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Montana Public Employees Retirement Association

Experience Study Results
Six-year Period Ending June 30, 2016

Presented May 11, 2017
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Actuarial Valuations

- Best estimate of ultimate costs
- Requires use of assumptions to estimate benefit payouts
  - When?
  - How much?
  - How long?
- Assumptions should represent the best estimate of future experience
- Each assumption should be individually reasonable

Actuarial Assumptions

- No “correct” assumptions
  - Blend of art and science
  - Range of acceptable assumptions
- More aggressive assumptions are more likely to generate actuarial losses in future years; more conservative assumptions are likely to generate actuarial gains.
- Assumptions are long term estimates.
  - Experience emerges short term
  - Year-to-year fluctuations expected
- Most powerful assumption is the investment return assumption.
- Ultimate responsibility for selection of assumptions lies with the Board of Trustees.

Selection of Assumptions

Economic

- Investment Return
- Payroll Growth Rate
- Inflation

Demographic

- Retirement Rates
- Merit Pay Increases
- Disability
- Turnover
- Mortality

Our Philosophy

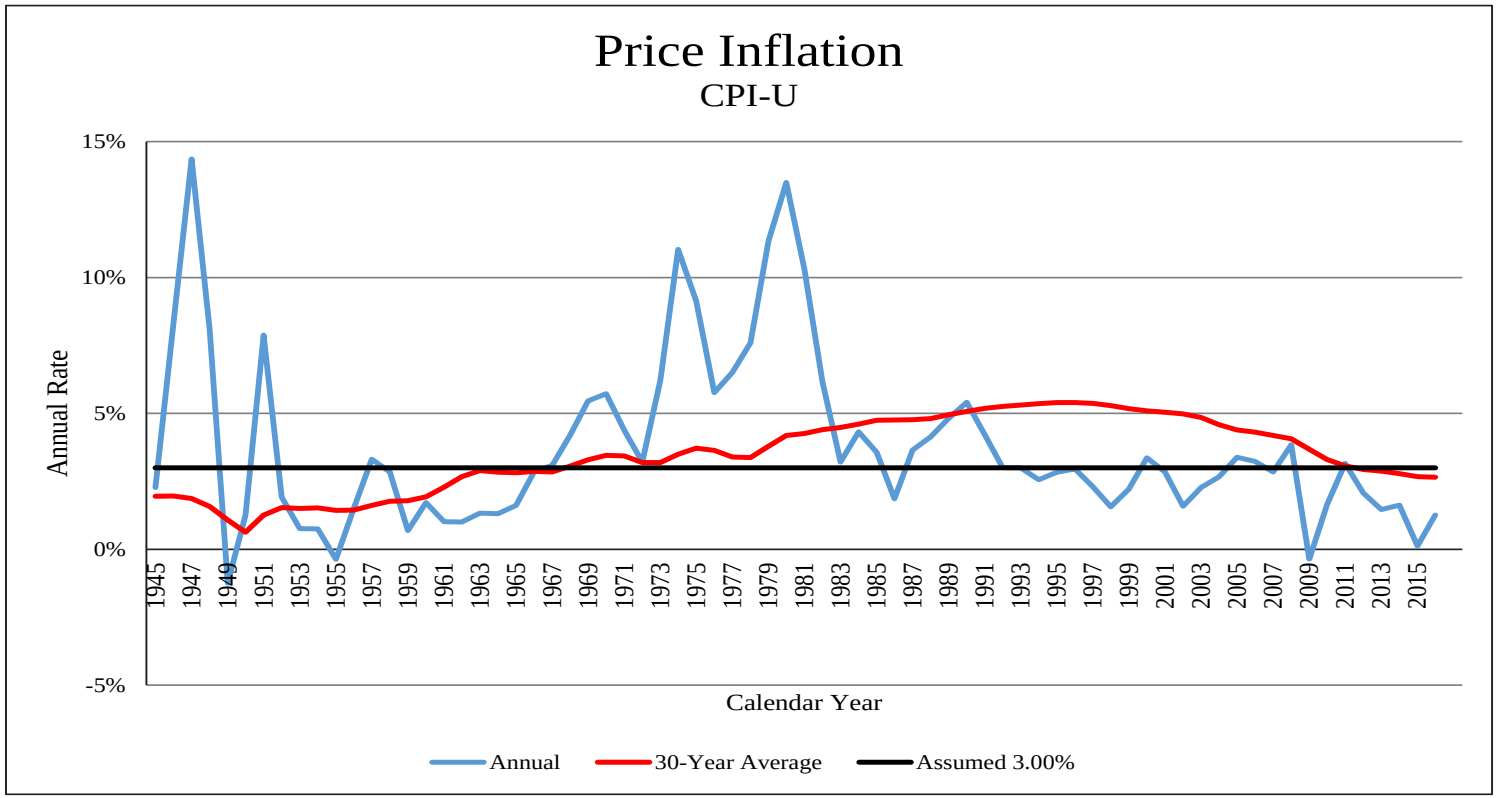
- Do Not Overreact
  - Typically, we do not make significant changes in actuarial assumptions unless a major event causes changes in expectations.
- Anticipate Trends
  - If an identified trend is expected to continue, like improved retiree mortality experience, then our assumptions should reflect these anticipated trends.
- Simplify
  - We identify which factors are significant and eliminate the ones that will not have a material impact on results.

Economic Assumptions

- Assumptions reviewed
  - Price inflation
  - Investment return
  - Wage inflation
- Actuarial Standard of Practice (ASOP) No. 27, *"Selection of Economic Assumptions for Measuring Pension Obligations"* provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans.

Economic Assumptions
Price Inflation

- Current assumption: 3.00%
- Historical data: Annual CPI (U) Increases



Economic Assumptions
Price Inflation

- Recommendation:
  - Expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration
    - In the most recent report, the projected average annual increase in the CPI over the next 75 years was estimated to be 2.60%.
  - Based on this data we recommend lowering the inflation assumption.

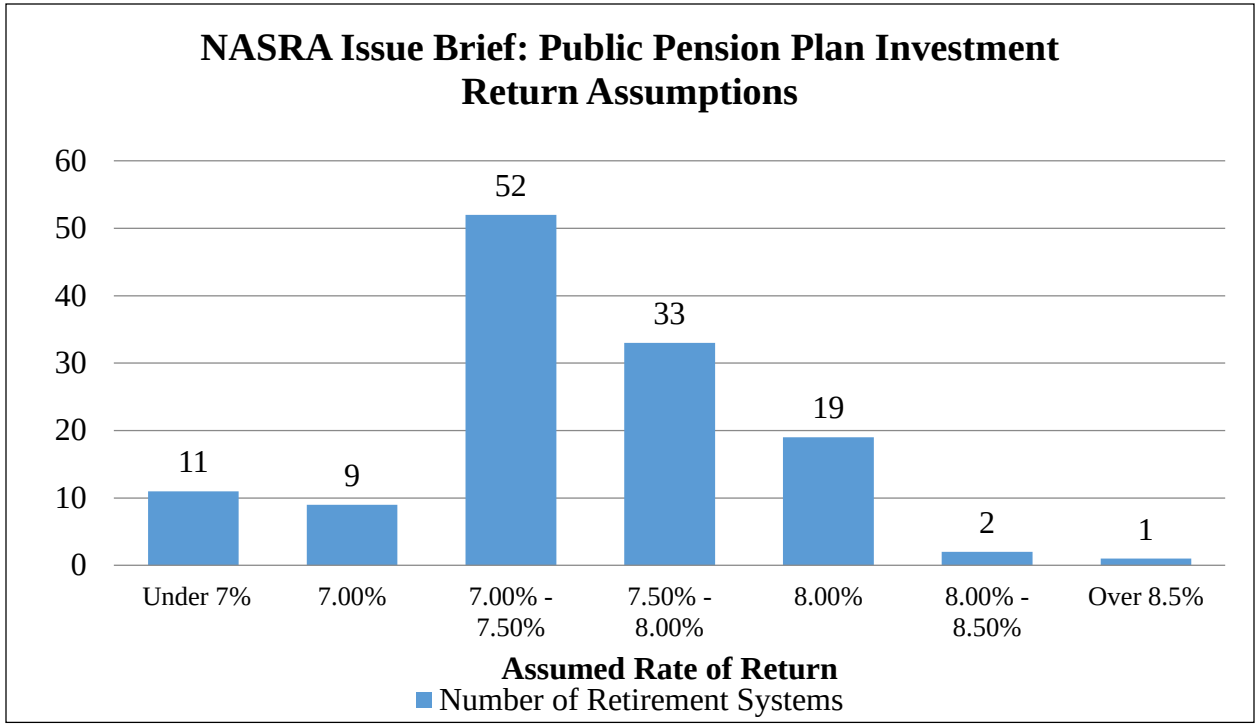
Price Inflation Assumption	
Current	3.00%
Recommended	2.75%

Economic Assumptions
Investment Return

- Recent Experience

Market Value Rate of Return								
Year Ending 6/30	PERS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2006	8.98%	8.97%	8.94%	8.61%	9.03%	8.65%	8.66%	8.58%
2007	17.92%	17.94%	17.87%	17.78%	18.07%	17.36%	17.36%	17.52%
2008	(4.91%)	(4.83%)	(4.86%)	(4.87%)	(4.83%)	(4.86%)	(4.80%)	(4.65%)
2009	(20.85%)	(20.61%)	(20.53%)	(20.23%)	(20.98%)	(20.32%)	(20.08%)	(20.69)%
2010	12.91%	12.82%	12.65%	12.21%	13.04%	12.02%	11.99%	12.30%
2011	21.70%	21.65%	21.57%	21.36%	21.79%	20.72%	20.71%	20.98%
2012	2.27%	2.20%	2.32%	2.31%	2.24%	2.40%	2.42%	1.67%
2013	12.99%	12.72%	12.88%	12.69%	12.88%	12.42%	12.43%	12.01%
2014	17.12%	17.03%	17.08%	16.97%	17.10%	16.53%	16.53%	16.23%
2015	4.60%	4.59%	4.60%	4.58%	4.60%	4.52%	4.52%	4.49%
2016	2.02%	2.06%	2.06%	2.11%	2.04%	2.13%	2.15%	1.84%
Average	6.11%	6.10%	6.11%	6.03%	6.12%	5.86%	5.90%	5.73%

Economic Assumptions
Investment Return



The average assumed rate of return among Public Retirement Systems is 7.52% according to the February 2017 NASRA Issue Brief: "Public Pension Plan Investment Return Assumptions"

Economic Assumptions
Investment Return

- Stochastic projection expected range of real rates of return, net of expenses:

Time Span In Years	Mean Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	4.37%	13.04%	-15.60%	-4.77%	3.56%	12.63%	27.08%
5	3.72	5.78	-5.49	-0.25	3.56	7.52	13.49
10	3.64	4.08	-2.93	0.85	3.56	6.35	10.49
20	3.60	2.88	-1.07	1.64	3.56	5.53	8.41
30	3.59	2.35	-0.23	1.99	3.56	5.16	7.51
50	3.58	1.82	0.61	2.34	3.56	4.80	6.61

- Based on current capital market assumptions and policy target asset allocation

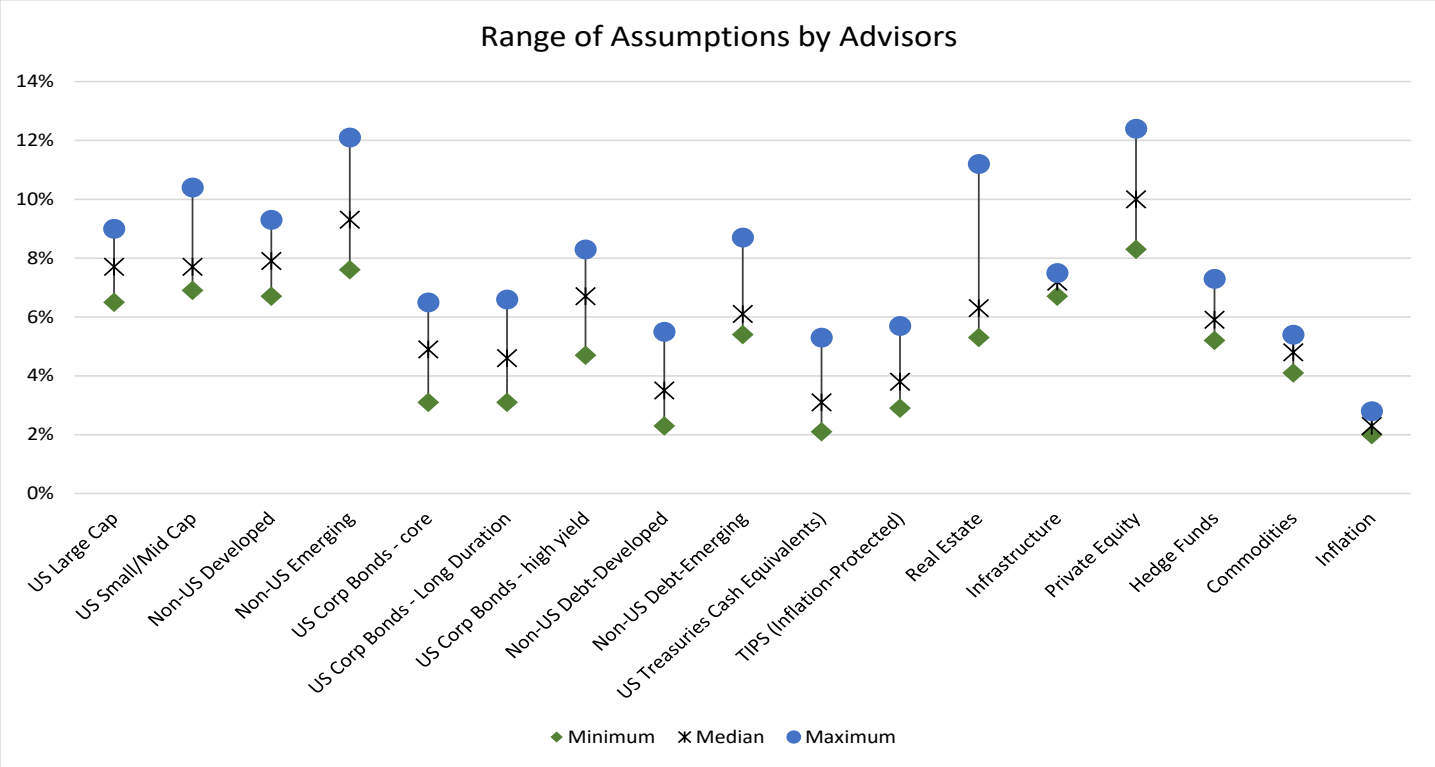
Economic Assumptions
Investment Return

- Stochastic Projection Approach
  - Projection results – 50 years:

Item	25th Percentile	50th Percentile	75th Percentile
Real Rate of Return	2.34%	3.56%	4.80%
Inflation	2.75%	2.75%	2.75%
Net Investment Return	5.09%	6.31%	7.55%

Economic Assumptions
Investment Return

The table below illustrates a survey of long-term economic assumption prepared by Horizon Actuarial Services.



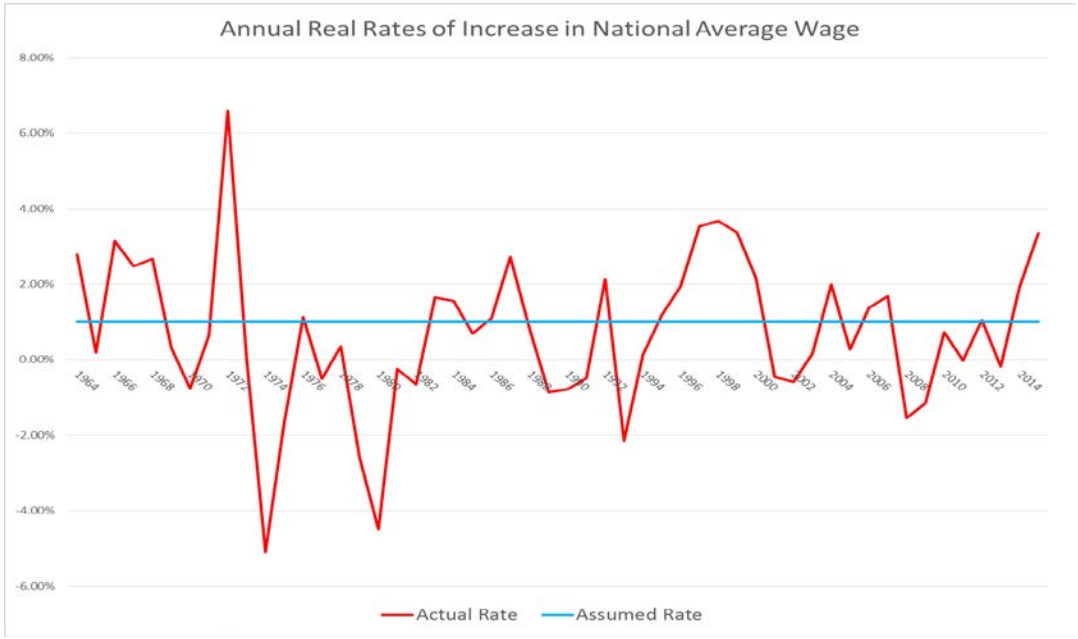
Economic Assumptions
Investment Return

- Recommend reducing the assumed rate of return from 7.75% to 7.65%, which is greater than the 50th percentile
- In general, there is an overall pessimism about future performance regarding financial markets.
- The average assumed rate of return of large public retirement systems has been declining.
- Recommend reviewing the assumed rate of return assumption on an annual basis

Investment Return Assumption	
Current	7.75%
Recommended	7.65%

Economic Assumptions
Wage Inflation

- Current assumption: 4.00%, which is 1.00% above prior price inflation assumption of 3.00%
- Social Security Administration data



Economic Assumptions
Wage Inflation

- Historical Experience:

Period	Wage Inflation	Price Inflation	Real Wage Growth
2006-2015	2.5%	1.8%	0.7%
1996-2015	3.3%	2.1%	1.2%
1986-2015	3.6%	2.7%	0.9%
1976-2015	4.4%	3.7%	0.7%
1966-2015	4.8%	4.1%	0.7%
1956-2015	4.6%	3.7%	0.9%

Economic Assumptions
Wage Inflation

- Social Security 75-year projection of national wage growth assumption is 1.2% greater than price inflation.
- Recommendation

Wage Inflation Assumption	
Current	4.00%
Recommended	3.50%

Demographic Assumptions

- Assumptions Reviewed
  - Post-Retirement Mortality
  - Pre-Retirement Mortality
  - Rates of Service Retirement
  - Rates of Disability Retirement
  - Rates of Withdrawal
  - Rates of Salary Increase for Merit and Promotions

- Actuarial Standard of Practice (ASOP) No. 35, *"Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations"* provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans.

Demographic Assumptions

- Study compares what actually happened during the study period with what was expected to happen.
- Assumption changes are recommended if actual experience differs significantly from expected.
- Judgment is required to extrapolate future experience from past experience.

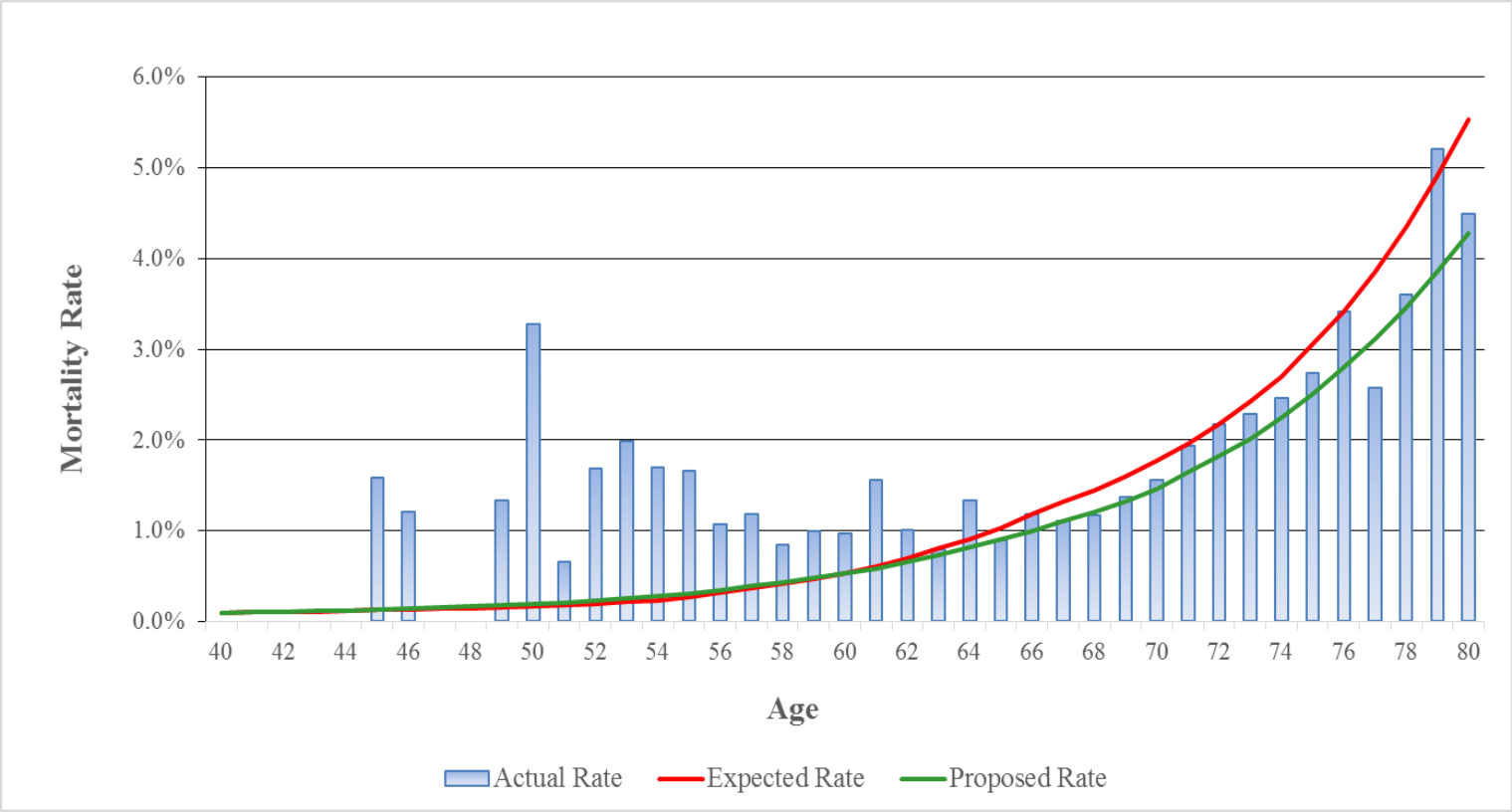
Demographic Assumptions

- Funds reviewed
  - PERS
  - JRS
  - SRS
  - GWPORS
  - HPORS
  - MPORS
  - FURS
  - VFCA
- Results compare actual and expected decrements and present recommended change, if any.

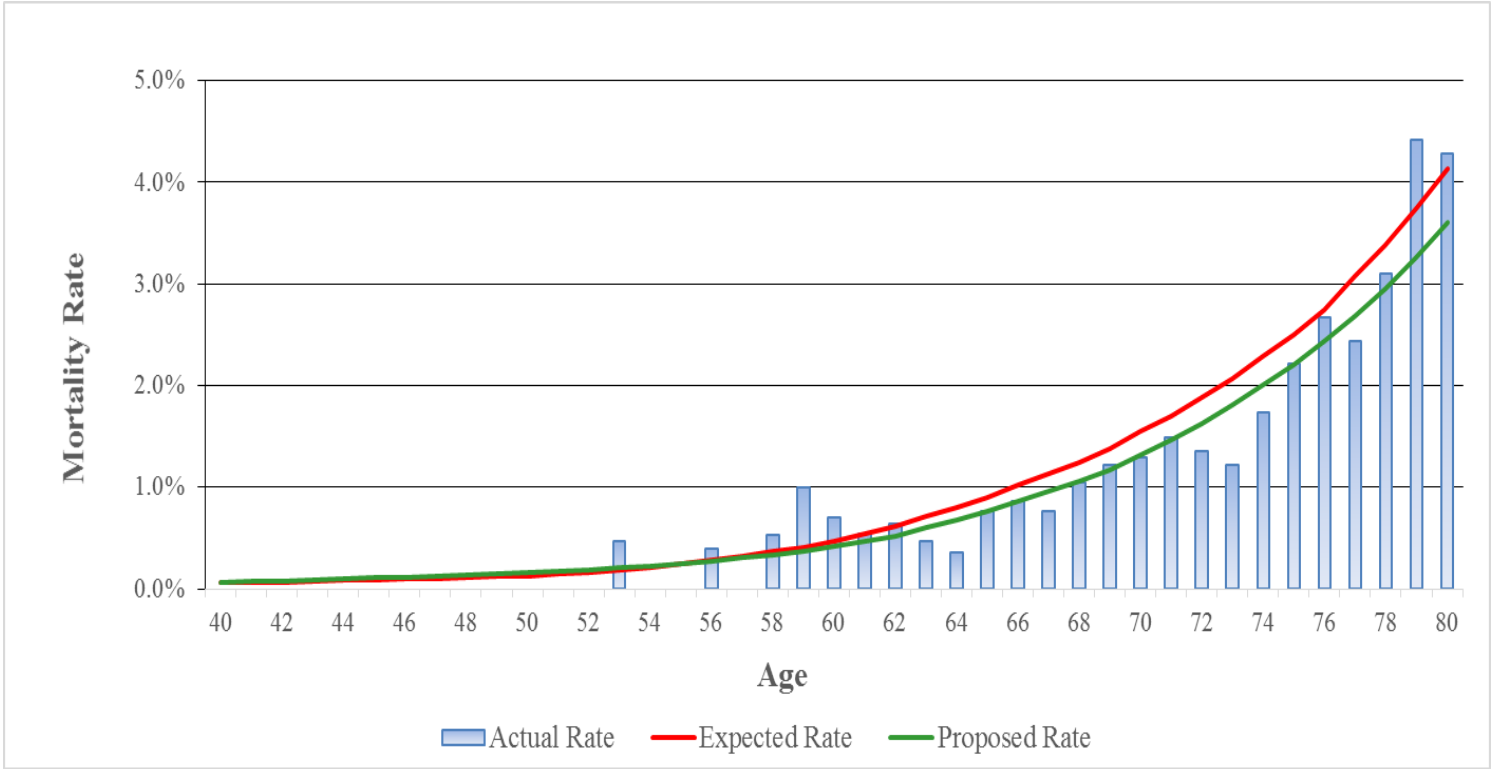
Demographic Assumptions (Healthy Mortality)

- Mortality experience was analyzed for all Systems combined.
- Experience yielded actual/expected ratios of 94% and 98% respectively for healthy male and female mortality experience.
- Mortality table assumption must provide a margin for mortality improvement which is indicated by an actual expected ratio greater than 100%.
- Recommend change in healthy mortality to the RP-2000 Combined Mortality Table to 2020 using the BB projection scale, set back 1 year for males.
- Actual expected ratio under proposed assumption is 118% and 113% for males and females respectively.
- Active mortality experience is not credible to develop a unique mortality assumption, therefore active mortality follows the same assumption as the healthy post-retirement mortality assumptions.

Demographic Assumptions (Healthy Male Mortality)



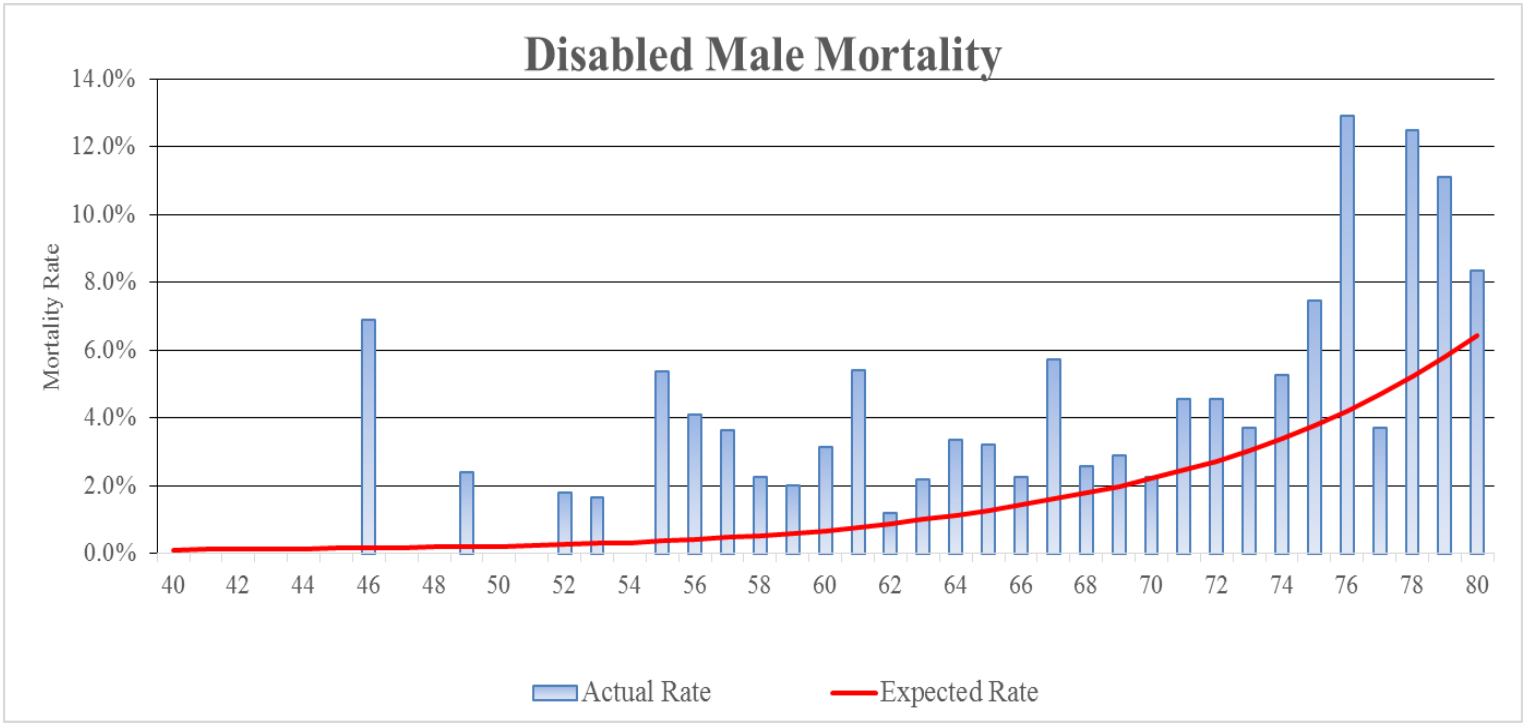
Demographic Assumptions (Healthy Female Mortality)



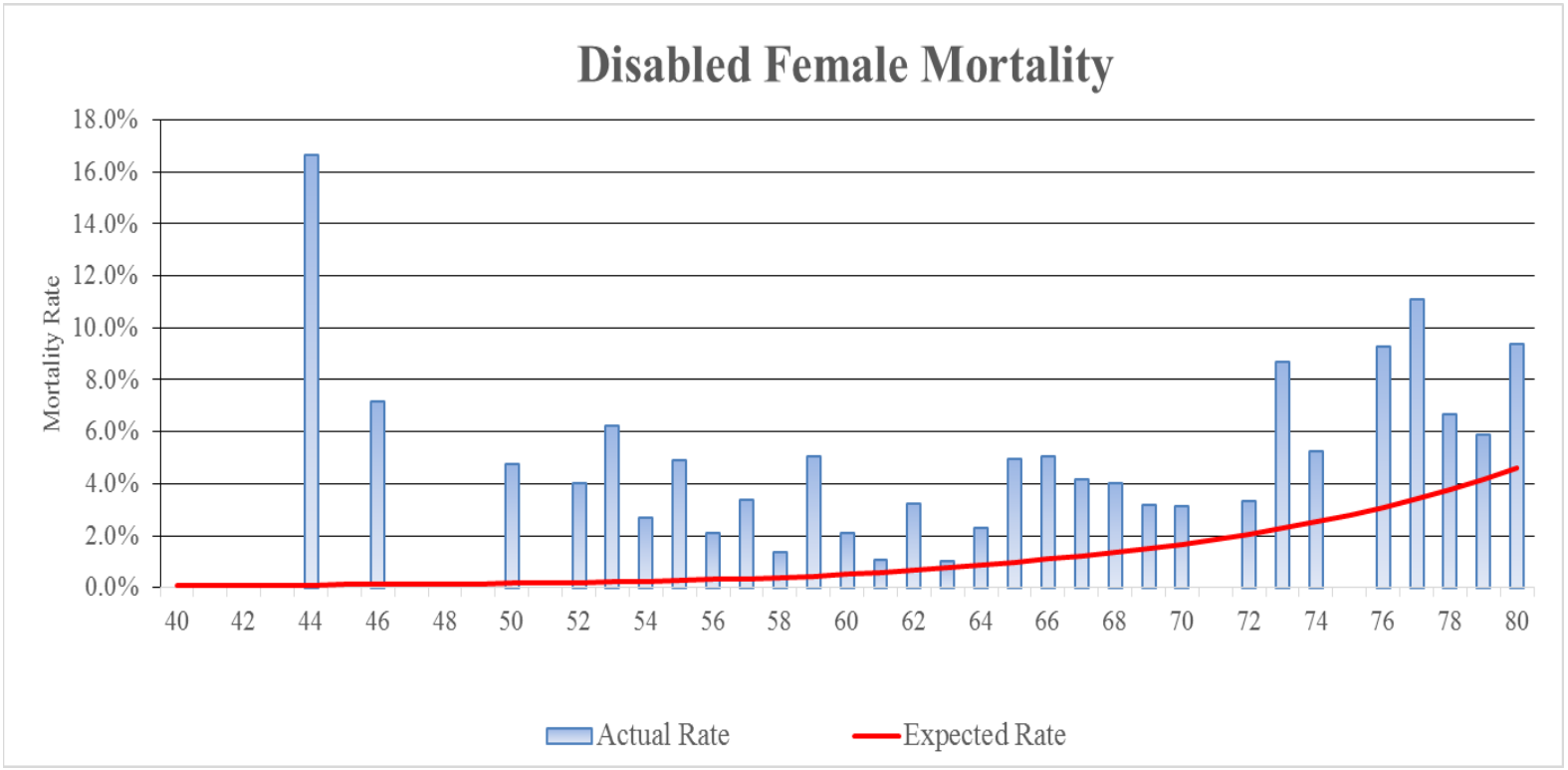
Demographic Assumptions (Disabled Mortality)

- Experience yielded actual/expected ratios of 177% and 235% respectively for disabled male and female mortality experience.
- Disabled mortality table assumption provides a significant margin for mortality improvement which is indicated by an actual expected ratio greater than 100%.
- Ratio greater than 100% indicates that there were more deaths than expected during the experience period.
- Recommend no change to the RP-2000 Combined Mortality Table for Males and Females.

Demographic Assumptions (Disabled Male Mortality)



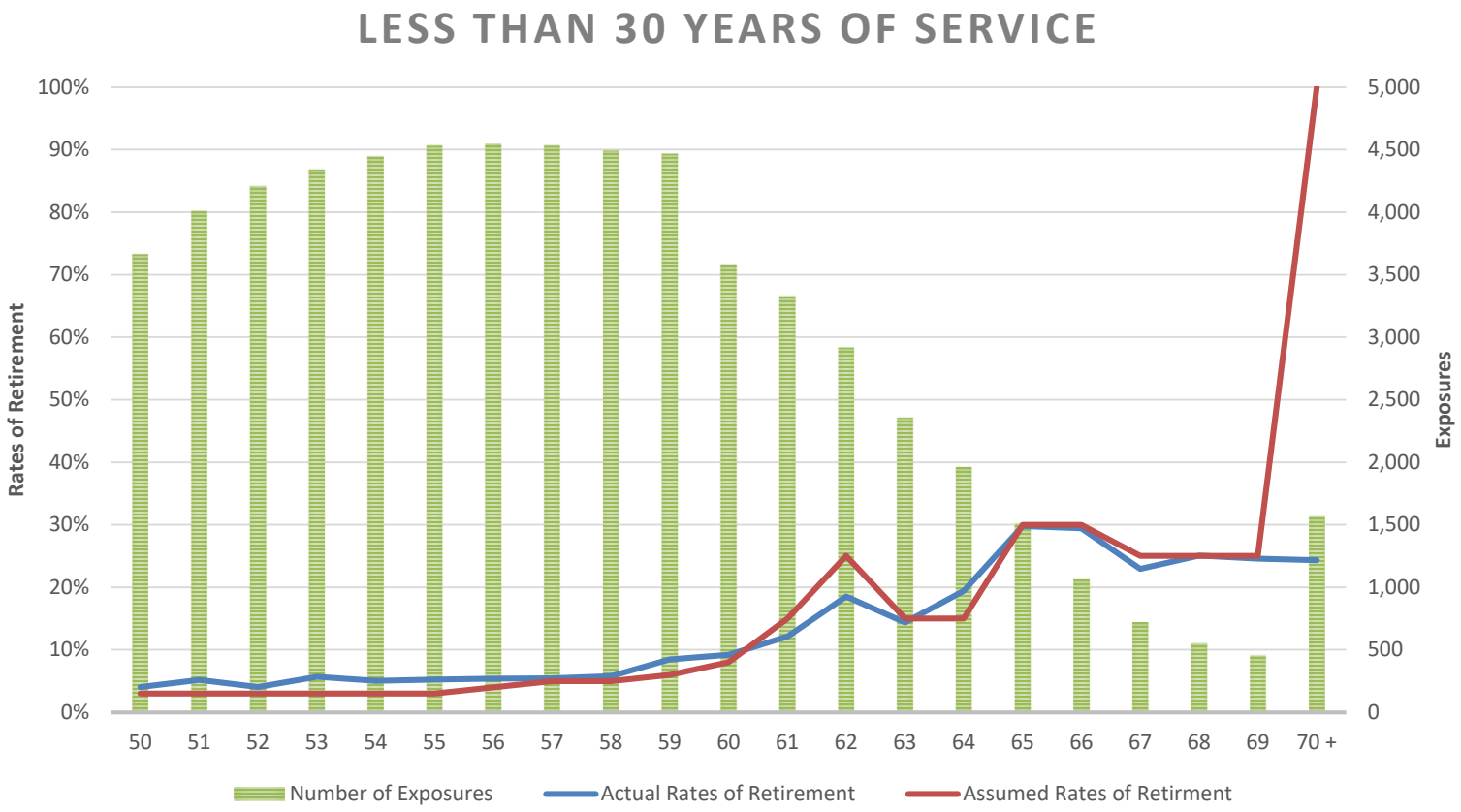
Demographic Assumptions (Disabled Female Mortality)



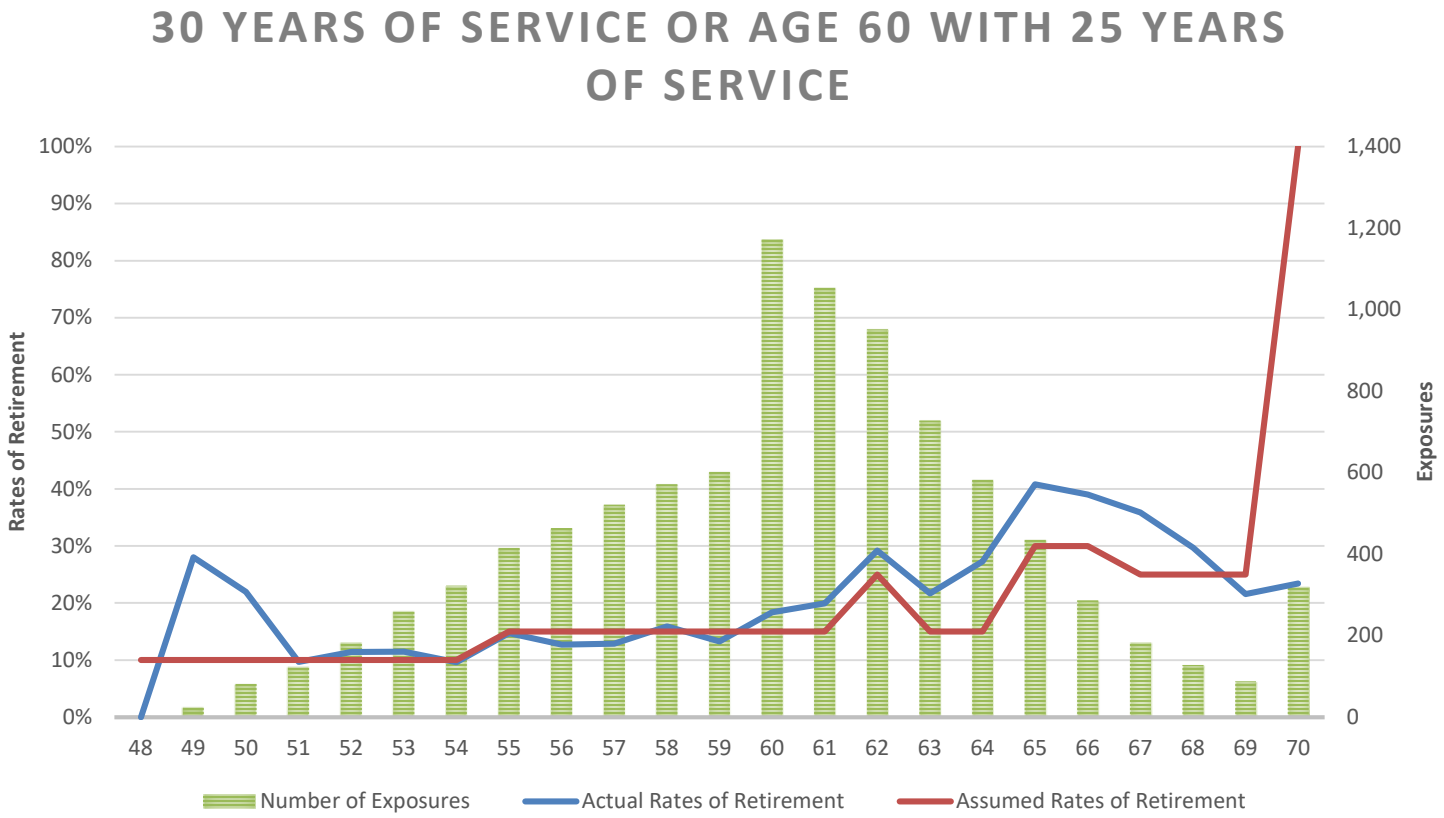
PERS Demographic Assumptions (Service Retirements)

- Reduced retirement benefit
  - Retirement experience was investigated separately for members who had less than 30 years of service and for members who had 30 or more years of service or who were at least age 60 with at least 25 years of service.
  - Experience yielded actual/expected ratios of 95%.
  - In general, retirements were less than anticipated.
  - Current experience is reasonable, therefore we do not recommend updating the assumption at this time.

PERS Demographic Assumptions (Service Retirements)



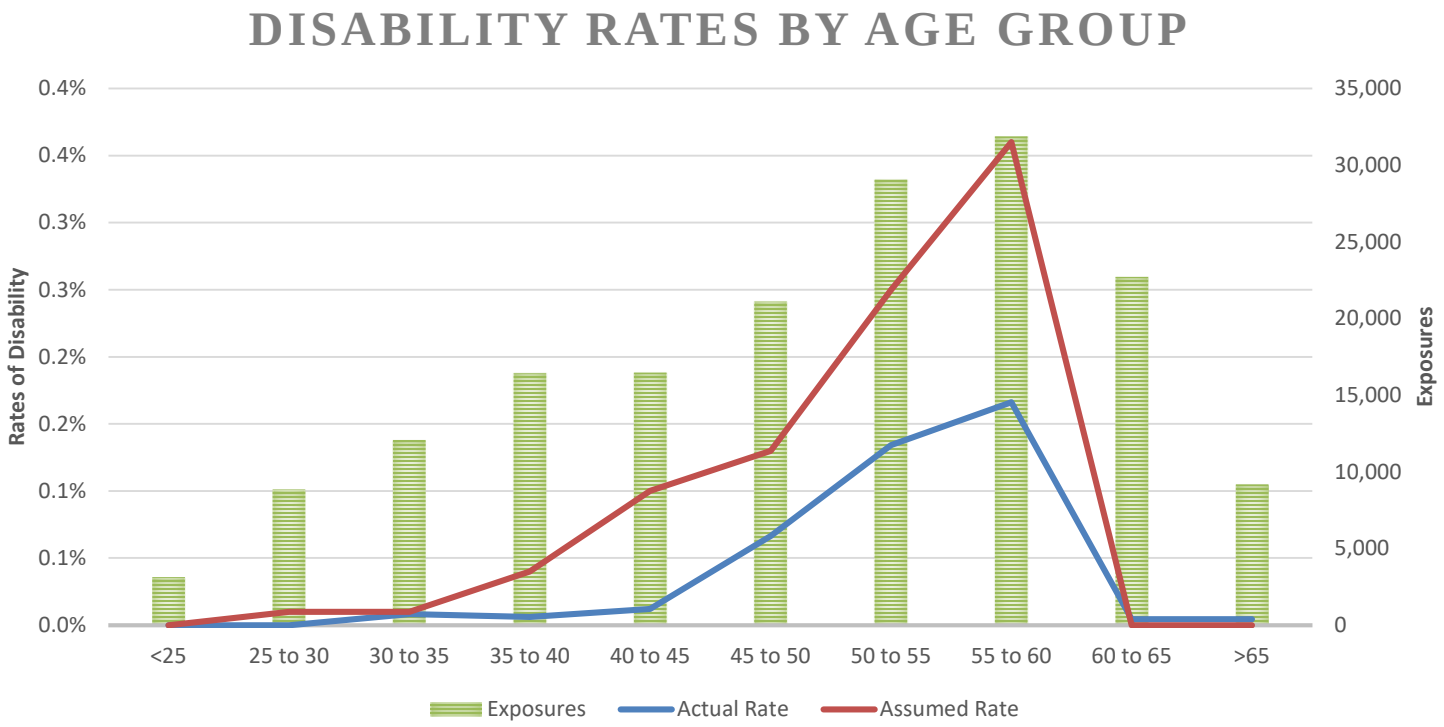
PERS Demographic Assumptions (Service Retirements)



PERS Demographic Assumptions (Disability Retirements)

- Experience yielded an actual/expected ratio of 46%.
- An actual/expected ratio that is less than 100% indicates that the number of disability retirements over the experience period was less than anticipated.
- Disability retirements represent are a small component of the Retirement System's obligation.
- Recommend no change in this assumption

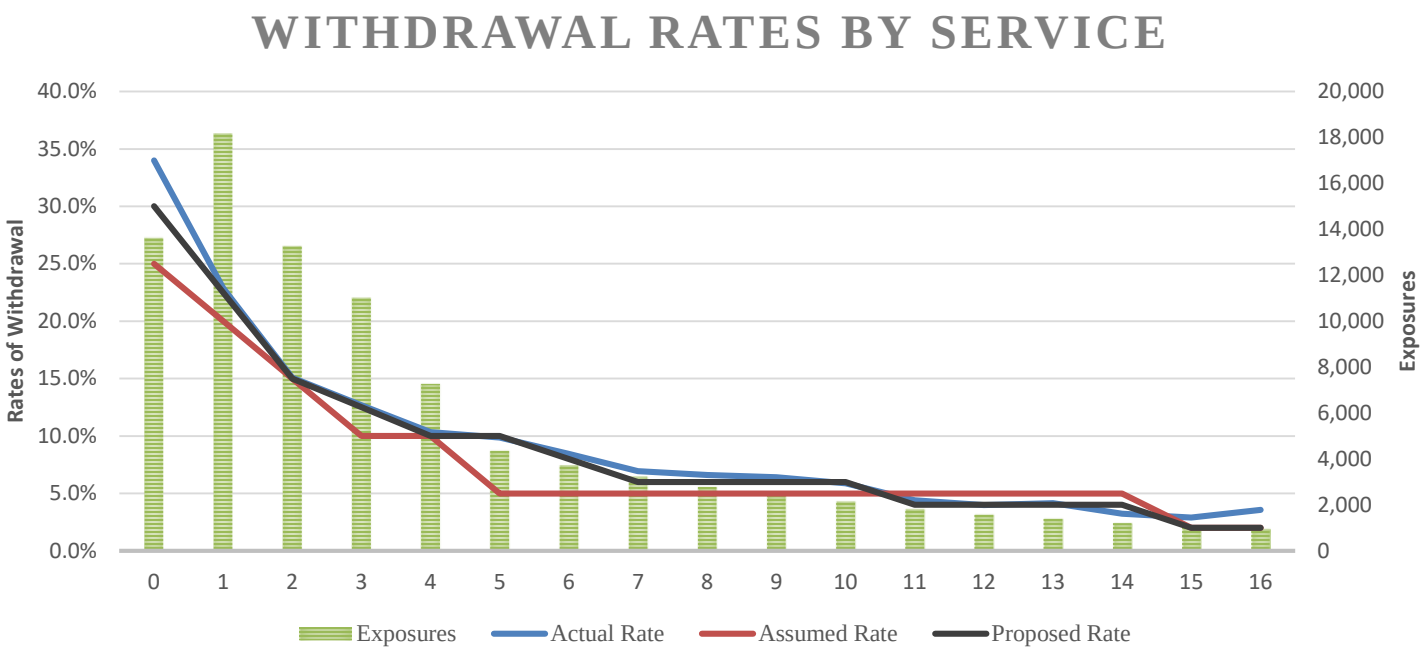
PERS Demographic Assumptions (Disability Retirements)



PERS Demographic Assumptions (Withdrawal Rates)

- Experience yielded actual/expected ratio of 121%.
- A ratio greater than 100% indicates that there were more withdrawals than expected.
- Overall, the assumed rates of withdrawal underestimated the number withdrawals during the experience period.
- Recommend revising assumption to better match experience

PERS Demographic Assumptions (Withdrawal Rates)



PERS Demographic Assumptions (Salary Increase Experience)

- Experience yields an actual/expected ratio equal to 98.9%.
- A ratio less than 100% indicates that salary increases were less than expected for the investigation period.
- We have recommended a decrease in wage inflation, which is a component of salary scale. This will drop expected total salary scale by 0.50%.
- In addition, changes to the merit component of the salary scales are recommended at this time.
- Actual/expected ratio under recommended salary increase assumption is 99.7%.

PERS Demographic Assumptions

Years of Service	Individual Merit and Longevity	General Wage Inflation	Total Salary Increase*
0 – 1	4.8%	3.50%	8.5%
1 – 2	3.8%	3.50%	7.4%
2 – 3	2.8%	3.50%	6.4%
3 – 4	2.0%	3.50%	5.6%
4 – 5	1.4%	3.50%	4.9%
5 – 6	0.8%	3.50%	4.3%
6 – 7	0.4%	3.50%	3.9%
7 & over	0.0%	3.50%	3.5%

* The total salary increase in a given year is determined by the following formula:

(1 + General Wage Inflation) x (1 + Total Salary Increase)

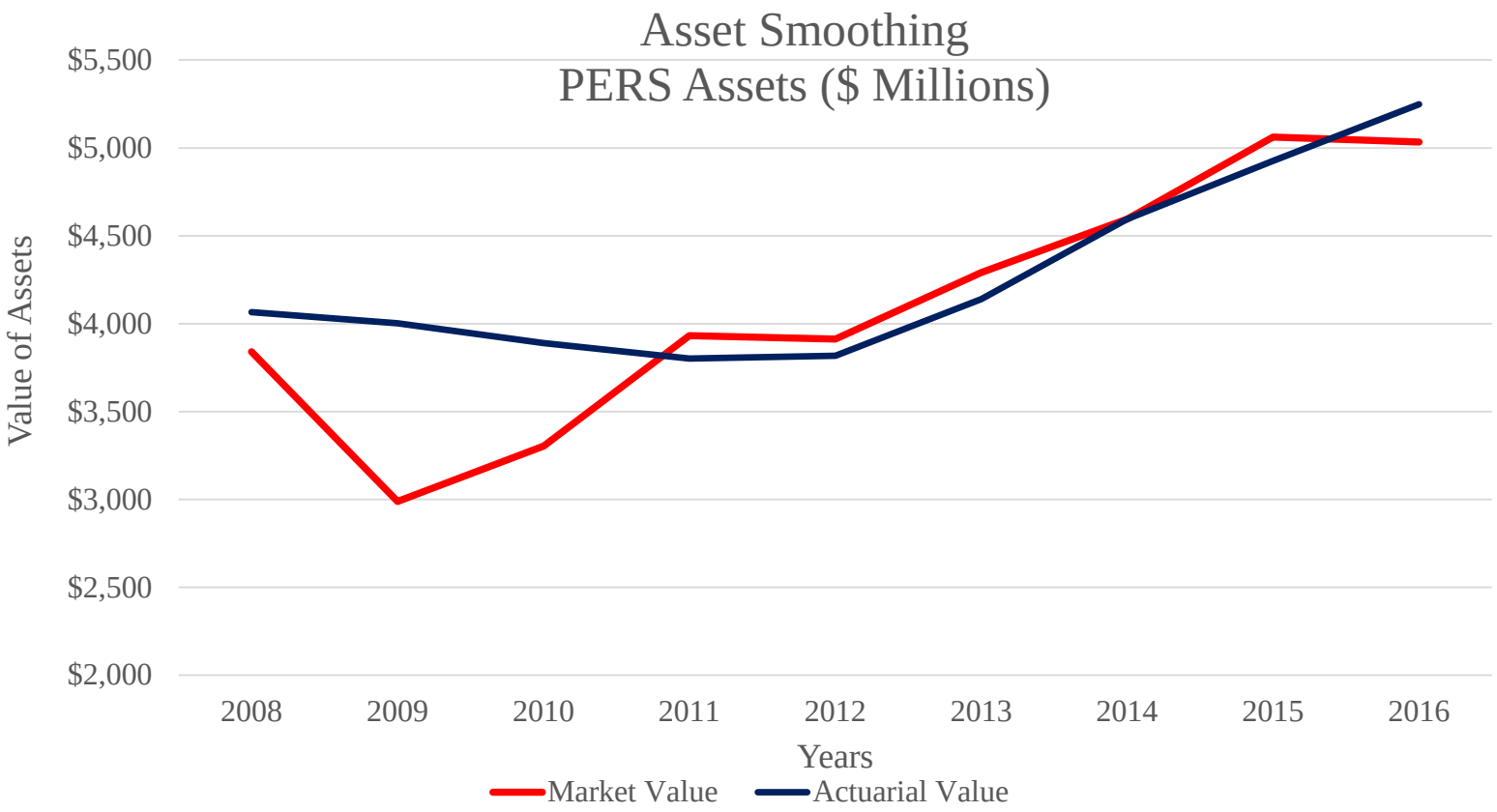
Demographic Assumptions
Other Systems

Retirement Plan	Assumption Changes
Public Employees' Retirement System Long-Term Disability Plan	Non-Disabled Mortality, Withdrawal, Merit Scale
Judges' Retirement System	Non-Disabled Mortality
Sheriffs' Retirement System	Non-Disabled Mortality, Withdrawal, Merit Scale
Game Wardens' and Peace Officers' Retirement System	Non-Disabled Mortality, Withdrawal, Merit Scale
Highway Patrol Officers' Retirement System	Non-Disabled Mortality, Merit Scale
Municipal Police Officers' Retirement System	Non-Disabled Mortality, Withdrawal, Merit Scale
Firefighters' United Retirement System	Non-Disabled Mortality, Withdrawal, Merit Scale
Volunteer Firefighters' Compensation Act	Non-Disabled Mortality, Withdrawal

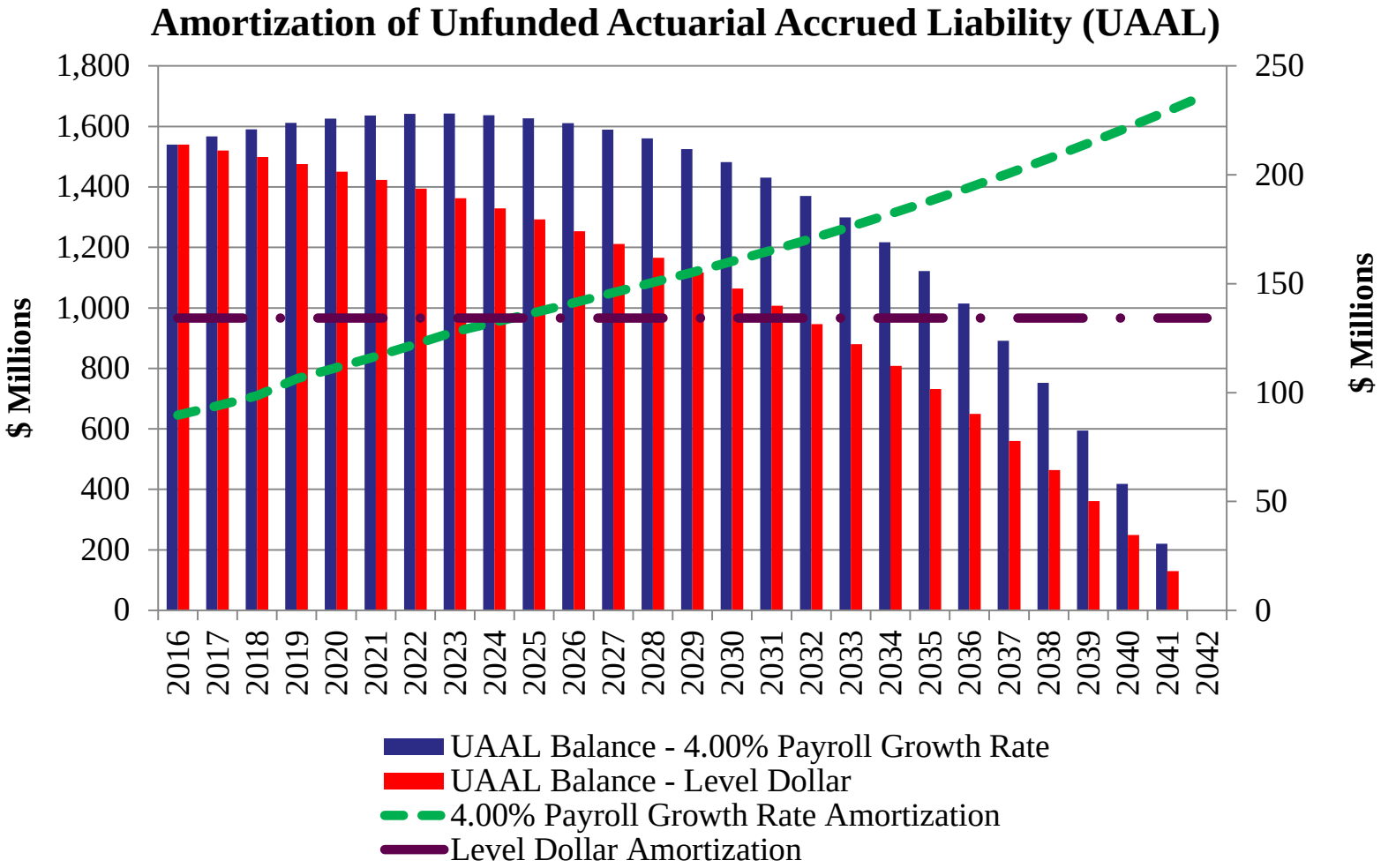
Actuarial Methods

- Actuarial Cost Method
  - Recommend no change in the Entry Age Normal Cost Method for all plans
- Actuarial Smoothing of Assets
  - Recommend no change in 5-year smoothing of market value gains and losses
- Amortization of Unfunded Accrued Liability (UAL)
  - Recommend no change in Level Percent of Payroll Amortization Payment Method
  - UAL is amortized as one single amount each valuation.
  - Amortization period is “open” and is solved for each valuation.
  - Result depends on UAL and fixed contribution rate.

Actuarial Methods



Actuarial Methods



Actuarial Methods

- Payroll Growth Assumption
  - Decrease from 4.00% to 3.50% to be consistent with wage inflation assumption

Actuarial Methods

- Administrative Expense Load
  - Recommend letting administrative expense load vary from year to year based on the prior year's actual administrative expenses for each system

Retirement Plan	Before Change	After Change
Public Employees' Retirement System	0.27%	0.27%
Public Employees' Retirement System Long-Term Disability Plan	0.00%	0.00%
Judges' Retirement System	0.15%	0.17%
Sheriffs' Retirement System	0.17%	0.19%
Game Wardens' and Peace Officers' Retirement System	0.17%	0.17%
Highway Patrol Officers' Retirement System	0.23%	0.28%
Municipal Police Officers' Retirement System	0.20%	0.22%
Firefighters' United Retirement System	0.19%	0.21%
Volunteer Firefighters' Compensation Act	$65,978	$89,298

Impact of Recommendations

Impact of Changes on the Unfunded Accrued Liability

($ in Thousands)

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	$1,540,238	$1,884,706	$344,468
Public Employees' Retirement System Long-Term Disability Plan	473	538	65
Judges' Retirement System	(36,398)	(32,796)	3,602
Sheriffs' Retirement System	62,636	75,730	13,094
Game Wardens' and Peace Officers' Retirement System	30,452	36,910	6,458
Highway Patrol Officers' Retirement System	69,457	77,039	7,582
Municipal Police Officers' Retirement System	161,961	178,090	16,129
Firefighters' United Retirement System	101,413	118,232	16,819
Volunteer Firefighters' Compensation Act	8,708	10,846	2,138

Impact of Recommendations

Impact of Changes on the Funding Ratio

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	77.3%	73.6%	(3.7%)
Public Employees' Retirement System Long-Term Disability Plan	86.8%	85.3%	(1.5%)
Judges' Retirement System	166.5%	156.2%	(10.3%)
Sheriffs' Retirement System	83.2%	80.4%	(2.8%)
Game Wardens' and Peace Officers' Retirement System	84.1%	81.3%	(2.8%)
Highway Patrol Officers' Retirement System	65.8%	63.5%	(2.3%)
Municipal Police Officers' Retirement System	68.8%	66.7%	(2.1%)
Firefighters' United Retirement System	78.3%	75.6%	(2.7%)
Volunteer Firefighters' Compensation Act	80.2%	76.5%	(3.7%)

Impact of Recommendations

Impact of Changes on the Amortization Period

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	26	35	9
Public Employees' Retirement System Long-Term Disability Plan	Infinite	15	N/A
Judges' Retirement System	0	0	No Change
Sheriffs' Retirement System	Infinite	Infinite	No Change
Game Wardens' and Peace Officers' Retirement System	Infinite	Infinite	No Change
Highway Patrol Officers' Retirement System	28	36	8
Municipal Police Officers' Retirement System	18	20	2
Firefighters' United Retirement System	9	10	1
Volunteer Firefighters' Compensation Act	7	8	1