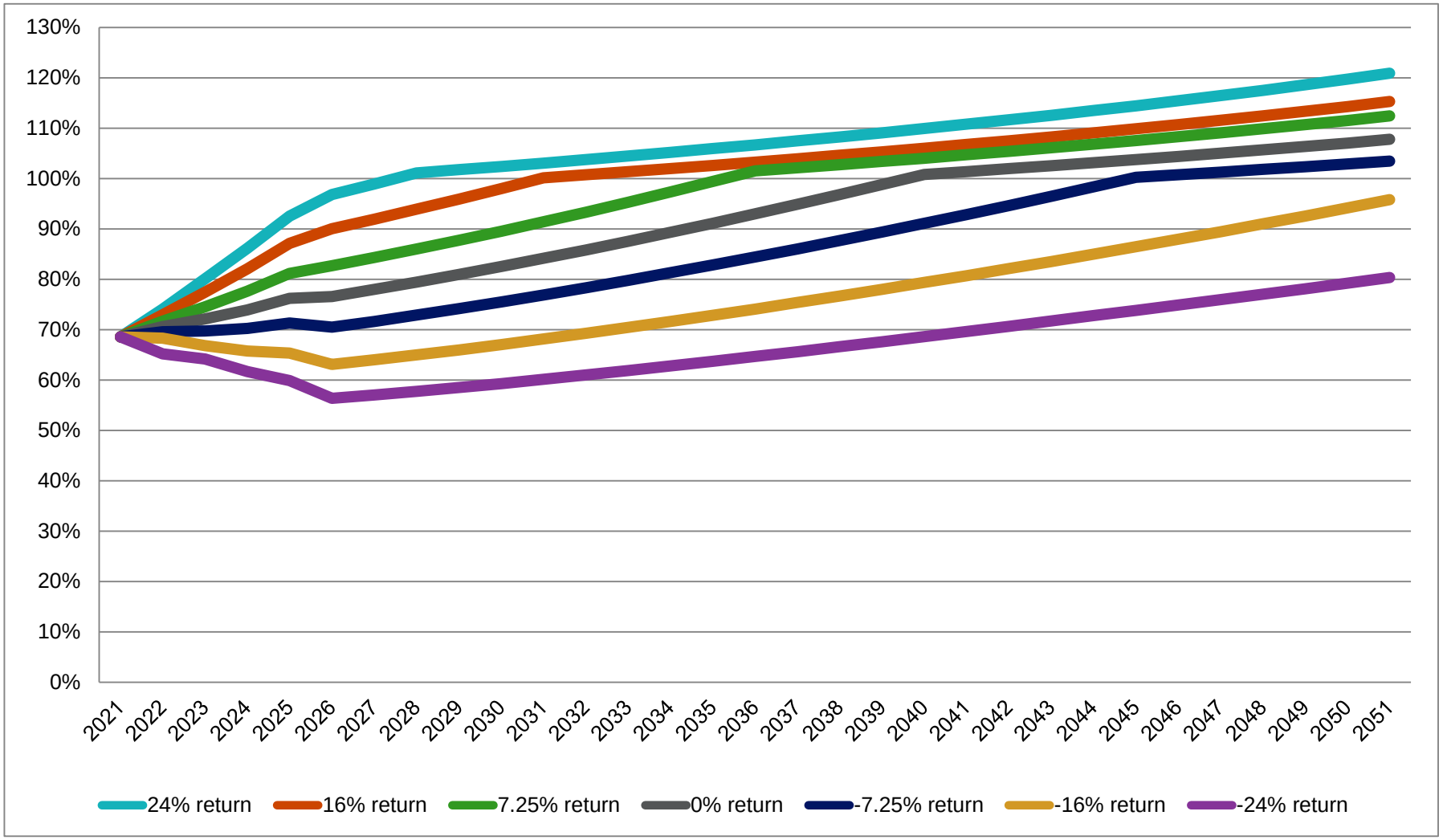


Projection based on all assumptions, including 7.25% investment return, realized as expected

Sensitivity Projections

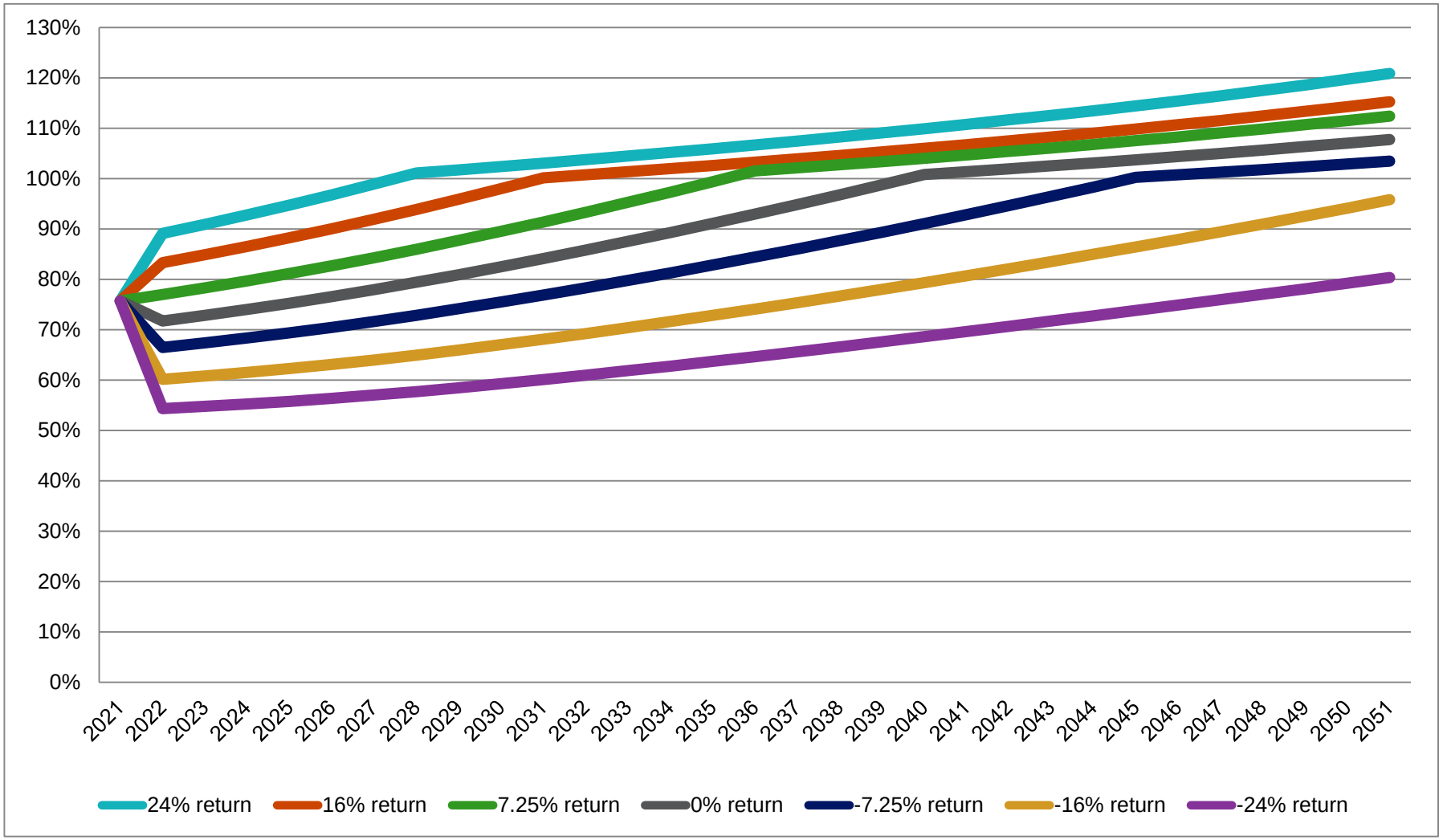
- Projections of estimated funded ratios for 30 years
  - Based on FY22 investment return scenarios ranging from -24% to +24%
  - Assumes Fund earns 7.25% per year in FY23 and each year thereafter
  - Additional projections assuming Fund earns 6.25% or 8.25% per year every year
  - Administrative expenses increase by 2.30% each year
  - All other experience is assumed to emerge as expected
- Includes contribution rates from HB 1134
  - Member rate is 11.75%
  - Employer rate is 12.75%
  - Member and Employer Contribution rates “sunset” back to 7.75% once the funded ratio reaches 100% (based on actuarial assets)

Projected Funded Ratios (AVA Basis)



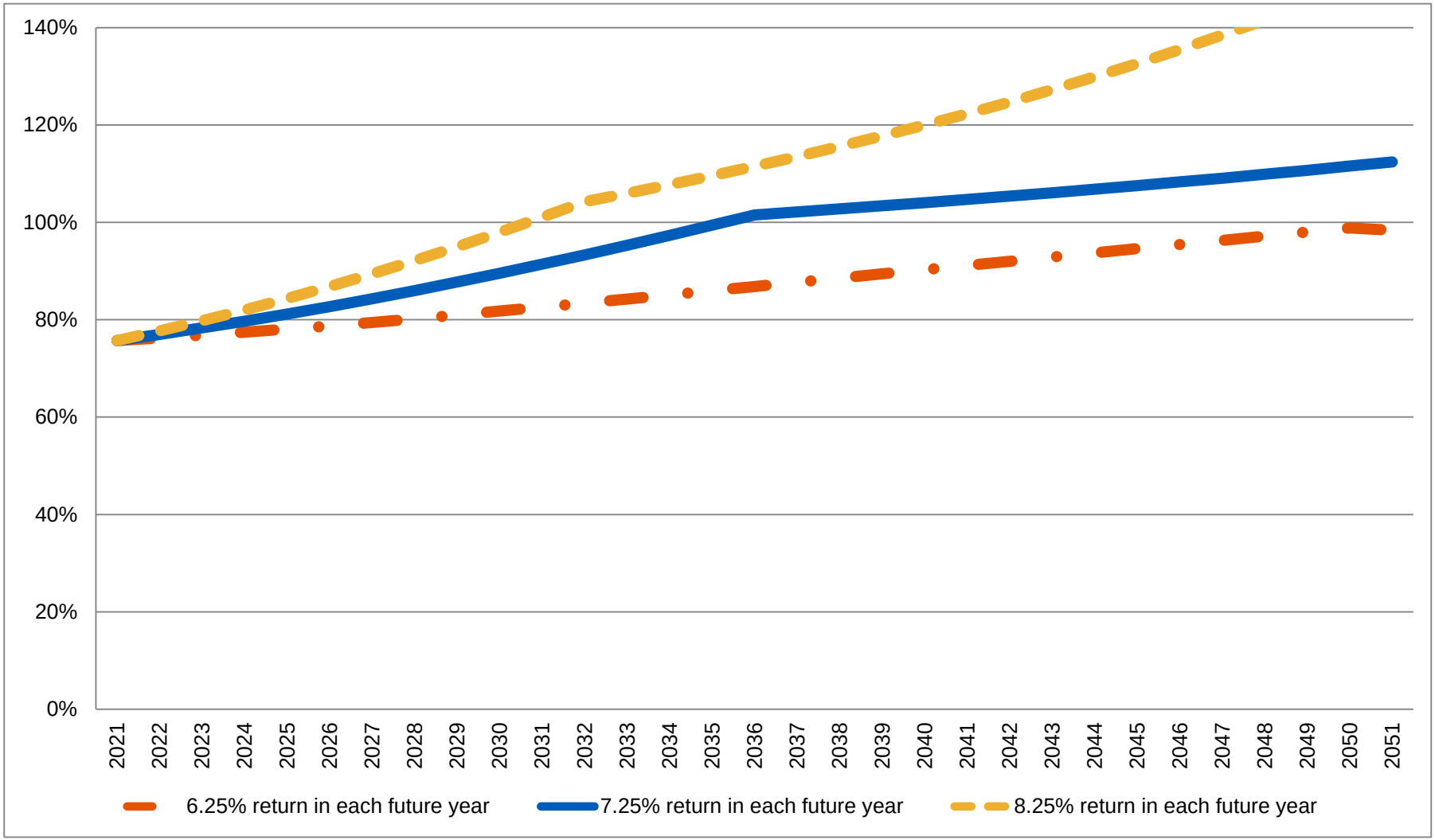
This sensitivity projection assumes one year (i.e., FY22) at each of the above returns, followed by assumed returns of 7.25% in each year thereafter.

Projected Funded Ratios (MVA Basis)



This sensitivity projection assumes one year (i.e., FY22) at each of the above returns, followed by assumed returns of 7.25% in each year thereafter.

Projected Funded Ratios (MVA Basis)
Actual Returns +1% or -1% of Assumed



This sensitivity projection assumes that the Fund will earn either 6.25%, 7.25%, or 8.25% per year, each year in the future, beginning with FY22.

Appendix

Items

- Additional Asset Information
- Gain/Loss History
- Projection Results in Tabular Format
- Glossary

Market Value of Assets ($ in millions)

	Fiscal Year Ending June 30, 2020	Fiscal Year Ending June 30, 2021
Beginning of Year	$2,616	$2,651
Contributions:		
• Employer	93	98
• Member	86	91
• Service Purchases	2	3
• Total	181	192
Benefits and Refunds	(233)	(244)
Investment Income (net)	86	684
End of Year	$2,651	$3,282
Rate of Return	3.33%	26.07%

Note: numbers may not add due to rounding

Actuarial Value of Assets ($ in millions)

1. Market Value of Assets as of June 30, 2020	$2,651
2. Cash Flow Items for FYE June 30, 2021	(52)
3. Expected Return	190
4. Expected Market Value of Assets (1) + (2) + (3)	$2,789
5. Actual Market Value of Assets on June 30, 2021	3,282
6. Excess/(Shortfall) for FYE June 30, 2021 (5) – (4)	(494)

Excess/(Shortfall) Returns:

Year	Initial Amount	Deferral %	Unrecognized Amount
2020	$494	80%	$395
2019	(115)	60%	(69)
2018	(59)	40%	(24)
2017	30	20%	6
2016	103	0%	0
7. Total			$309

8. Actuarial Value of Assets as of June 30, 2021 (5) – (7)	$2,974
Actuarial Value of Assets as a % of Market Value of Assets	90.6%

Note: numbers may not add due to rounding

Five-Year History of Gain/(Loss)

$ in thousands	July 1, 2021	July 1, 2020	July 1, 2019	July 1, 2018	July 1, 2017
Investments	$83,839	($40,947)	($34,821)	$4,586	$9,464
Admin expenses	(547)	233	(59)	116	(275)
Demographics					
• Turnover	($1,844)	($3,380)	($3,820)	($1,696)	($2,013)
• Retirement	(6,175)	(606)	(1,286)	(3,038)	(1,503)
• Mortality	5,879	9,680	9,738	6,945	9,358
• Salary/service	1,067	18,179	21,896	29,231	9,408
• New entrants	(6,123)	(6,932)	(7,394)	(4,463)	(4,865)
• Miscellaneous	(513)	4,463	5,006	1,584	986
• Subtotal	($7,709)	$21,403	$24,139	$28,564	$11,371
Total	**$75,583**	**($19,311)**	**($10,742)**	**$33,266**	**$20,560**

Note: numbers may not add due to rounding

Projected Funded Ratios (AVA Basis)

Valuation Year	24% for FY2022	16% for FY2022	7.25% for FY2022	0% for FY2022	-7.25% for FY2022	-16% for FY2022	-24% for FY2022
2021	69%	69%	69%	69%	69%	69%	69%
2022	74%	73%	72%	71%	70%	68%	65%
2023	80%	77%	75%	72%	70%	67%	64%
2024	86%	82%	78%	74%	70%	66%	62%
2025	93%	87%	81%	76%	71%	65%	60%
2030	102%	98%	90%	83%	76%	67%	59%
2035	106%	103%	99%	91%	83%	73%	64%
2040	110%	106%	104%	101%	91%	79%	69%
2045	114%	110%	108%	104%	100%	86%	74%
2050	120%	114%	112%	107%	103%	94%	79%

Projected Funded Ratios (MVA Basis)

Valuation Year	24% for FY2022	16% for FY2022	7.25% for FY2022	0% for FY2022	-7.25% for FY2022	-16% for FY2022	-24% for FY2022
2021	76%	76%	76%	76%	76%	76%	76%
2022	89%	83%	77%	72%	66%	60%	54%
2023	91%	85%	78%	73%	67%	61%	55%
2024	93%	87%	80%	74%	68%	62%	55%
2025	95%	88%	81%	75%	69%	62%	56%
2030	102%	98%	90%	83%	76%	67%	59%
2035	106%	103%	99%	91%	83%	73%	64%
2040	110%	106%	104%	101%	91%	79%	69%
2045	114%	110%	108%	104%	100%	86%	74%
2050	120%	114%	112%	107%	103%	94%	79%

Projected Funded Ratios (MVA Basis)
Actual Returns +1% or -1% of Assumed

Valuation Year	6.25% Return in Each Future Year	7.25% Return in Each Future Year	8.25% Return in Each Future Year
2021	76%	76%	76%
2022	76%	77%	78%
2023	77%	78%	80%
2024	77%	80%	82%
2025	78%	81%	84%
2030	82%	90%	98%
2035	86%	99%	110%
2040	90%	104%	120%
2045	95%	108%	133%
2050	99%	112%	148%

Glossary

Actuarial Accrued Liability For Actives: The equivalent of the accumulated Normal Costs allocated to the years before the valuation date.

Actuarial Accrued Liability For Pensioners: The single-sum value of lifetime benefits to existing pensioners. This sum takes account of life expectancies appropriate to the ages of the pensioners and the interest that the sum is expected to earn before it is entirely paid out in benefits.

Actuarial Cost Method: A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the Actuarially Determined Contribution.

Actuarial Gain or Actuarial Loss: A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two actuarial valuation dates. Through the Actuarial Assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., the plan's assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the Actuarial Assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield in actuarial liabilities that are larger than projected. Actuarial gains will shorten the time required for funding of the actuarial balance sheet deficiency while actuarial losses will lengthen the funding period

Actuarially Equivalent: Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.

Actuarial Present Value (APV): The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.), multiplied by the probability of the occurrence of an event (such as survival, death, disability, termination of employment, etc.) on which the payment is conditioned, and discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Glossary

Actuarial Present Value of Future Plan Benefits: The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would be provide sufficient assets to pay all projected benefits and expenses when due.

Actuarial Valuation: The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for compliance with GASB, such as the ADC and the NPL.

Actuarial Value of Assets (AVA): The value of the plan's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ADC.

Actuarially Determined: Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.

Actuarially Determined Contribution (ADC): The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation. The ADC consists of the Employer Normal Cost and the Amortization Payment.

Amortization Method: A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.

Glossary

Amortization Payment: The portion of the pension plan contribution, or ADC, that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Assumptions or Actuarial Assumptions: The estimates on which the cost of a plan is calculated including:

(a) Investment return - the rate of investment yield that the plan will earn over the long-term future;

(b) Mortality rates - the death rates of employees and pensioners; life expectancy is based on these rates;

(c) Retirement rates - the rate or probability of retirement at a given age;

(d) Turnover rates - the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement;

(e) Salary increase rates - the rates of salary increase due to inflation and productivity growth

Closed Amortization Period: A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Funding Period and Open Amortization Period.

Decrements: Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or termination.

Defined Benefit Plan: A retirement plan in which benefits are defined by a formula applied to the member's compensation and/or years of service.

Defined Contribution Plan: A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.

Employer Normal Cost: The portion of the Normal Cost to be paid by the employers. This is equal to the Normal Cost less expected member contributions.

Glossary

Experience Study: A periodic review and analysis of the actual experience of a plan that may lead to a revision of one or more Actuarial Assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the actuary.

Funded Ratio: The ratio of the actuarial value of assets (AVA) to the actuarial accrued liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than the AVA.

Funding Period or Amortization Period: The term "Funding Period" is used in two ways. First, it is the period used in calculating the Amortization Payment as a component of the ADC. Second, it is a calculated item: the number of years in the future that will theoretically be required to amortize (i.e., pay off or eliminate) the Unfunded Actuarial Accrued Liability, based on the statutory employer contribution rate, and assuming no future actuarial gains or losses.

GASB: Governmental Accounting Standards Board.

GASB 67 and GASB 68: Governmental Accounting Standards Board Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.

Investment Return: The rate of earnings of a plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the plan's assets. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.

Margin: The difference, whether positive or negative, between the statutory employer contribution rate and the Actuarially Determined Contribution.

Net Pension Liability (NPL): The Net Pension Liability is equal to Total Pension Liability minus Plan Fiduciary Net Position.

Glossary

Normal Cost: That portion of the Actuarial Present Value of pension plan benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment in respect of an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of employee contributions and employer Normal Cost unless otherwise specifically stated. Under the entry age normal cost method, the Normal Cost is intended to be the level cost (when expressed as a percentage of pay) needed to fund the benefits of a member from hire until ultimate termination, death, disability, or retirement.

Open Amortization Period: An Open Amortization Period is one that is used to determine the Amortization Payment, but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period with level percentage of payroll is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never decrease, but will become smaller each year, in relation to covered payroll, if the Actuarial Assumptions are realized.

Plan Fiduciary Net Position: GASB term for the market value of assets.

Total Pension Liability (TPL): The actuarial accrued liability based on the blended discount rate as described in GASB 67/68.

Unfunded Actuarial Accrued Liability (UAAL): The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.

Valuation Date or Actuarial Valuation Date: The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.

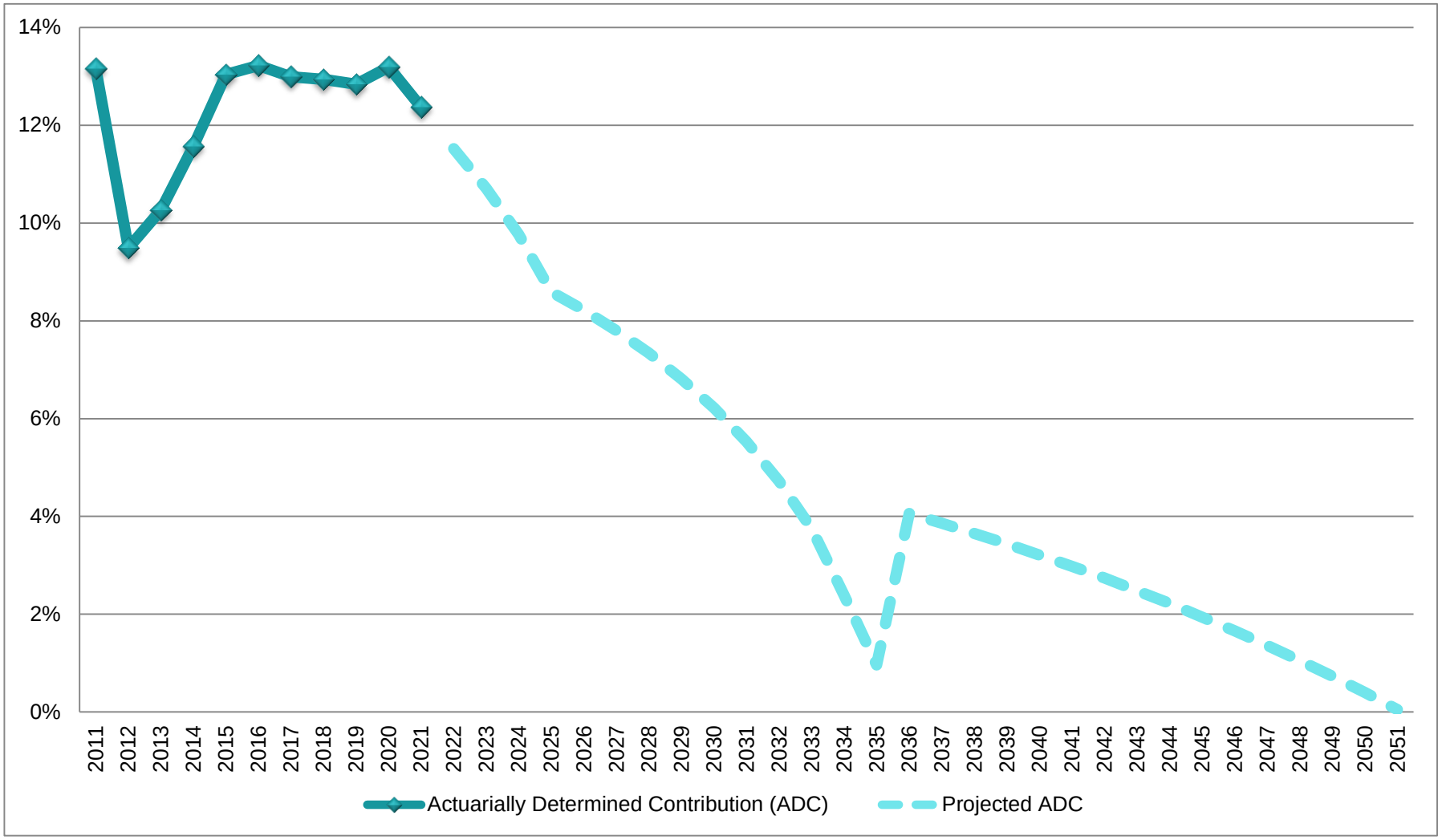
Caveats

This presentation is based on the results of the July 1, 2021, actuarial valuation performed for the Board of Trustees of the North Dakota Teachers' Fund for Retirement. The actuarial valuation report has information on the plan provisions, data, methods and assumptions used in the valuation. Use of the information in this presentation is subject to the caveats described in that document. The measurements in this presentation may not be appropriate for purposes other than those described in the actuarial valuation report.

Segal valuation results are based on proprietary actuarial modeling software. The actuarial valuation models generate a comprehensive set of liability and cost calculations that are presented to meet regulatory, legislative and client requirements. Deterministic cost projections are based on our proprietary forecasting model. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models and reviews test lives and results, under the supervision of the responsible actuary.

Suggested Slides to Remove

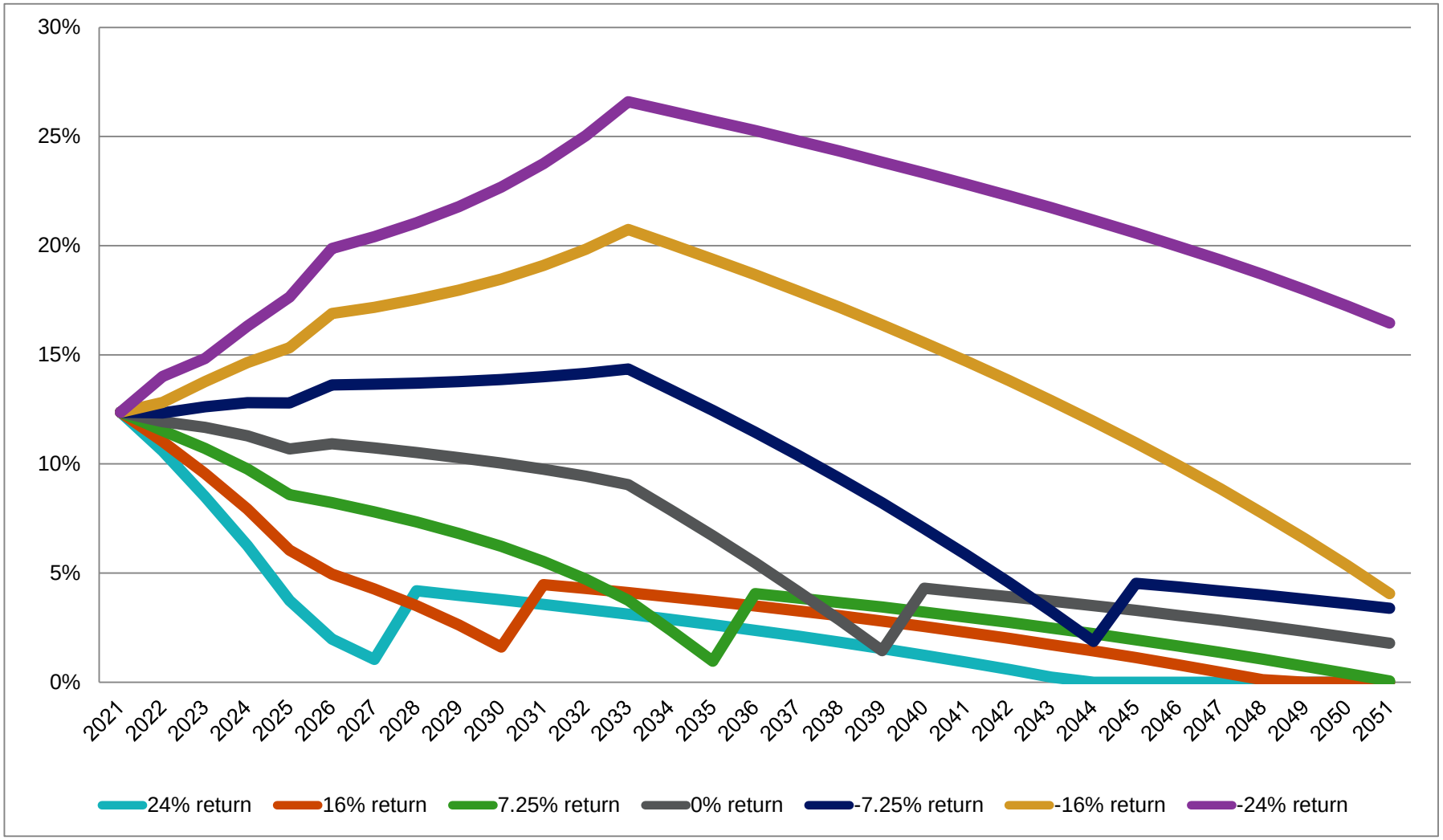
Actuarially Determined Contribution (ADC)



- For 2009 - 2013, the calculation of the ADC was based on a 30-year open level percentage of payroll amortization.
- Beginning in 2013, the period is 30-year closed. In 2033, when the remaining period reaches 10 years, it is assumed to operate as 10-year open
- 2012 and 2013 reflect the actuarial present value of contribution increases effective July 1, 2014.

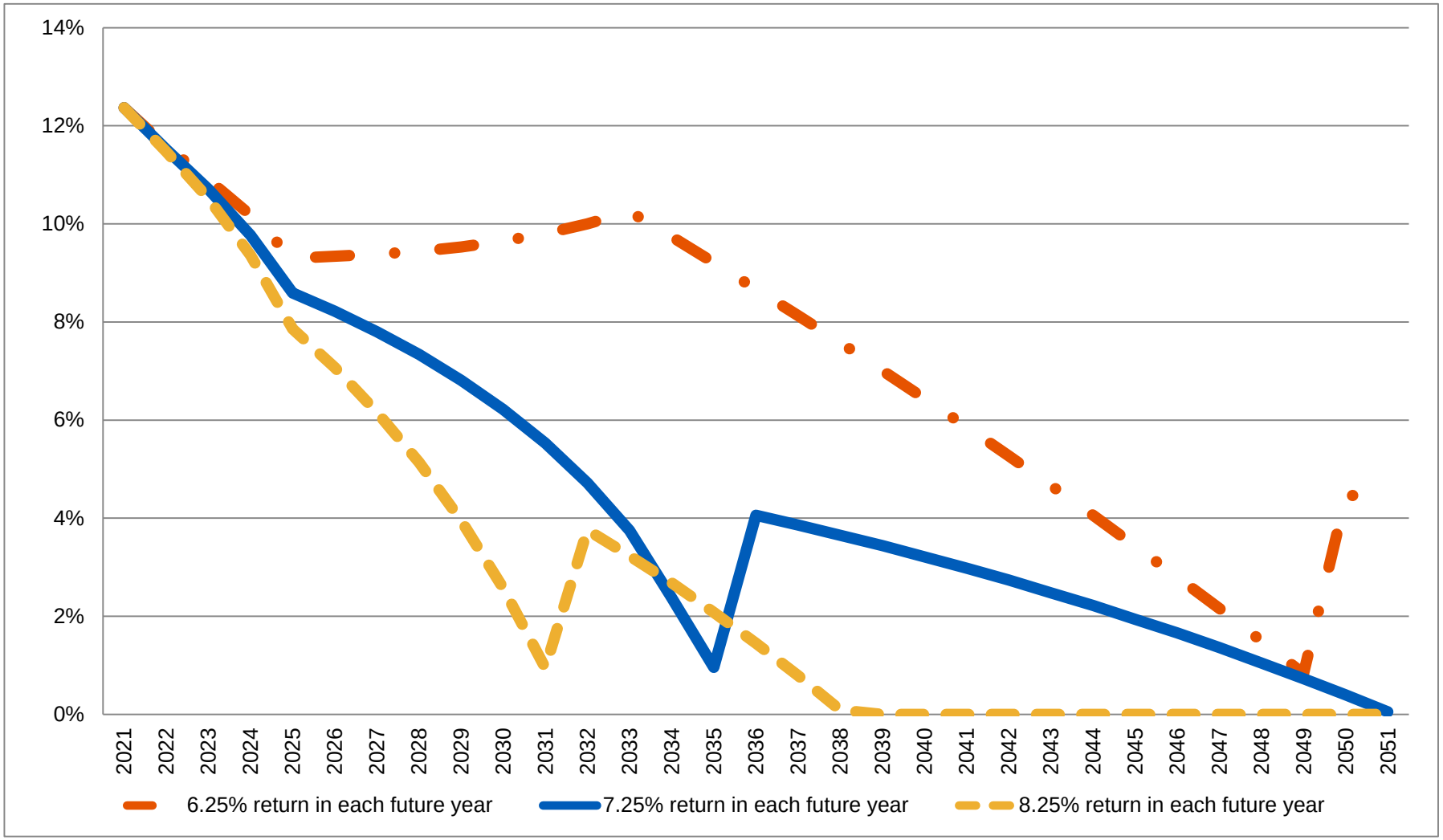
Projection based on all assumptions, including 7.25% investment return, realized as expected

Projected ADC



This sensitivity projection assumes one year (i.e., FY22) at each of the above returns, followed by assumed returns of 7.25% in each year thereafter.

Projected ADC
Actual Returns +1% or -1% of Assumed



This sensitivity projection assumes that the Fund will earn either 6.25%, 7.25%, or 8.25% per year, each year in the future, beginning with FY22.

Next Steps

- Policy score based on 2020 valuation is +6
  - From March 3, 2021, presentation
  - Reflects impact of newly adopted actuarial assumptions
- Update Policy score based on 2021 valuation and updated capital market assumption basis
  - Present in Q1 2022

Projected Margin (AVA Basis)

Valuation Year	24% for FY2022	16% for FY2022	7.25% for FY2022	0% for FY2022	-7.25% for FY2022	-16% for FY2022	-24% for FY2022
2021	0.38%	0.38%	0.38%	0.38%	0.38%	0.38%	0.38%
2022	2.16%	1.72%	1.23%	0.82%	0.42%	-0.07%	-1.26%
2023	4.25%	3.19%	2.04%	1.08%	0.13%	-1.02%	-2.08%
2024	6.49%	4.82%	2.98%	1.46%	-0.06%	-1.89%	-3.57%
2025	9.01%	6.70%	4.16%	2.06%	-0.04%	-2.58%	-4.89%
2030	4.53%	11.14%	6.53%	2.71%	-1.11%	-5.72%	-9.93%
2035	5.12%	4.05%	11.79%	6.04%	0.30%	-6.63%	-12.96%
2040	6.52%	5.20%	4.54%	3.45%	5.71%	-2.80%	-10.58%
2045	7.75%	6.63%	5.81%	4.46%	3.22%	1.79%	-7.83%
2050	7.75%	7.75%	7.35%	5.69%	4.15%	7.41%	-4.48%

* The projected margin is based on a 30-year closed period starting July 1, 2013. Once the period declines to 10 years remaining, the projected margin is based on a 10-year open period.

** If an overfunded position exists, the surplus is amortized over a 30-year open period.

Projected ADC

Valuation Year	24% for FY2022	16% for FY2022	7.25% for FY2022	0% for FY2022	-7.25% for FY2022	-16% for FY2022	-24% for FY2022
2021	12.37%	12.37%	12.37%	12.37%	12.37%	12.37%	12.37%
2022	10.59%	11.03%	11.52%	11.93%	12.33%	12.82%	14.01%
2023	8.50%	9.56%	10.71%	11.67%	12.62%	13.77%	14.83%
2024	6.26%	7.93%	9.77%	11.29%	12.81%	14.64%	16.32%
2025	3.74%	6.05%	8.59%	10.69%	12.79%	15.33%	17.64%
2030	3.22%	1.61%	6.22%	10.04%	13.86%	18.47%	22.68%
2035	2.63%	3.70%	0.96%	6.71%	12.45%	19.38%	25.71%
2040	1.23%	2.55%	3.21%	4.30%	7.04%	15.55%	23.33%
2045	0.00%	1.12%	1.94%	3.29%	4.53%	10.96%	20.58%
2050	0.00%	0.00%	0.40%	2.06%	3.60%	5.34%	17.23%

* The projected margin is based on a 30-year closed period starting July 1, 2013. Once the period declines to 10 years remaining, the projected margin is based on a 10-year open period.

** If an overfunded position exists, the surplus is amortized over a 30-year open period.

Projected ADC
Actual Returns +1% or -1% of Assumed

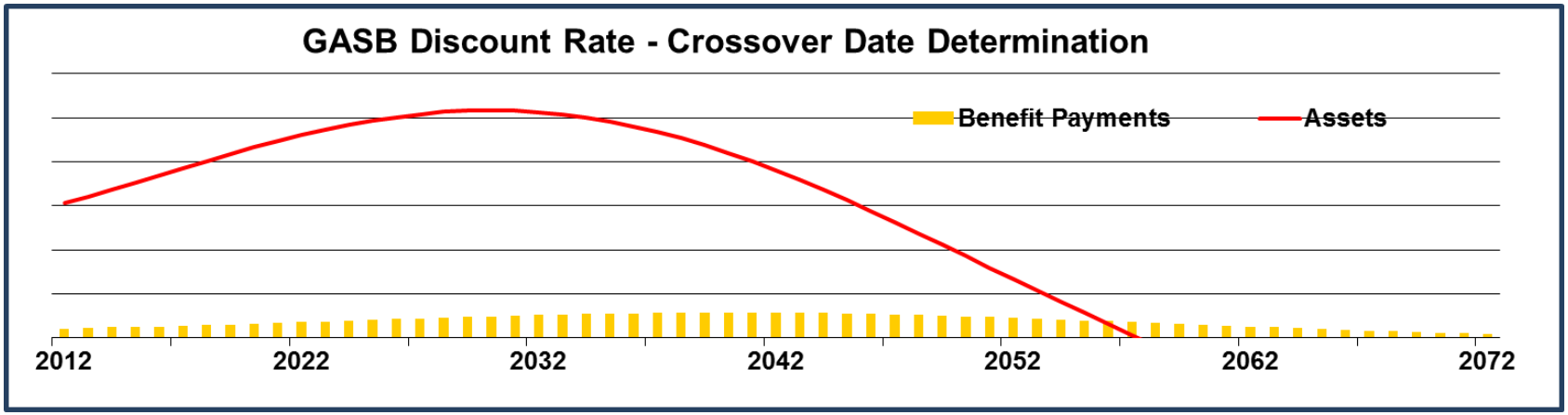
Valuation Year	6.25% Return in Each Future Year	7.25% Return in Each Future Year	8.25% Return in Each Future Year
2021	12.37%	12.37%	12.37%
2022	11.58%	11.52%	11.47%
2023	10.90%	10.71%	10.52%
2024	10.18%	9.77%	9.36%
2025	9.30%	8.59%	7.86%
2030	9.65%	6.22%	2.58%
2035	9.21%	0.96%	2.08%
2040	6.44%	3.21%	0.00%
2045	3.43%	1.94%	0.00%
2050	4.43%	0.40%	0.00%

GASB Discount Rate

- Determined annually based on a projection of benefit payments and assets
  - Benefit payment projection is for current members
  - Asset projection is based on expected investment return assumption (7.25%) and contributions on behalf of current members
- If projected assets are always sufficient to pay projected benefit payments, the GASB discount rate is equal to the expected investment return assumption
- If not, a blended discount rate must be used
  - For projected benefit payments that are covered by projected assets, the expected return assumption is used
  - For projected benefit payments that are not covered by projected assets, the 2-year AA/Aa tax-exempt municipal bond index is used (2.16%).
    - The date at which projected assets are not sufficient to cover projected benefit payments is called the “crossover date”

GASB Discount Rate

- As an example, the graph below shows the crossover occurring in 2058 for a hypothetical plan.



- Determination if a plan has a crossover date depends on
  - The Fund's current funded ratio
  - Projected future contributions and benefit payments
  - Expected investment return
- As of July 1, 2021, TFFR does not have a crossover date

Net Pension Liability ($ in millions)

Collective TFFR	June 30, 2020	June 30, 2021
Total Pension Liability at 7.25%	$4,181	$4,336
Fiduciary Net Plan Position (i.e., MVA)	2,651	3,282
Net Pension Liability (NPL)	1,531	1,054
Sensitivity to changes in discount rate		
• 1% decrease at 6.25%	$2,039	$1,582
• Current discount rate at 7.25%	1,531	1,054
• 1% increase at 8.25%	1,108	615

Reconciliation of Collective Net Pension Liability

($ in millions)	Total Pension Liability	Plan Fiduciary Net Position	Net Pension Liability
Balance as of June 30, 2020	$4,181	$2,650	$1,531
Changes for the year			
Service cost	87		87
Interest	301		301
Difference between expected and actual experience	8		8
Contributions – employer		98	(98)
Contributions – member		91	(91)
Contributions – purchased service credit and other		3	(3)
Net investment income		684	(684)
Benefit payments and refunds of contributions	(241)	(241)	-
Administrative expense		(3)	3
Changes of assumptions	-		-
Change of benefit terms	-		-
Net changes	155	632	(477)
Balance as of June 30, 2021	$4,336	$3,282	$1,054

Note: numbers may not add due to rounding

Collective Pension Expense ($ in millions)

	Year ending June 30, 2020	Year ending June 30, 2021
Service cost	$81	$87
Interest on the total pension liability	307	301
Projected earning on plan investments	(201)	(190)
Contributions – member	(86)	(91)
Contributions – purchased service credit and other	(2)	(3)
Administrative expense	2	3
Current year of recognition of:		
• Change of assumptions	32	32
• Difference between expected and actual experience	(11)	(12)
• Difference between projected and actual earning on pension plan investments	39	(91)
• Change of benefit terms	0	0
Total pension expense	$161	$37

Note: numbers may not add due to rounding