

Section III - Economic Assumptions

Recommendation

It is difficult to predict inflation accurately. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10 and 50 years. Although the 10-year average of 1.73% is lower than the Fund's assumed rate of 2.75%, the longer 50-year average of 3.97% is somewhat higher than GMPF's current rate. The reasonableness of GMPF's assumption is, therefore, dependent upon the emphasis one assigns to the short and long-terms.

Current economic forecasts suggest lower inflation but are generally looking at a shorter time period than appropriate for our purposes. We consider the range included in the Social Security Administration of 1.80% to 3.00% to be reasonable and recommend lowering the inflation assumption for GMPF from 2.75% to 2.50%.

Price Inflation Assumption	
Current	2.75%
Recommended	2.50%



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Investment Return

Background

The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current assumption is 7.50%, consisting of a price inflation assumption of 2.75% and a real rate of return assumption of 4.75%. The current GMPF funding policy states that the long-term expected return on assets assumption, which was set at 7.50% in the previous experience study, shall be reduced by 0.10% per year from the immediate prior valuation when the actual rate of return for the fiscal year exceeds the assumed rate. The minimum return assumption stated in the funding policy is 7.00%. The asset return assumption used in the most recent actuarial valuation is 7.30%.

Long Term Perspective

Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds. For actuarial calculations, we typically consider very long periods of time. For example, a newly hired employee who is 25 years old may work for 35 years, to age 60, and live another 30 years, to age 90 (or longer). The retirement system would receive contributions for the first 35 years and then pay out benefits for the next 30 years. During the entire 65-year period, the system is investing assets related to the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open, ongoing system like GMPF, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions.



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Past Experience

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns, so comparing results over long periods when different asset allocations were in place may not be meaningful.

The assets for the Fund are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value Rate of Return
2015	8.88%	3.73%
2016	7.15	1.40
2017	7.76	12.51
2018	8.26	9.09
2019	7.01	6.96
Average	7.81%	6.67%

While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

Future Expectation Analysis

The Division of Investment Services (DIS) assists the GMPF Board with developing investment strategies and providing capital market assumptions for the GMPF portfolio. As part of their duties, DIS periodically performs asset-liability studies, along with comprehensive reviews of the expected return of the various asset classes in which the GMPF portfolio is invested. We believe it is appropriate to consider the results of DIS' work as one factor in assessing expected future returns.

We also recognize that there can be differences of opinion among investment professionals regarding future return expectations. Horizon Actuarial Services prepares an annual study in which they survey various investment advisors (35 were included in the 2020 study with a 10-year horizon) and provide ranges of results as well as averages. This information provides an



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additional perspective on what a broad group of investment experts anticipate for future investment returns.

Our forward-looking analysis used the real rates of return in the DIS capital market assumptions and the GMPF target asset allocation. Using statistical projections that assume investment returns approximately follow a lognormal distribution with no correlation between years, produces an expected range of real rates of return over a 50-year time horizon. Looking at one year's results produces a mean real return of 6.18%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the real return does not change, but the volatility declines significantly. The table below provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	6.18%	13.90%	-15.04%	-3.58%	5.28%	14.95%	30.46%
5	5.46	6.15	-4.35	1.22	5.28	9.50	15.87
10	5.37	4.35	-1.62	2.39	5.28	8.25	12.66
20	5.32	3.07	0.35	3.23	5.28	7.37	10.45
30	5.31	2.51	1.24	3.60	5.28	6.98	9.48
40	5.30	2.17	1.77	3.82	5.28	6.75	8.91
50	5.30	1.94	2.13	3.98	5.28	6.59	8.52

The percentile results are the percentages of random returns over the time span shown that are expected to be less than the amount indicated. For example, for the 10-year time span, 5% of the resulting real rates of return will be below -1.62% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate there will be a 25% chance that real returns will be below 3.98% and a 25% chance they will be above 6.59%. In other words, there is a 50% chance the real returns will be between 3.98% and 6.59%.

For a broader view of expected returns, we also reviewed the 2020 Survey of Capital Market Assumptions produced by Horizon Actuarial Services, LLC to see what other investment professionals are currently using for capital market assumptions. The Horizon survey includes both 10-year horizon and 20-year horizon capital market assumptions. We applied the same statistical analysis to these survey results as we did the capital market assumptions of DIS with the following real return results for the 20-year horizon:



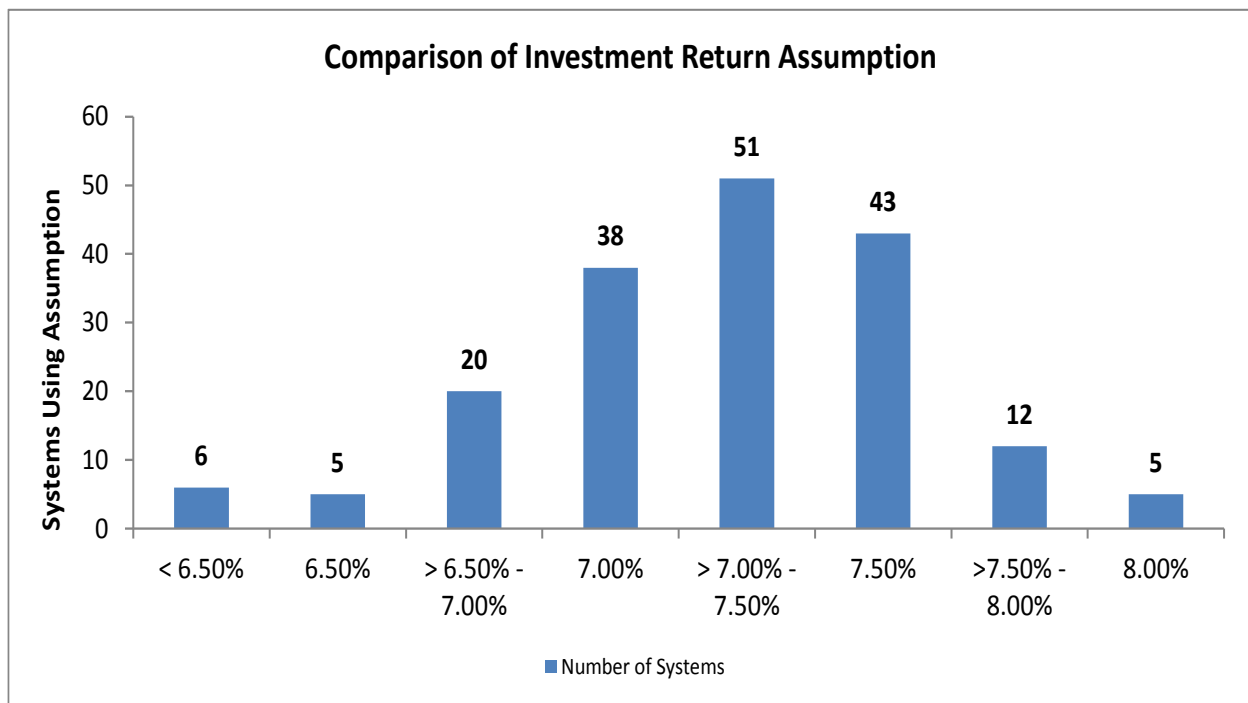
Section III - Economic Assumptions

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	4.85%	11.49%	-12.92%	-3.18%	4.22%	12.19%	24.74%
5	4.35	5.10	-3.82	0.84	4.22	7.71	12.94
10	4.28	3.60	-1.54	1.82	4.22	6.68	10.32
20	4.25	2.55	0.12	2.52	4.22	5.95	8.50
30	4.24	2.08	0.86	2.83	4.22	5.63	7.70
40	4.24	1.80	1.30	3.01	4.22	5.44	7.23
50	4.23	1.61	1.61	3.14	4.22	5.31	6.90

As can be seen from the Horizon survey analysis, the forecast shows that over a 50-year time span, there is a 50% chance that real returns will be between 3.14% and 5.31%. This is slightly lower than the results from DIS' analysis.

Peer Comparison

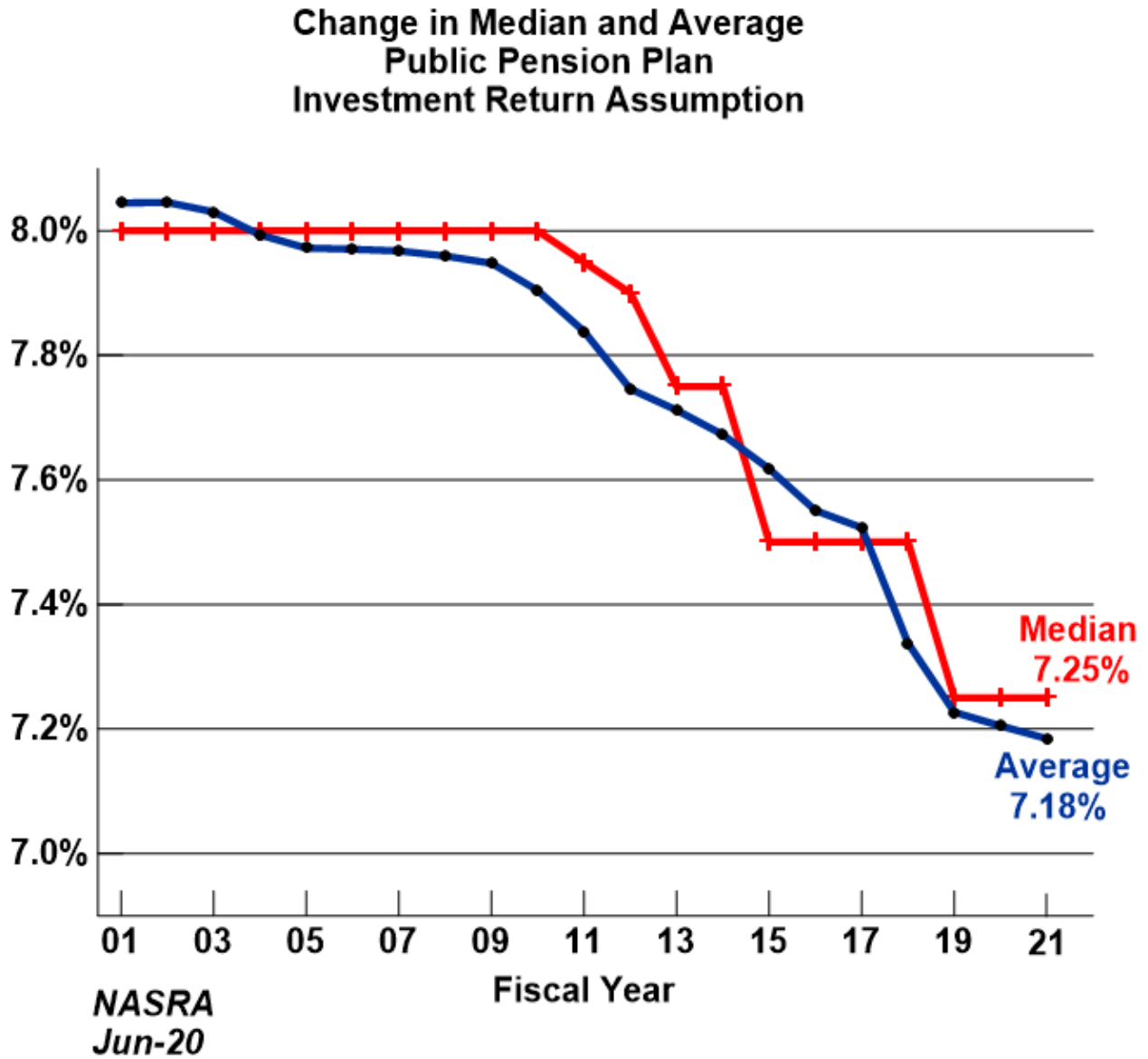
The following chart shows the nominal investment return assumptions of 180 plans in the Public Plan Database of the Center for Retirement Research. The assumptions are from FYE 2019 reporting.





Section III - Economic Assumptions

The following chart shows the changes in expected investment return assumption from the NASRA public plan survey over the last 20 years from 2001.





Section III - Economic Assumptions

Recommendation

By actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or the short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

Based on our analysis of the DIS' capital market assumptions and the Horizon Survey capital market assumptions, we are recommending a reduction in the real return assumption from 4.75% to 4.50%. Based on our recommended inflation assumption of 2.50%, we are recommending a 7.00% expected long term nominal rate of return assumption.

Investment Return Assumption		
	Current*	Recommended
Real Rate of Return**	4.75%	4.50%
Inflation	<u>2.75</u>	<u>2.50</u>
Net Investment Return	7.50%	7.00%

* actual assumption for the 2019 valuation is 7.30% based on the Board funding policy

** net of investment expenses.



Section IV – Actuarial Methods

Actuarial Cost Method

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board (GASB) Statement Numbers 67 and 68 require that the Entry Age Normal (EAN) cost method be used for financial reporting. Most systems do not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most common funding method for public systems for many years. This is the cost method currently used by GMPF.

The rationale of the (EAN funding method is that the cost of each member's benefit is determined to be a level dollar amount from date of hire to the end of employment. This level amount is referred to as the normal cost and is that portion of the total cost of the employee's benefit that is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this amount times the present value of the member's probability of remaining an active member for all future years including the current year. The EAN actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the value of plan assets is subtracted from the EAN actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as anticipated by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate.

Considering that the EAN cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and less volatile, and is the required cost method under calculations required by GASB Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained for GMPF.**



Section IV – Actuarial Methods

Actuarial Value of Assets

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a percentage of payroll or in actual dollars, as opposed to a cost pattern that may be extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations*.

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to manipulate annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost. The 5-year phase-in methodology that GMPF currently uses meets these rules and is, in fact, the most commonly used methodology for plans similar to GMPF.

Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected market value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected market value. **We recommend no change in this methodology.**



Section IV – Actuarial Methods

Amortization of the Unfunded Actuarial Accrued Liability

The actuarial accrued liability is the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of plan assets. These deficiencies can result from:

- (i) plan improvements that have not been completely paid for,
- (ii) experience that is less favorable than expected,
- (iii) assumption changes that increase liabilities, or
- (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

Amortization Period: The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future valuation. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially “refinances” the System’s debt (UAAL) every year.

Amortization Payment: The level dollar amortization method is similar to the method in which a homeowner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor’s population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

Amortization Bases: The UAAL can be amortized either as one single amount or as components or “layers”, each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other changes in the UAAL are folded into the single UAAL



Section IV – Actuarial Methods

amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment schedule and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on that valuation date. The UAAL is then the sum of all the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

Recommendation

In the current GMPF Board funding policy, an actuarially determined employer contribution (ADEC) is calculated during each annual valuation. The methodology in calculating the ADEC is as follows:

- Amortization Period – Closed period with maximum period of 20 years for new bases
- Amortization Payment – Level dollar
- Amortization Bases – Separate bases for all experience gains and losses, assumption changes or benefit changes

We recommend no changes in these methods.



Section V - Demographic Assumptions

There are several demographic assumptions used in the actuarial valuations performed for the Georgia Military Pension Fund. They are:

- Rates of Withdrawal
- Rates of Service Retirement
- Rates of Mortality

The Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 35, “*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*”, which provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

The purpose of a study of demographic experience is to compare what actually happened to the membership during the study period (July 1, 2014, through June 30, 2019) with what was expected to happen based on the assumptions used in the most recent Actuarial Valuations.

Detailed tabulations by age, service and/or gender are performed over the entire study period. These tabulations look at all active and retired members during the period as well as separately annotating those who experience a demographic event, also referred to as a decrement. In addition, the tabulation of all members together with the current assumptions permits the calculation of the number of expected decrements during the study period.

If the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, gender, or service does not follow the expected pattern, new assumptions are recommended. Recommended changes usually do not follow the exact actual experience during the observation period. Judgment is required to extrapolate future experience from past trends and current member behavior.

The remainder of this section presents the results of the demographic study. We have prepared tables that show a comparison of the actual and expected decrements and the overall ratio of actual to expected results (A/E Ratios) under the current assumptions. If a change is being proposed, the revised A/E Ratios are shown as well.



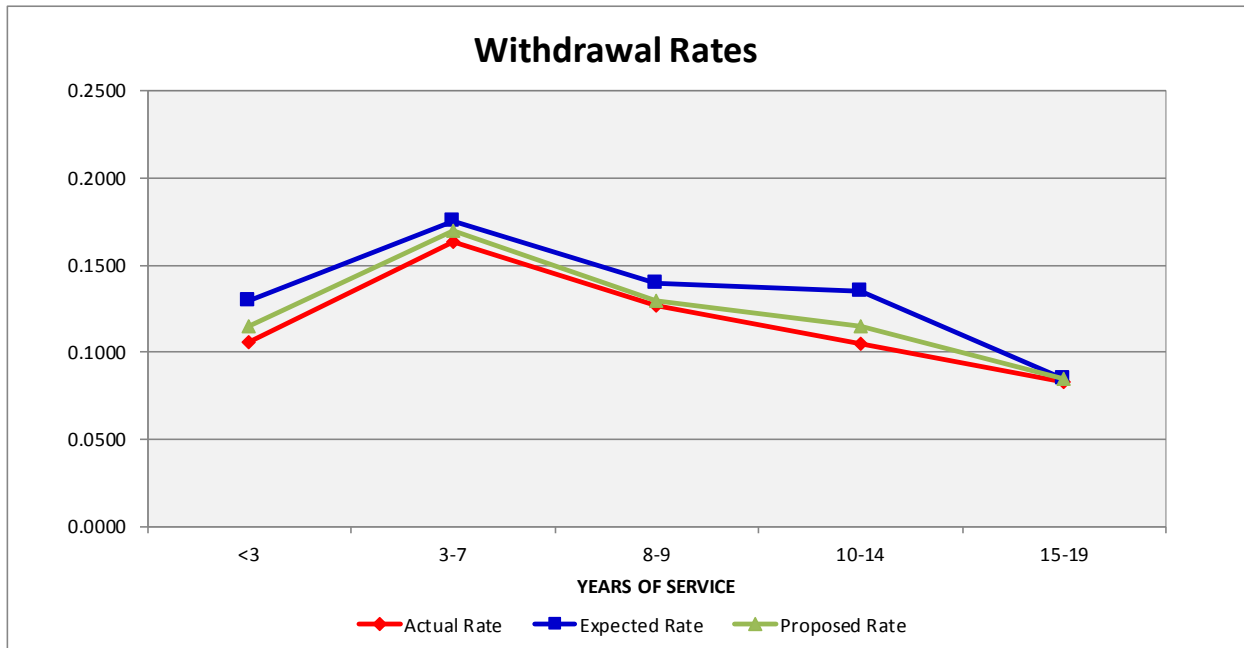
Section V - Demographic Assumptions

RATES OF WITHDRAWAL

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

YEARS OF SERVICE	NUMBER OF WITHDRAWALS CURRENT RATES		
	Actual	Expected	Ratio of Actual to Expected
2 & Under	1,543	1,895.4	0.814
3-7	3,517	3,771.2	0.933
8-9	676	746.1	0.906
10-14	933	1,203.3	0.775
15-19	577	588.9	0.980
20 & Over	1,646	1,535.0	1.072
TOTAL	8,892	9,739.9	0.913

The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The experience indicates that during the period studied, there were fewer withdrawals than expected in most age groups except for those with 20 or more years of service. We recommend a small adjustment in the rates to partially reflect the experience. The following graph shows a comparison of the current expected, actual, and proposed rates of withdrawal for actives.





Section V - Demographic Assumptions

The charts below provide our recommended changes to this assumption and the resulting A/E (actual to expected) ratio.

COMPARATIVE RATES OF WITHDRAWAL

YEARS OF SERVICE	RATES OF WITHDRAWAL	
	Present	Proposed
2 & Under	13.00%	11.50%
3-7	17.50%	17.00%
8-9	14.00%	13.00%
10-14	13.50%	11.50%
15-19	8.50%	8.50%
20 & Over	14.50%	15.50%

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS BASED ON PROPOSED RATES

YEARS OF SERVICE	NUMBER OF WITHDRAWALS PROPOSED RATES		
	Actual	Expected	Ratio of Actual to Expected
2 & Under	1,543	1,676.7	0.920
3-7	3,517	3,663.5	0.960
8-9	676	692.8	0.976
10-14	933	1,025.1	0.910
15-19	577	588.9	0.980
20 & Over	1,646	1,641.0	1.003
TOTAL	8,892	9,288.0	0.957



Section V - Demographic Assumptions

RATES OF DISABILITY RETIREMENT

Since there are no specific disability benefits payable from the Fund and the experience indicates no members are classified as disabled, we recommend no disability retirement rates be utilized at this time.



Section V - Demographic Assumptions

RATES OF RETIREMENT

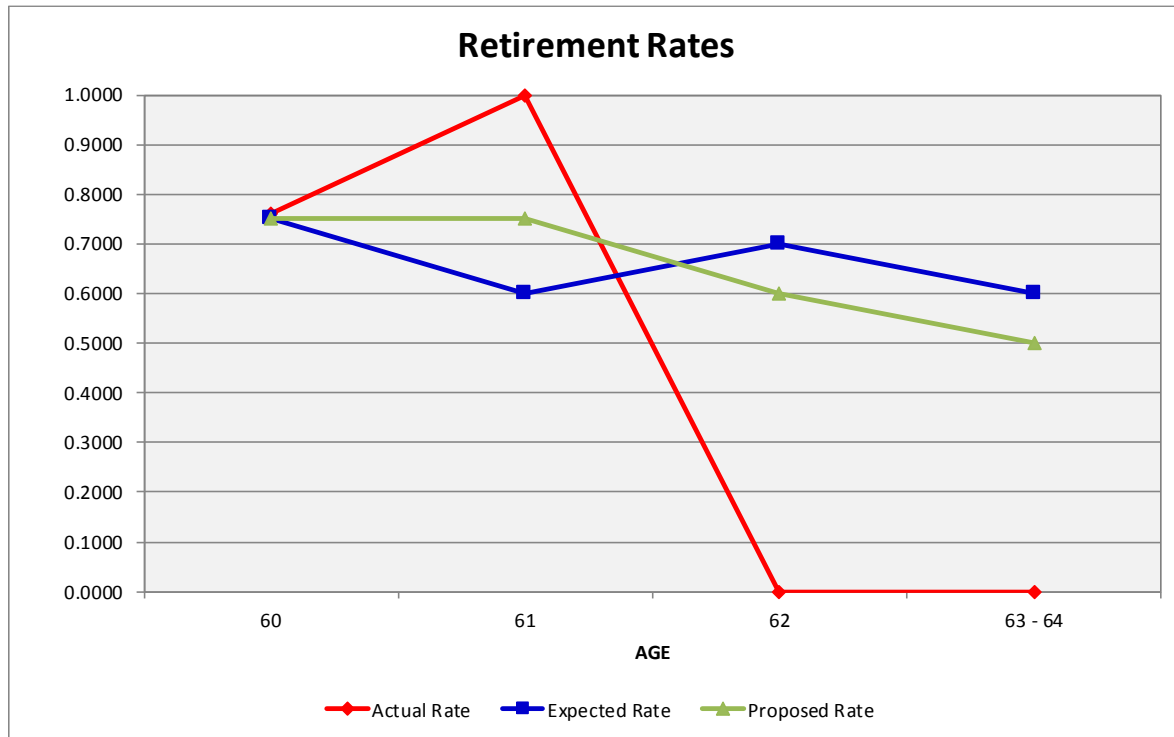
COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

AGE	NUMBER OF SERVICE RETIREMENTS CURRENT RATES		
	Actual	Expected	Ratio of Actual to Expected
60	19	18.8	1.013
61	1	0.6	1.667
62	0	0.0	0.000
63	0	0.0	0.000
64	0	0.0	0.000
65 & Over	0	0.0	0.000
TOTAL	20	19.4	1.034

The analysis of the experience reflects that the current assumed rates of retirement were very close to actual retirements over the five-year period. We note that all exposures to retirement retired at either age 60 or age 61 during this 5-year period. Therefore, we recommend small adjustments to the rates to reflect the experience as well as maintain a reasonable degree of margin. The following graph shows a comparison of the present and actual rates of service retirements.



Section V - Demographic Assumptions



The charts below provide our recommended changes to this assumption and the resulting A/E (actual to expected) ratio.

COMPARITIVE RATES OF RETIREMENT

AGE	RATES OF SERVICE RETIREMENT	
	Present	Proposed
60	75.0%	75.0%
61	60.0%	75.0%
62	70.0%	60.0%
63	60.0%	50.0%
64	60.0%	50.0%
65 & Over	100.0%	100.0%



Section V - Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS
BASED ON PROPOSED RATES**

AGE	NUMBER OF SERVICE RETIREMENTS PROPOSED RATES		
	Actual	Expected	Ratio of Actual to Expected
60	19	18.8	1.013
61	1	0.8	1.333
62	0	0.0	0.000
63	0	0.0	0.000
64	0	0.0	0.000
65 & Over	0	0.0	0.000
TOTAL	20	19.5	1.026



Section V - Demographic Assumptions

RATES OF MORTALITY

Post-Retirement Mortality Rates

Since the Fund has minimal post-retirement mortality experience, we recommend that the rates of post-retirement mortality be revised to the same mortality tables used for the Employees’ Retirement System of Georgia. We believe the new Pub-2010 tables would be a good choice and we recommend changing the mortality basis for GMPF so that all ERS plans can share a common family of tables. We also recommend the most recent mortality improvement scale, MP-2019, be used to anticipate future mortality improvements in the valuation process through at least the next experience study.

Therefore, our recommended mortality assumption for service retirees is based on the Pub-2010 healthy annuitant tables, with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward (+)/ Setback (-)</u>	<u>Adjustment to Rates</u>
Service Retirees	General	Male: +1, Female: +1	Male: 105%, Female: 108%

Since there are no beneficiaries or disability retirements in the Fund, we recommend no mortality rates be utilized at this time for these groups.

Pre-Retirement Mortality

Since the Fund has minimal pre-retirement mortality experience, we recommend that the rates of mortality in active service for both males and females be changed to the same mortality table that is used for the Employees’ Retirement Fund of Georgia. The recommended table is the Pub-2010 General Employee Table, with no adjustments, projected generationally with the MP-2019 scale.



Section VI – Other Assumptions and Methods

ADMINISTRATIVE EXPENSES: Currently, budgeted administrative expenses for the fiscal year are added to the normal cost. **We recommend that an annual amount of \$250,000 be added to normal cost.**



Appendix A - Historical June CPI (U) Index

Year	CPI (U)	Year	CPI (U)
1961	29.8	1991	136.0
1962	30.2	1992	140.2
1963	30.6	1993	144.4
1964	31.0	1994	148.0
1965	31.6	1995	152.5
1966	32.4	1996	156.7
1967	33.3	1997	160.3
1968	35.7	1998	163.0
1969	34.7	1999	166.2
1970	38.8	2000	172.4
1971	40.6	2001	178.0
1972	41.7	2002	179.9
1973	44.2	2003	183.7
1974	49.0	2004	189.7
1975	53.6	2005	194.5
1976	56.8	2006	202.9
1977	60.7	2007	208.352
1978	65.2	2008	218.815
1979	72.3	2009	215.693
1980	82.7	2010	217.965
1981	90.6	2011	225.722
1982	97.0	2012	229.478
1983	99.5	2013	233.504
1984	103.7	2014	238.343
1985	107.6	2015	238.638
1986	109.5	2016	241.018
1987	113.5	2017	244.955
1988	118.0	2018	251.989
1989	124.1	2019	256.143
1990	129.9	2020	257.797



Appendix B - Capital Market Assumptions & Asset Allocations

As Provided by the System

Arithmetic Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Rate of Return*	Standard Deviation
Fixed Income	1.4%	2.3%
US Large Stocks	12.1%	19.8%
US Small Stocks	16.3%	31.5%
Int'l Developed Mkt Stocks	12.1%	21.8%
Int'l Emerging Mkt Stocks	13.3%	31.7%
Alternatives	13.5%	27.9%

*Includes 2.90% assumed inflation

Asset Class Correlation Coefficients

Asset Class	Fixed Income	US Large Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks	Alts
Fixed Income	1.00					
US Large Stocks	0.01	1.00				
US Small Stocks	(0.09)	0.79	1.00			
Int'l Developed Mkt Stocks	(0.11)	0.67	0.51	1.00		
Int'l Emerging Mkt Stocks	(0.11)	0.67	0.51	0.72	1.00	
Alternatives	0.31	0.74	0.74	0.64	0.62	1.00

Asset Allocation Targets

Asset Class	Asset Allocation
Fixed Income	30.0%
US Large Stocks	46.4%
US Small Stocks	1.1%
Int'l Developed Mkt Stocks	11.7%
Int'l Emerging Mkt Stocks	5.8%
Alternatives	5.0%



Appendix B - Capital Market Assumptions & Asset Allocations

**As Determined by the 2020 Horizon Actuarial Services, LLC.
Survey of Capital Market Assumptions (20-year Horizon)**

Arithmetic Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Rate of Return*	Standard Deviation
Fixed Income	2.28%	1.78%
US Large Stocks	8.36%	16.22%
US Small Stocks	9.54%	20.22%
Int'l Developed Mkt Stocks	9.09%	18.05%
Int'l Emerging Mkt Stocks	11.33%	24.23%
Alternatives (Private Equity)	12.54%	21.99%

*Includes 2.17% assumed inflation

Asset Class Correlation Coefficients

Asset Class	Fixed Income	US Large Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks	Alts
Fixed Income	1.00					
US Large Stocks	(0.08)	1.00				
US Small Stocks	(0.08)	0.89	1.00			
Int'l Developed Mkt Stocks	(0.07)	0.84	0.76	1.00		
Int'l Emerging Mkt Stocks	(0.06)	0.73	0.69	0.80	1.00	
Alternatives (Private Equity)	(0.06)	0.73	0.71	0.67	0.59	1.00



Appendix C - Recommended Rates

**TABLE 1
RATES OF SEPARATION FROM ACTIVE SERVICE**

AGE	Rates of Withdrawal Service						Death*		Retirement
	0-2	3-7	8-9	10-14	15-19	20+	Male	Female	
19	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000380	0.000130	
20	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000370	0.000130	
21	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000360	0.000120	
22	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000330	0.000110	
23	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000310	0.000100	
24	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000290	0.000090	
25	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000280	0.000090	
26	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000300	0.000100	
27	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000310	0.000110	
28	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000330	0.000120	
29	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000340	0.000130	
30	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000360	0.000150	
31	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000380	0.000160	
32	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000400	0.000180	
33	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000420	0.000190	
34	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000440	0.000210	
35	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000470	0.000230	
36	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000500	0.000250	
37	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000530	0.000280	
38	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000570	0.000300	
39	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000610	0.000330	
40	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000660	0.000360	
41	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000710	0.000400	
42	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000770	0.000430	
43	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000830	0.000470	
44	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000900	0.000510	
45	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.000980	0.000560	
46	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001070	0.000610	
47	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001160	0.000660	
48	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001270	0.000710	
49	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001380	0.000770	
50	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001490	0.000830	
51	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001620	0.000900	
52	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001750	0.000970	
53	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.001890	0.001050	
54	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002030	0.001130	
55	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002190	0.001230	
56	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002360	0.001330	
57	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002550	0.001440	
58	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002750	0.001560	
59	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.002960	0.001700	
60	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.003190	0.001860	0.75000
61	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.003440	0.002030	0.60000
62	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.003710	0.002220	0.70000
63	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.004010	0.002440	0.60000
64	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.004330	0.002690	0.60000
65	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.004680	0.002960	1.00000
66	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.005060	0.003270	1.00000
67	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.005480	0.003620	1.00000
68	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.005940	0.004000	1.00000
69	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.006460	0.004420	1.00000
70	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.007030	0.004890	1.00000
71	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.007670	0.005410	1.00000
72	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.008370	0.005980	1.00000
73	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.009150	0.006610	1.00000
74	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.010010	0.007310	1.00000
75	0.11500	0.17000	0.13000	0.11500	0.08500	0.15500	0.01096	0.00808	1.00000

*Base mortality rates as of 2010 before application of the improvement scale



Appendix C - Recommended Rates

TABLE 2

BASE RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE*

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.00039	0.00014	70	0.01788	0.01286
20	0.00038	0.00013	71	0.01999	0.01442
21	0.00035	0.00012	72	0.02236	0.01617
22	0.00033	0.00011	73	0.02503	0.01813
23	0.00031	0.00010	74	0.02805	0.02034
24	0.00029	0.00010	75	0.03145	0.02280
25	0.00032	0.00011	76	0.03529	0.02557
26	0.00033	0.00012	77	0.03964	0.02871
27	0.00035	0.00013	78	0.04455	0.03225
28	0.00036	0.00014	79	0.05013	0.03629
29	0.00038	0.00016	80	0.05643	0.04090
30	0.00040	0.00017	81	0.06355	0.04618
31	0.00042	0.00019	82	0.07152	0.05221
32	0.00044	0.00021	83	0.08039	0.05912
33	0.00046	0.00023	84	0.09021	0.06701
34	0.00049	0.00025	85	0.10096	0.07604
35	0.00053	0.00027	86	0.11270	0.08626
36	0.00056	0.00030	87	0.12544	0.09770
37	0.00060	0.00032	88	0.13923	0.11033
38	0.00064	0.00036	89	0.15406	0.12406
39	0.00069	0.00039	90	0.16979	0.13860
40	0.00075	0.00043	91	0.18632	0.15378
41	0.00081	0.00046	92	0.20362	0.16958
42	0.00087	0.00051	93	0.22162	0.18606
43	0.00095	0.00055	94	0.24032	0.20331
44	0.00103	0.00061	95	0.25968	0.22145
45	0.00112	0.00066	96	0.27966	0.24060
46	0.00122	0.00071	97	0.30018	0.26079
47	0.00133	0.00077	98	0.32115	0.28202
48	0.00145	0.00083	99	0.34240	0.30413
49	0.00313	0.00240	100	0.36368	0.32686
50	0.00337	0.00252	101	0.38472	0.34973
51	0.00363	0.00266	102	0.40534	0.37254
52	0.00391	0.00280	103	0.42538	0.39508
53	0.00421	0.00294	104	0.44470	0.41715
54	0.00453	0.00309	105	0.46319	0.43858
55	0.00486	0.00325	106	0.48075	0.45921
56	0.00522	0.00343	107	0.49732	0.47888
57	0.00560	0.00363	108	0.51285	0.49752
58	0.00602	0.00387	109	0.52500	0.51505
59	0.00646	0.00415	110	0.52500	0.53141
60	0.00694	0.00449	111	0.52500	0.54000
61	0.00749	0.00490	112	0.52500	0.54000
62	0.00809	0.00540	113	0.52500	0.54000
63	0.00878	0.00596	114	0.52500	0.54000
64	0.00959	0.00662	115	0.52500	0.54000
65	0.01053	0.00737	116	0.52500	0.54000
66	0.01163	0.00821	117	0.52500	0.54000
67	0.01291	0.00917	118	0.52500	0.54000
68	0.01436	0.01026	119	1.00000	1.00000
69	0.01602	0.01148	120	1.00000	1.00000

*Base mortality rates as of 2010 before application of the improvement scale