# Actuarial Experience Study for the Period December 31, 2012 through December 31, 2017

**September 26, 2018**

FOSTER & FOSTER
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September 26, 2018

Board of Trustees
Metropolitan Water Reclamation District Retirement Fund
111 E. Erie St.
Chicago, IL 60611

Re: Draft Actuarial Experience Study

Dear Board:

The following report presents the results of our experience study of the actuarial assumptions of the Metropolitan Water Reclamation District Retirement Fund for the period December 31, 2012 and ending December 31, 2017. The report includes a review of demographic and economic experience, a comparison of this experience to current actuarial assumptions, our recommendations regarding changes in assumptions or methods to be effective for the December 31, 2018 actuarial valuation. In addition, the report details the estimated actuarial impact of these recommended changes, determined as the impact the changes would have had on the December 31, 2017 valuation.

In preparing this report, we compiled experience for the Plans using data furnished by the retirement system. While we have not audited the information provided, the supplied information was reviewed for consistency and reasonableness. We have no reason to doubt the substantial accuracy of the information and believe it has produced appropriate results.

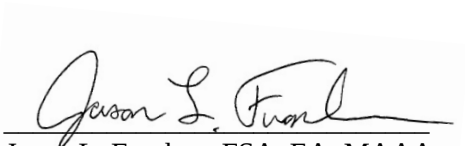
Future actuarial measurements may differ significantly from current measurements due to such factors as: plan experience differing from that anticipated by the assumptions; changes in assumptions; increases or decreases expected as part of the natural operation of the methodology used (such as the end of an amortization period); changes in plan provisions or applicable law.

The study was prepared in accordance with the applicable Actuarial Standards of Practice issued by the Actuarial Standards Board. Jason is a Fellow in the Society of Actuaries and a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We look forward to presenting the conclusions and recommendations contained in this report to the Board and are available to answer any questions concerning its contents.

Respectfully submitted,

FOSTER & FOSTER INC.

By: 
Jason L. Franken, FSA, EA, MAAA

INTRODUCTION

The purpose of this study is to review the current economic and demographic assumptions used in the actuarial valuations of the Plan to determine which changes, if any, are necessary to achieve the objective of developing costs that are stable, predictable, and represent our best estimate of anticipated future experience.

The ultimate cost of any defined benefit pension plan is the sum of the benefits paid from the plan and the administrative expenses incurred, less any net investment gains received. Therefore, the actual cost of plan will only be known after all benefits accrued by the members are paid to the members or their beneficiaries. Since members who retire, become disabled, terminate or die are continuously replaced by new employees, the exact cost to the System cannot be determined at any one point in time. To assure that adequate assets will accumulate to meet current and future benefit obligations, the actuary must make certain demographic and economic assumptions about future contingent events to determine the funding requirements necessary to meet the actual cost. Economic assumptions include salary growth and investment growth, both of which include inflation as a component. The demographic assumptions include rates of retirement, withdrawal, disability, and mortality.

Although the ultimate cost is independent of the actuarial assumptions used to determine funding requirements, the assumptions should reflect the actuary's best estimate of future plan experience. If the assumptions are inappropriate or do not reflect the long-term plan experience, the plan will incur experience gains (over-funding) or experience losses (under-funding) which will exceed or fall short of the actual long-term plan cost. If the contributions determined based upon these assumptions are paid as required, and if the assumptions are in accordance with the actual experience of the plan, then sufficient assets will accumulate to pay the actual cost.

The specific assumptions investigated throughout the remainder of this study are as follows:

- Retirement Rates
- Withdrawal Rates
- Mortality Rates
- Reciprocal Benefits Load
- Investment Return
- Salary Increases
- Inflation/Tier 2 Cost-of-Living Adjustment
- Payroll Growth Rate

ACTUARIAL STANDARDS OF PRACTICE

Background

The Actuarial Standards Board has provided coordinated guidance through of a series of Actuarial Standards of Practice (ASOP) for measuring pension obligations and determining pension plan costs or contributions. The ASOPs that apply specifically to valuing pensions are as follows:

- ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, which ties together the standards shown below, provides guidance on actuarial cost methods, and addresses overall considerations for measuring pension obligations and determining plan costs or contributions

- ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*

- ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*

- ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*

Please note that the contents displayed throughout the remainder of this report are in compliance and consistent with the aforementioned Actuarial Standards of Practice. When applicable, further details of the ASOP associated with the reviewed actuarial assumption will be provided in the experience analysis, which is the basis for the remainder of the report.

Additional Required Communications

Please keep in mind that future actuarial measurements may differ significantly from current measurements due to such factors as the following:

- Plan experience differing from that anticipated by the economic or demographic assumptions
- Changes in economic or demographic assumptions
- Increases or decreases expected as part of the natural operation of the methodology used (such as the end of an amortization period)
- Changes in plan provisions or applicable law

EXPERIENCE REVIEW SUMMARY

Foster & Foster performed an experience study on valuation data for the years December 31, 2012 through December 31, 2018. The purpose of this study is to review and update the assumptions used by the District for the Pension Fund. Below is a summary of our key findings and recommended changes. The remainder of the document provides details of our analysis and documents our recommendations. The impact on the accrued liabilities for each assumption change is summarized on p. 33 of this document.

- **Retirement Rates**: We recommend increasing retirement rates at younger ages and lowering rates at many of the older ages to better reflect experience.

- **Withdrawal Rates**: We propose small increases to the withdrawal rates for both tables.

- **Mortality Rates**: We recommend updating the RP-2000 Combined Healthy mortality rates for female members by a factor of 1.04, with no changes to the to the rates for male members.

- **Reciprocal Benefits Load**: We propose no change to the current reciprocal benefits load of 1.50%.

- **Investment Return**: We recommend lowering the current investment return assumption from 7.50% to 7.25%.

- **Salary Increases:** We recommend updating the salary increase rates to reflect higher increases at 5, 10, 15 and 20 years of service.

- **Payroll Growth Rate**: We recommend lowering this assumption from 3.70% to 3.00%.

- **Tier 2 Cost-of-Living Adjustment**: We recommend no change to the current 1.25% payroll growth rate assumption.

EXPERIENCE ANALYSIS – DEMOGRAPHIC ASSUMPTIONS

ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations,* provides guidance to actuaries in selecting (including giving advice on selecting) demographic and other noneconomic assumptions for measuring obligations under defined benefit pension plans.

In this section, the following demographic assumptions will be reviewed:

- Retirement Rates
- Withdrawal Rates
- Mortality Rates
- Reciprocal Benefits Load

Generally, demographic assumptions are based on actual plan experience with additional considerations for current trends. ASOP No. 35 states "the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment." ASOP No. 35 also states that "a reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses…the actuary should not give undue weight to past experience when selecting demographic assumptions."

Demographic assumptions generally remain consistent over time, absent significant changes in plan provisions. Therefore, the best true indicator of future experience is often past experience. For each assumption, the study compares actual experience for that time period to assumptions used in the valuations.

Note that actuarial assumptions reflect average experience over long periods of time. A change in actuarial assumptions generally results when experience over a period of years indicates a consistent pattern. Recommended changes to the demographic assumptions better reflect actual Fund experience over the studied time period. The recommended changes also meet the objective of developing costs that are stable, predictable, and represent our best estimate of anticipated future experience.

## Retirement Rates

### Overview

A retirement rate is the associated probability at a specific point in time that a member will retire, given that they have attained the eligibility requirements for retirement. The associated cost due to retirement experience is determined by the age at which members actually retire. Higher rates of retirement at earlier ages generally result in higher costs to the plans.

The current requirements for Normal Retirement eligibility are as follows:

1. Members hired prior to January 1, 2011 (Tier 1): Age 60 and 5 years of service
2. Member hired on and after January 1, 2011 (Tier 2): Age 67 and 10 years of service

The current requirements for Early Retirement eligibility are as follows:

1. Members hired prior to January 1, 2011 (Tier 1): Age 55 (50 if hired before June 13, 1997) and 10 years of service
2. Member hired on and after January 1, 2011 (Tier 2): Age 62 and 10 years of service

### Current Assumption

The current retirement rate assumption for the plan reflects one age-based table for Tier 1 and Tier 2 members. The rates vary from 6% at age 50 for eligible Tier 1 members with rate increases at age 60 (normal retirement eligible age for Tier 1 members) and again at ages when members begin becoming eligible for Social Security Normal Retirement. All members are assumed to retire by age 75.

### Experience

The charts and graphs on the following pages illustrate the relationship between actual retirement experience over the last five years and expected experience based on the current assumption. Over the period studied, the number of Tier 2 members eligible to retire and be included in the retirement experience was not significant. Therefore, we do not illustrate experience separated by benefit tiers. The "Eligible Members" column sums the total number of members eligible to retire at each age for each year of experience.

In total, when comparing these assumptions to the actual experience shown on the following graphs, the current retirement assumption was reasonably close to the actual experience incurred during the studied period. The total expected number of retirements was 423.5 and the actual number of retirements was 422. However, for ages 50 through 60, actual retirement experience was heavier than expected. For ages after 60, actual experience was generally lighter than expected.

- Table 1: Retirement Experience
- Graph 1: Retirement Experience

### Recommended Assumption

In general, we recommend increasing retirement rates at younger ages and lowering rates at many of the older ages. Because the number of retirement eligible members at age 75 represent only about 1% of total eligible retirees, we recommend keeping the 100% retirement age as age 75. The weighted average retirement age decreases from 64.59 to 64.40 as a result of this change.

An illustration of the expected retirements using the proposed rates is included in the charts listed above.

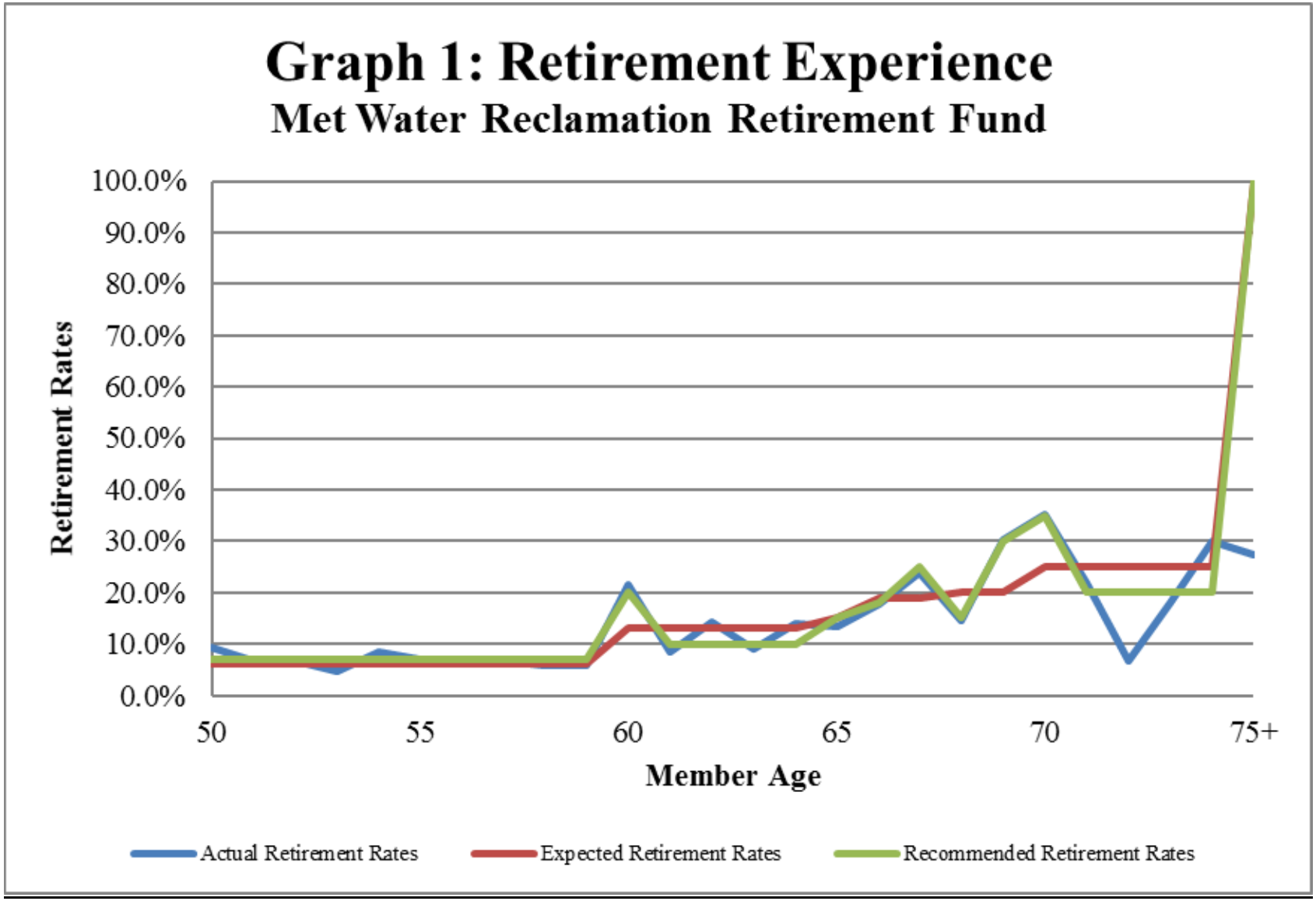
# Metropolitan Water Reclamation District
# Retirement Fund

Table 1 - Retirement Experience*

| Age | Eligible Members | Actual Retirements | Expected Retirements | Proposed Retirements | Actual Retirement Rates | Expected Retirement Rates | Recommended Retirement Rates |
|---|---|---|---|---|---|---|---|
| 50 | 86 | 8 | 5.2 | 6.0 | 9.3% | 6.0% | 7.0% |
| 51 | 164 | 11 | 9.8 | 11.5 | 6.7% | 6.0% | 7.0% |
| 52 | 176 | 12 | 10.6 | 12.3 | 6.8% | 6.0% | 7.0% |
| 53 | 189 | 9 | 11.3 | 13.2 | 4.8% | 6.0% | 7.0% |
| 54 | 198 | 17 | 11.9 | 13.9 | 8.6% | 6.0% | 7.0% |
| 55 | 271 | 19 | 16.3 | 19.0 | 7.0% | 6.0% | 7.0% |
| 56 | 344 | 23 | 20.6 | 24.1 | 6.7% | 6.0% | 7.0% |
| 57 | 328 | 22 | 19.7 | 23.0 | 6.7% | 6.0% | 7.0% |
| 58 | 319 | 19 | 19.1 | 22.3 | 6.0% | 6.0% | 7.0% |
| 59 | 311 | 18 | 18.7 | 21.8 | 5.8% | 6.0% | 7.0% |
| 60 | 293 | 63 | 38.1 | 58.6 | 21.5% | 13.0% | 20.0% |
| 61 | 221 | 19 | 28.7 | 22.1 | 8.6% | 13.0% | 10.0% |
| 62 | 202 | 29 | 26.3 | 20.2 | 14.4% | 13.0% | 10.0% |
| 63 | 165 | 15 | 21.5 | 16.5 | 9.1% | 13.0% | 10.0% |
| 64 | 144 | 20 | 18.7 | 14.4 | 13.9% | 13.0% | 10.0% |
| 65 | 127 | 17 | 19.1 | 19.1 | 13.4% | 15.0% | 15.0% |
| 66 | 107 | 19 | 20.3 | 19.3 | 17.8% | 19.0% | 18.0% |
| 67 | 88 | 21 | 16.7 | 22.0 | 23.9% | 19.0% | 25.0% |
| 68 | 62 | 9 | 12.4 | 9.3 | 14.5% | 20.0% | 15.0% |
| 69 | 53 | 16 | 10.6 | 15.9 | 30.2% | 20.0% | 30.0% |
| 70 | 37 | 13 | 9.3 | 13.0 | 35.1% | 25.0% | 35.0% |
| 71 | 23 | 5 | 5.8 | 4.6 | 21.7% | 25.0% | 20.0% |
| 72 | 15 | 1 | 3.8 | 3.0 | 6.7% | 25.0% | 20.0% |
| 73 | 11 | 2 | 2.8 | 2.2 | 18.2% | 25.0% | 20.0% |
| 74 | 10 | 3 | 2.5 | 2.0 | 30.0% | 25.0% | 20.0% |
| 75+ | 44 | 12 | 44.0 | 44.0 | 27.3% | 100.0% | 100.0% |
| **Total**** | **3,988** | **422** | **423.5** | **453** | **10.6%** | **10.6%** | **11.4%** |
| **Total (50 - 74)** | **3,944** | **410** | **379.5** | **409** | **10.4%** | **9.6%** | **10.4%** |

*Data from December 31, 2012 through December 31, 2017.

**Total rates are based on the number of incidences divided by the number of exposures and do not represent an average of the numbers above.


Graph 1: Retirement Experience
Met Water Reclamation Retirement Fund
Retirement Rates
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
50
55
60
65
70
75+
Member Age
Actual Retirement Rates
Expected Retirement Rates
Recommended Retirement Rates

## Withdrawal Rates

### Overview
The withdrawal rate, or termination rate, is the probability that a member will separate employment from a cause other than disability, death, or retirement. This includes members who terminate and receive a refund of contributions.

### Current Assumption
The current withdrawal assumption reflects separate tables of rates for male and female members that vary by service.

### Experience
The following charts compare actual termination experience to the current assumption. In total, for both male and female members, actual termination experience was slightly heavier than expected.

- Table 2: Withdrawal Experience – Male Members
- Graph 2: Withdrawal Experience – Male Members
- Table 3: Withdrawal Experience – Female Members
- Graph 3: Withdrawal Experience – Female Members

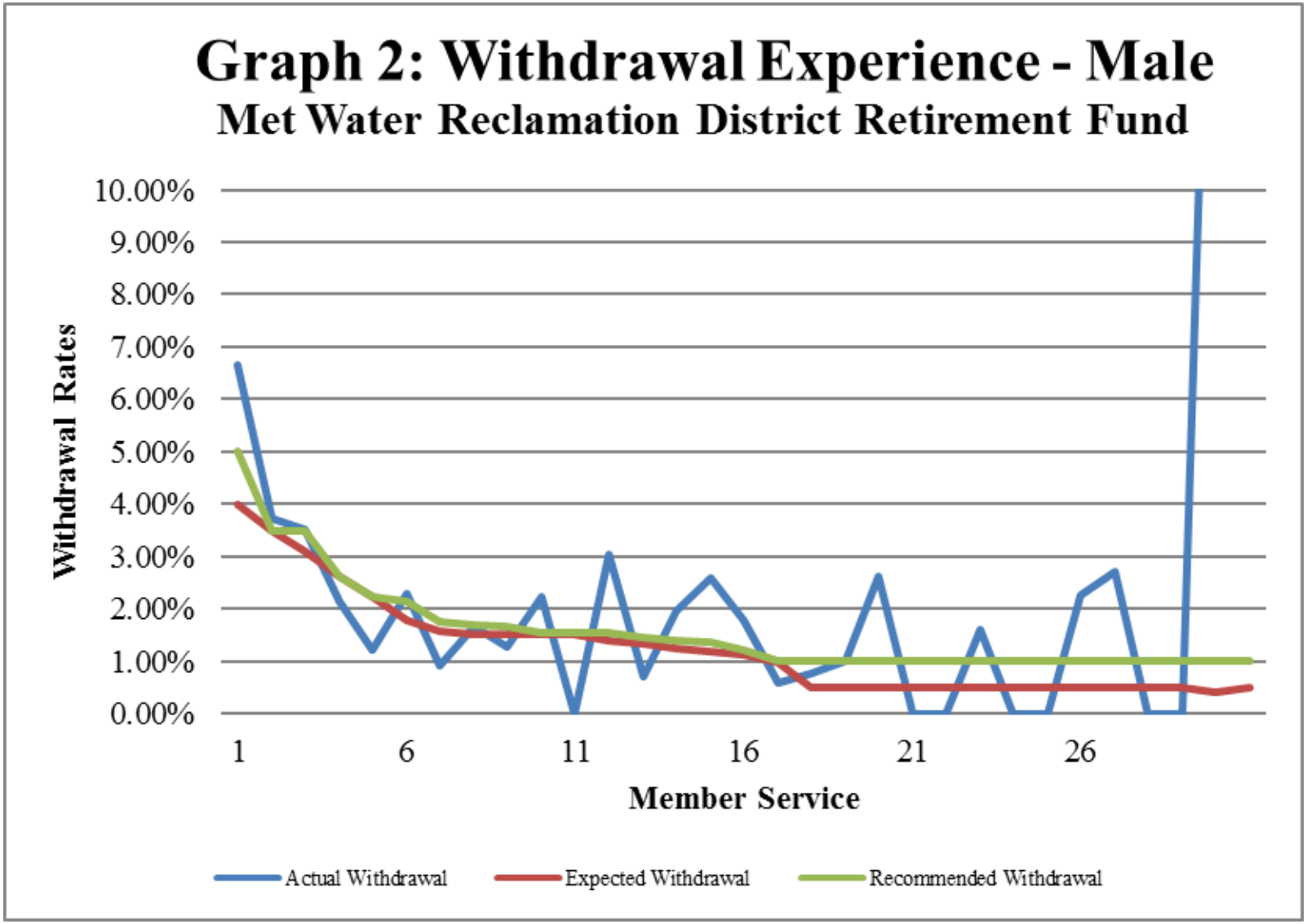
### Recommended Assumption
We are proposing small increases to the withdrawal rates for both tables. The recommended rates are detailed in the experience charts.

# Metropolitan Water Reclamation District
# Retirement Fund

Table 2: Withdrawal Experience - Male Members *

| Service | Exposures | Actual Terminations | Expected Terminations | Actual Withdrawal | Expected Withdrawal | Recommended Withdrawal |
|---|---|---|---|---|---|---|
| 0 | 75 | 5 | 3.0 | 6.67% | 4.00% | 5.00% |
| 1 | 295 | 11 | 10.3 | 3.73% | 3.48% | 3.50% |
| 2 | 228 | 8 | 7.0 | 3.51% | 3.09% | 3.50% |
| 3 | 187 | 4 | 4.9 | 2.14% | 2.60% | 2.60% |
| 4 | 165 | 2 | 3.7 | 1.21% | 2.24% | 2.24% |
| 5 | 175 | 4 | 3.1 | 2.29% | 1.78% | 2.15% |
| 6 | 218 | 2 | 3.4 | 0.92% | 1.56% | 1.75% |
| 7 | 241 | 4 | 3.6 | 1.66% | 1.50% | 1.70% |
| 8 | 236 | 3 | 3.5 | 1.27% | 1.50% | 1.65% |
| 9 | 224 | 5 | 3.4 | 2.23% | 1.50% | 1.55% |
| 10 | 171 | 0 | 2.6 | 0.00% | 1.50% | 1.55% |
| 11 | 132 | 4 | 1.8 | 3.03% | 1.39% | 1.55% |
| 12 | 139 | 1 | 1.9 | 0.72% | 1.35% | 1.45% |
| 13 | 154 | 3 | 1.9 | 1.95% | 1.25% | 1.40% |
| 14 | 155 | 4 | 1.8 | 2.58% | 1.19% | 1.35% |
| 15 | 169 | 3 | 1.9 | 1.78% | 1.11% | 1.20% |
| 16 | 169 | 1 | 1.7 | 0.59% | 0.99% | 1.00% |
| 17 | 130 | 1 | 0.7 | 0.77% | 0.50% | 1.00% |
| 18 | 100 | 1 | 0.5 | 1.00% | 0.50% | 1.00% |
| 19 | 76 | 2 | 0.4 | 2.63% | 0.50% | 1.00% |
| 20 | 61 | 0 | 0.3 | 0.00% | 0.49% | 1.00% |
| 21 | 51 | 0 | 0.3 | 0.00% | 0.49% | 1.00% |
| 22 | 62 | 1 | 0.3 | 1.61% | 0.50% | 1.00% |
| 23 | 59 | 0 | 0.3 | 0.00% | 0.49% | 1.00% |
| 24 | 44 | 0 | 0.2 | 0.00% | 0.50% | 1.00% |
| 25 | 44 | 1 | 0.2 | 2.27% | 0.50% | 1.00% |
| 26 | 37 | 1 | 0.2 | 2.70% | 0.49% | 1.00% |
| 27 | 22 | 0 | 0.1 | 0.00% | 0.50% | 1.00% |
| 28 | 10 | 0 | 0.1 | 0.00% | 0.50% | 1.00% |
| 29 | 5 | 1 | 0.0 | 20.00% | 0.40% | 1.00% |
| 30+ | 2 | 1 | 0.0 | 50.00% | 0.50% | 1.00% |
| **Total** | **3,836** | **73** | **63.0** | **1.90%** | **1.64%** | **1.86%** |

*Data from December 31, 2012 through December 31, 2017.

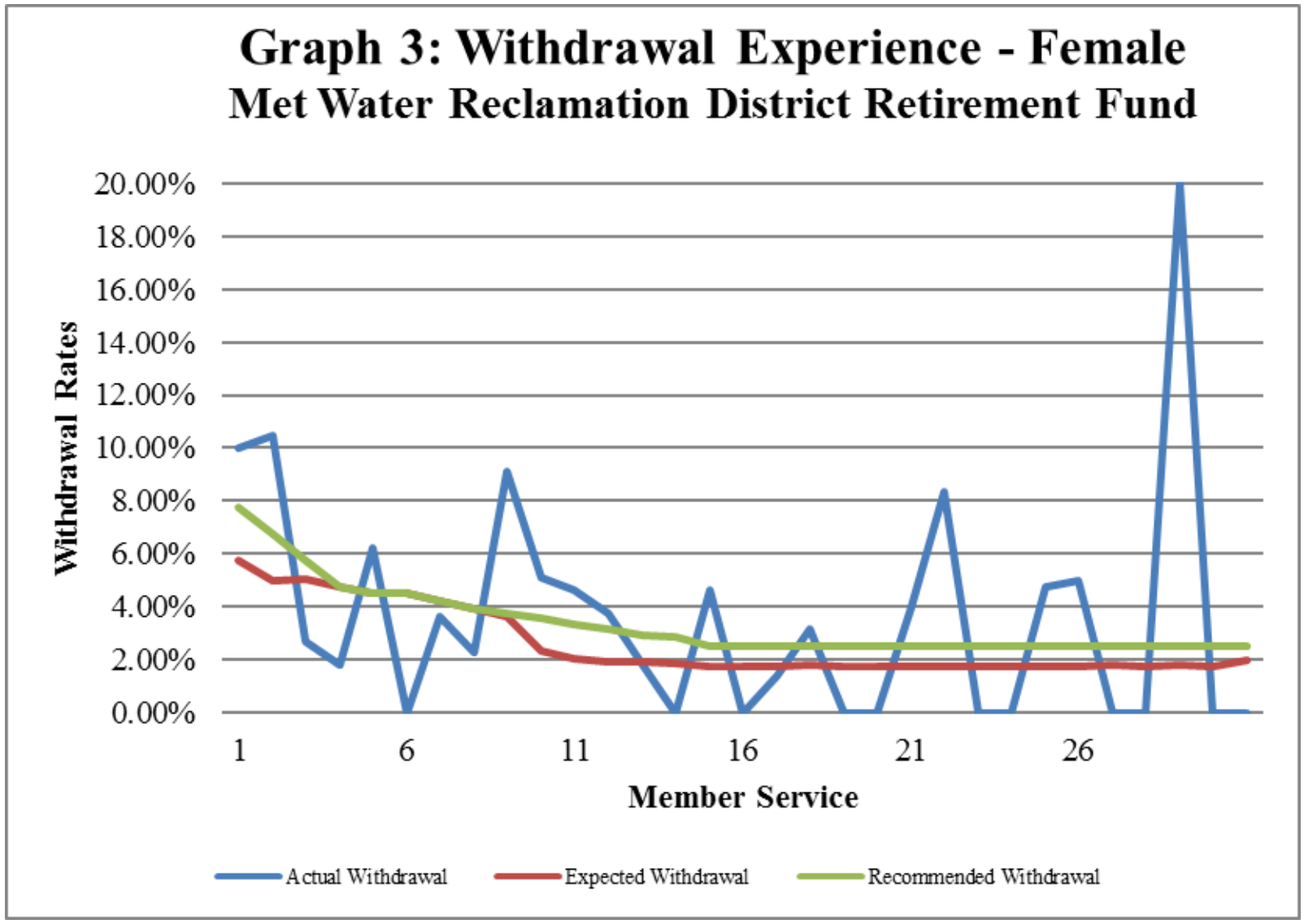

Graph 2: Withdrawal Experience - Male
Met Water Reclamation District Retirement Fund
Withdrawal Rates
10.00%
9.00%
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
1
6
11
16
21
26
Member Service
Actual Withdrawal
Expected Withdrawal
Recommended Withdrawal

# Metropolitan Water Reclamation District
# Retirement Fund

Table 3: Withdrawal Experience - Female Members*

| Service | Exposures | Actual Terminations | Expected Terminations | Actual Withdrawal | Expected Withdrawal | Recommended Withdrawal |
|---|---|---|---|---|---|---|
| 0 | 20 | 2 | 1.2 | 10.00% | 5.75% | 7.75% |
| 1 | 105 | 11 | 5.2 | 10.48% | 4.97% | 6.75% |
| 2 | 75 | 2 | 3.8 | 2.67% | 5.07% | 5.75% |
| 3 | 56 | 1 | 2.7 | 1.79% | 4.75% | 4.75% |
| 4 | 64 | 4 | 2.9 | 6.25% | 4.52% | 4.52% |
| 5 | 61 | 0 | 2.7 | 0.00% | 4.49% | 4.49% |
| 6 | 83 | 3 | 3.5 | 3.61% | 4.19% | 4.19% |
| 7 | 87 | 2 | 3.4 | 2.30% | 3.94% | 3.94% |
| 8 | 88 | 8 | 3.2 | 9.09% | 3.65% | 3.74% |
| 9 | 78 | 4 | 1.8 | 5.13% | 2.35% | 3.54% |
| 10 | 65 | 3 | 1.3 | 4.62% | 2.06% | 3.34% |
| 11 | 53 | 2 | 1.0 | 3.77% | 1.94% | 3.14% |
| 12 | 56 | 1 | 1.1 | 1.79% | 1.89% | 2.94% |
| 13 | 61 | 0 | 1.1 | 0.00% | 1.85% | 2.85% |
| 14 | 65 | 3 | 1.2 | 4.62% | 1.77% | 2.52% |
| 15 | 75 | 0 | 1.3 | 0.00% | 1.77% | 2.52% |
| 16 | 73 | 1 | 1.3 | 1.37% | 1.77% | 2.52% |
| 17 | 63 | 2 | 1.1 | 3.17% | 1.78% | 2.52% |
| 18 | 42 | 0 | 0.7 | 0.00% | 1.76% | 2.52% |
| 19 | 30 | 0 | 0.5 | 0.00% | 1.77% | 2.52% |
| 20 | 25 | 1 | 0.4 | 4.00% | 1.76% | 2.52% |
| 21 | 12 | 1 | 0.2 | 8.33% | 1.75% | 2.52% |
| 22 | 20 | 0 | 0.4 | 0.00% | 1.75% | 2.52% |
| 23 | 21 | 0 | 0.4 | 0.00% | 1.76% | 2.52% |
| 24 | 21 | 1 | 0.4 | 4.76% | 1.76% | 2.52% |
| 25 | 20 | 1 | 0.4 | 5.00% | 1.75% | 2.52% |
| 26 | 15 | 0 | 0.3 | 0.00% | 1.80% | 2.52% |
| 27 | 8 | 0 | 0.1 | 0.00% | 1.75% | 2.52% |
| 28 | 5 | 1 | 0.1 | 20.00% | 1.80% | 2.52% |
| 29 | 4 | 0 | 0.1 | 0.00% | 1.75% | 2.52% |
| 30+ | 1 | 0 | 0.0 | 0.00% | 2.00% | 2.52% |
| **Total** | **1,452** | **54** | **44** | **3.72%** | **3.02%** | **3.72%** |

*Data from December 31, 2012 through December 31, 2017.


Graph 3: Withdrawal Experience - Female
Met Water Reclamation District Retirement Fund
Withdrawal Rates
20.00%
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1
6
11
16
21
26
Member Service
Actual Withdrawal
Expected Withdrawal
Recommended Withdrawal

## Mortality Rates

### Overview

The rate of mortality is the probability of death at a given age. While mortality is a contingency for both the active and retiree populations, it has the greatest cost implications for retirees. If retirees live longer than anticipated by the assumptions, benefits will be paid longer than expected and experience losses will develop. If retirees do not live as long as anticipated by the assumptions, experience gains will develop. Mortality rates represent the probability of death at a given age. The choice of mortality rates impacts active member and retiree costs and liabilities and has the greatest impact on the liabilities for retirees.

The actuarial profession has increasingly become more focused on the issue of future mortality improvement. Mortality rates have declined over time as advances in medical care have evolved. The extent of future mortality improvement will impact the magnitude of pension costs and liabilities for future benefit commitments. ASOP No. 35 discusses the importance of actuaries considering mortality improvements when measuring pension obligations. Specifically, an actuary should make and disclose a specific recommendation with respect to future mortality improvement after the measurement date. Mortality improvement can be accounted for with static or generational mortality tables. A static table includes a projection of the base mortality rates to a specific date or equivalently for a specific number of years. The same mortality rates at any given age apply to everyone. A generational table anticipates future improvements in mortality by using a different static mortality table for each year of birth, with the tables for later years of birth assuming lower mortality than the tables of earlier years of birth.

Credibility procedures employed in our analysis used a statistical approach to combine actual mortality experience with standard mortality tables to improve the estimate of future mortality.

### Current Assumption

The current mortality assumption is the RP-2000 Combined Healthy Mortality, with generational mortality improvements using Scale AA.

### Experience

Experience was reviewed for annuitants and actives separately. For a plan to develop a mortality table based solely on its own experience it must have hundreds of thousands of lives and thousands of deaths at each age and sex. However, many plans provide enough credible experience to adjust a published table by multiplying the mortality rates in the published table by the ratio of actual to expected deaths. We employed this methodology by first identifying a standard table with mortality rates that are similar to those shown by the actual plan membership. Since the rate at each age in the mortality table will be a multiple of the rate at that age from the standard table, close attention was given to the shape of the standard table in making the selection.

Once the appropriate standard table was selected, we determined the multiple using the limited fluctuation approach to credibility, as described in the Society of Actuaries Credibility Educational Resource for Pension Actuaries, issued in August 2017. Using this approach, 1082 deaths are needed to provide full credibility based on a 90% confidence level and a 5% margin of error. If the experience data is fully credible, then the rates from the standard table are multiplied by the ratio of the actual to expected deaths from the standard table. Where there are fewer than the 1,082 deaths needed for full credibility, the limited fluctuations approach allows some of the plan's actual experience to be used to adjust the standard table.

*Annuitants:*
Mortality rates for retirees and survivors are much more significant to the valuation since mortality rates are significantly higher for this group. Using the credibility approach described above, we found that with 270 deaths for male annuitants, the experience was 50.0% credible. For female annuitants, the plan experienced 245 deaths and is 47.6% credible. In selecting a standard table, we considered the current RP-2000 Combined Healthy Mortality table and the PubG.H-2010 Public Retirement Plans Mortality Table published by the Society of Actuaries for both male annuitants and female annuitants.

We found that particularly for male annuitants, the current RP-2000 Combined Healthy tables provided a closer match to the total A/E ratio. The A/E ratio for male annuitants was 1.00 and 1.08 for female annuitants. The corresponding ratios using the PubG.H-2010 Public Retirement Plans Mortality Tables were 1.06 and 1.15 for male and female annuitants, respectively. In addition, after adjusting the standard tables with the multiples determined using the credibility method, the RP-2000 Combined Healthy table provided the closest overall fit to actual plan experience. Therefore, the recommended mortality tables for annuitants are current RP-2000 Combined Healthy tables for male and female annuitants, with the rates at each age unadjusted for male annuitants and adjusted by 1.04 for female annuitants.

*Active Mortality*:
Mortality rates for active members are much less significant to the valuation since mortality rates are significantly lower for active members than for retirees. The low number of active member deaths results in an insufficient number of deaths needed to provide fully credible experience on which to develop the system's mortality rates. Using the credibility approach identified above, we found that with 16 deaths for males, the plan's experience was only 12.2% credible (credibility factor). The number of female deaths during the study period was 4, which resulted in a credibility factor of 6.1%. Given the low credibility ratings of the data and minimal impact of active mortality experience on liabilities, we recommend using the same mortality table and adjustments as used for annuitants.

*Disability Retiree Mortality:*
Over the studied period, the annuitants receiving disability benefits were not isolated on the data. Given this limited experience, we recommend using the same mortality tables for all annuitants.

*Future Mortality Improvement:*
To address expected future mortality improvement, we recommend adjusting the above base tables using the current Scale AA. The mortality experienced by the plan does not reflect the trend of mortality improvements realized by the general population. The charts and graphs listed below compare actual experience to expected experience using the current and recommended assumption tables. Experience was reviewed separately for female members and for male members. Because the assumed tables of rates are the same for active members, retirees and survivors, we have combined the experience into one table for all members.

- Table 4: Female Mortality Experience – RP2000CH – Generational (Current Table)
- Graph 4: Female Mortality Experience – RP2000CH – Generational (Current Table)
- Table 5: Male Mortality Experience – RP2000CH – Generational (Current and Recommended Table)
- Graph 5: Male Mortality Experience – RP2000CH – Generational (Current and Recommended Table)
- Table 6: Female Mortality Experience – RP2000CH, Adjusted – Generational (Recommended Table)
- Graph 6: Female Mortality Experience – RP2000CH, Adjusted – Generational (Recommended Table)

**Recommended Assumption**

We recommend adjusting the current RP-2000 Combined Healthy mortality assumption for female participants by a factor of 1.04 and recommend no adjustment for male participants. We also recommend keeping the current mortality improvement projection scale (Scale AA).

# Metropolitan Water Reclamation District Retirement Fund

Table 4: Female Mortality Experience - Annuitants - Current Assumption*

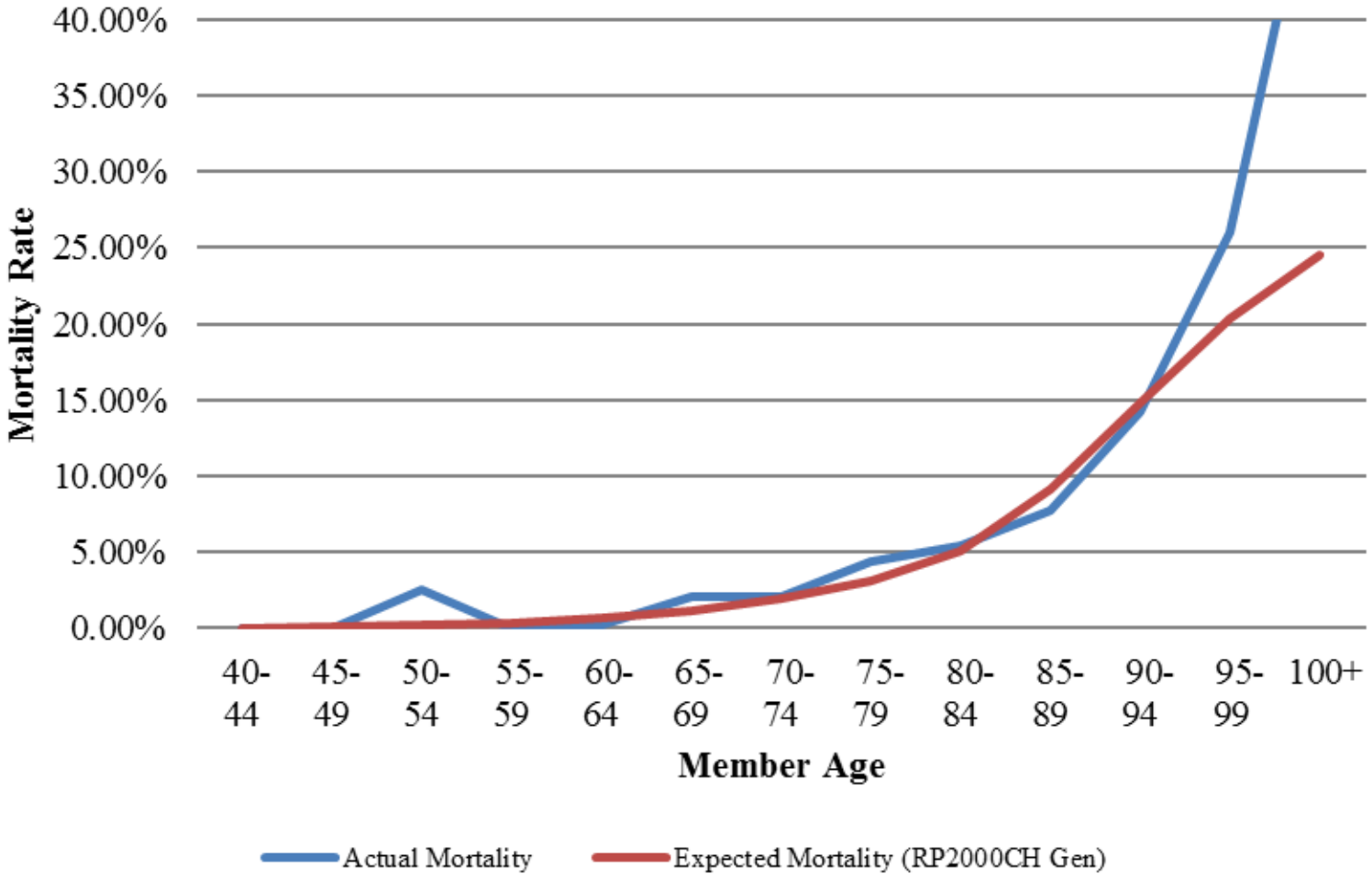
| Age | Exposures | Actual Deaths | Expected Deaths** | Actual Mortality | Expected Mortality** |
|---|---|---|---|---|---|
| 40-44 | 3 | 0 | 0.0 | 0.00% | 0.00% |
| 45-49 | 23 | 0 | 0.0 | 0.00% | 0.09% |
| 50-54 | 81 | 2 | 0.2 | 2.47% | 0.19% |
| 55-59 | 185 | 0 | 0.6 | 0.00% | 0.34% |
| 60-64 | 420 | 1 | 2.8 | 0.24% | 0.65% |
| 65-69 | 685 | 14 | 7.9 | 2.04% | 1.15% |
| 70-74 | 688 | 14 | 13.1 | 2.03% | 1.90% |
| 75-79 | 738 | 32 | 23.1 | 4.34% | 3.13% |
| 80-84 | 718 | 39 | 36.7 | 5.43% | 5.11% |
| 85-89 | 598 | 46 | 54.6 | 7.69% | 9.13% |
| 90-94 | 386 | 55 | 57.2 | 14.25% | 14.81% |
| 95-99 | 127 | 33 | 25.9 | 25.98% | 20.35% |
| 100+ | 17 | 9 | 4.2 | 52.94% | 24.59% |
| **Total** | **4,669** | **245** | **226.1** | **5.25%** | **4.84%** |

*Data from December 31, 2012 through December 31, 2017.

**Expected experience reflects current assumption: RP-2000 Combined Healthy Mortality, Fully Generational with Scale AA.

# Graph 4: Female Mortality Experience

## Met Water Reclamation District Retirement Fund



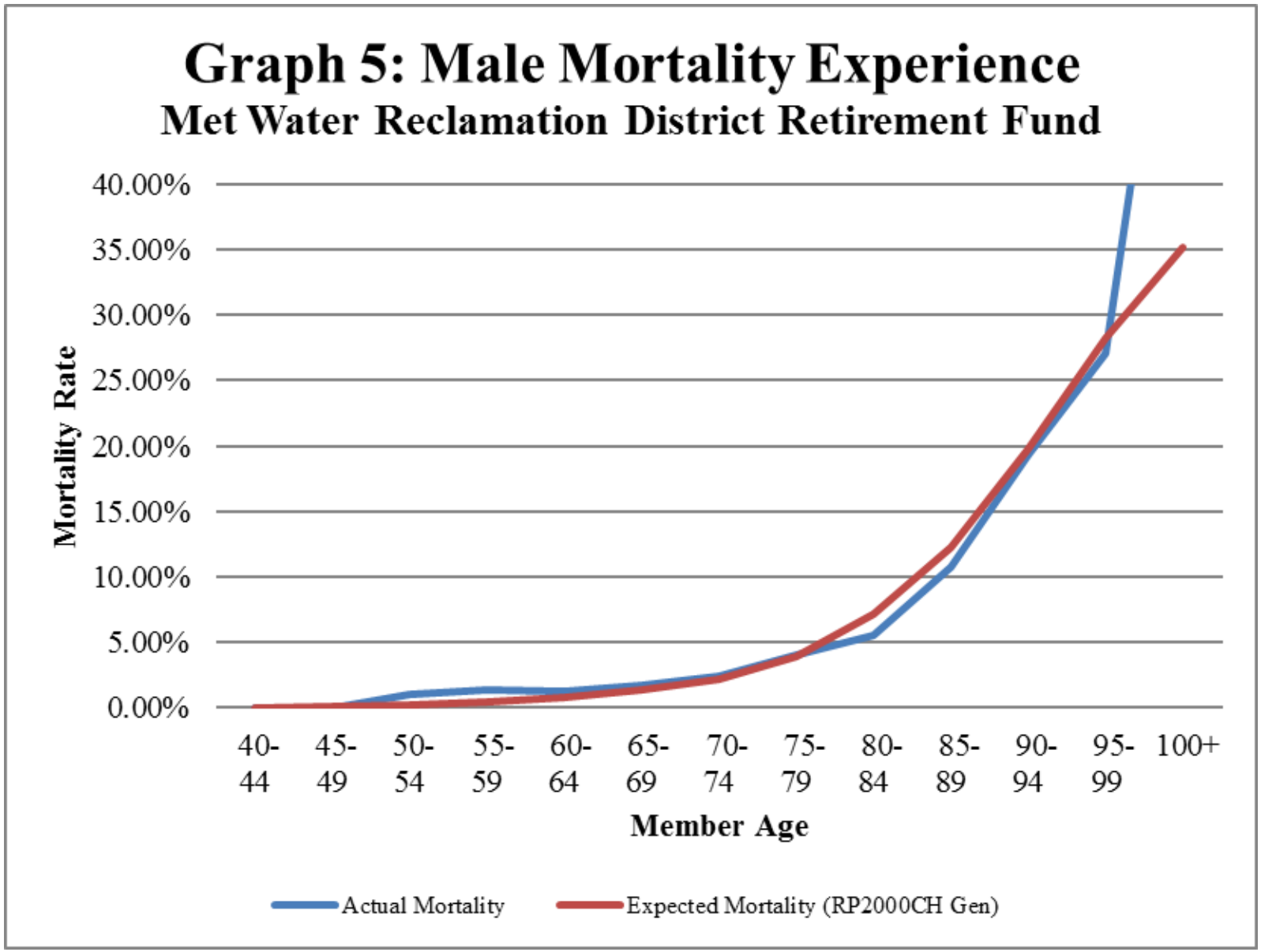
# Metropolitan Water Reclamation District Retirement Fund

Table 5: Male Mortality Experience - Current Assumption*

| Age | Exposures | Actual Deaths | Expected Deaths** | Actual Mortality | Expected Mortality** |
|---|---|---|---|---|---|
| 40-44 | 2 | 0 | 0.0 | 0.00% | 0.00% |
| 45-49 | 12 | 0 | 0.0 | 0.00% | 0.08% |
| 50-54 | 102 | 1 | 0.2 | 0.98% | 0.22% |
| 55-59 | 377 | 5 | 1.5 | 1.33% | 0.39% |
| 60-64 | 899 | 11 | 6.7 | 1.22% | 0.75% |
| 65-69 | 1,542 | 27 | 20.9 | 1.75% | 1.35% |
| 70-74 | 1,465 | 36 | 32.4 | 2.46% | 2.21% |
| 75-79 | 1,034 | 41 | 40.6 | 3.97% | 3.93% |
| 80-84 | 811 | 45 | 58.1 | 5.55% | 7.16% |
| 85-89 | 477 | 51 | 58.2 | 10.69% | 12.21% |
| 90-94 | 186 | 36 | 36.9 | 19.35% | 19.83% |
| 95-99 | 48 | 13 | 13.6 | 27.08% | 28.29% |
| 100+ | 6 | 4 | 2.1 | 66.67% | 35.17% |
| **Total** | **6,961** | **270** | **271.1** | **3.88%** | **3.90%** |

*Data from December 31, 2012 through December 31, 2017.

**Expected experience reflects current assumption: RP-2000 Combined Healthy Mortality, Fully Generational with Scale AA.


Graph 5: Male Mortality Experience
Met Water Reclamation District Retirement Fund
Mortality Rate
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100+
Member Age
Actual Mortality
Expected Mortality (RP2000CH Gen)

# Metropolitan Water Reclamation District Retirement Fund

Table 6: Female Mortality Experience - Recommended Assumption*

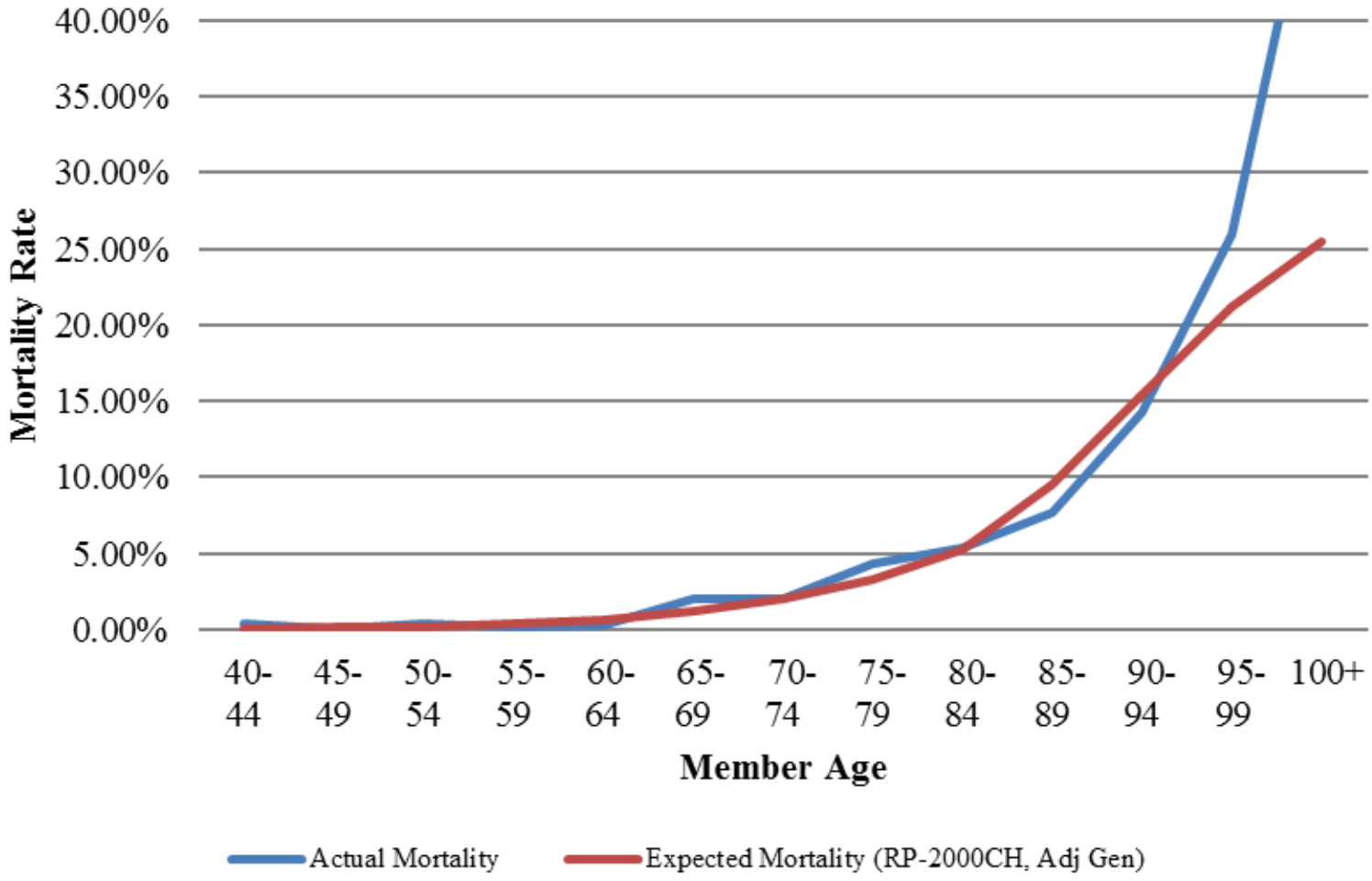
| Age | Exposures | Actual Deaths | Expected Deaths** | Actual Mortality | Expected Mortality** |
|---|---|---|---|---|---|
| 40-44 | 294 | 1 | 0 | 0.34% | 0.07% |
| 45-49 | 438 | 0 | 0 | 0.00% | 0.11% |
| 50-54 | 679 | 3 | 1 | 0.44% | 0.18% |
| 55-59 | 656 | 1 | 2 | 0.15% | 0.34% |
| 60-64 | 694 | 2 | 5 | 0.29% | 0.66% |
| 65-69 | 812 | 16 | 10 | 1.97% | 1.18% |
| 70-74 | 710 | 14 | 14 | 1.97% | 1.97% |
| 75-79 | 745 | 32 | 24 | 4.30% | 3.22% |
| 80-84 | 720 | 39 | 38 | 5.42% | 5.30% |
| 85-89 | 598 | 46 | 57 | 7.69% | 9.50% |
| 90-94 | 386 | 55 | 59 | 14.25% | 15.40% |
| 95-99 | 127 | 33 | 27 | 25.98% | 21.17% |
| 100+ | 17 | 9 | 4 | 52.94% | 25.53% |
| **Total** | **7,411** | **251** | **242.2** | **3.39%** | **3.27%** |

*Data from December 31, 2012 through December 31, 2017.

**Expected experience reflects recommended assumption: RP-2000 Combined Healthy Mortality, Adjusted by 1.04, Fully Generational with Scale AA.

# Graph 6: Female Mortality Experience

## Met Water Reclamation District Retirement Fund



## Reciprocal Benefits Load

### Overview
The reciprocal benefits load assumption adjusts the results to reflect the eventual reciprocal benefits paid from the fund.

### Current Assumption
Currently, the fund assumes a load of 1.50% to active liabilities and normal costs to reflect the reciprocal benefits.

### Experience
To assess the reasonability of the current assumption, we analyzed the reciprocal benefits payable for new retirees over the course of the studied period. For each year of the study, we determined the ratio of the sum of the annuity amounts for all new retirees including the reciprocal amounts to the sum of the annuity amounts for all new retirees without the reciprocal amounts. We then determined the average ratio over the 5-year period. The results are as follows:

| New Retirees during year: | Ratio of Sum of New Retiree Annuities with Reciprocal amounts/ New Retiree Annuities without Reciprocal amounts |
|---|---|
| 2013 | 1.0040 |
| 2014 | 1.0057 |
| 2015 | 1.0288 |
| 2016 | 1.0018 |
| 2017 | 1.0370 |
| **5-year average** | **1.0155** |

### Recommended Assumption
We propose keeping the reciprocal benefits load assumption at 1.50%. The actual experience for the studied period does not warrant a change to the assumption at this time.

## EXPERIENCE ANALYSIS – ECONOMIC ASSUMPTIONS

ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries in selecting (including giving advice on selecting) economic assumptions – primarily investment return, discount rate, and salary scale – for measuring obligations under defined benefit pension plans.

Throughout the remainder of this section, we have used the standards set forth in ASOP No. 27 as a guideline for reviewing and if applicable, selecting recommended changes to the following economic actuarial assumptions:

- Investment Return
- Salary Increases
- Inflation/Tier 2 Cost-of-Living Adjustment
- Payroll Growth Rate (used for amortizing the Unfunded Actuarial Accrued Liability)

Please keep in mind that ASOP No. 27 states that "the best an actuary can do is to use professional judgment to estimate possible future economic outcomes based on past experience and future expectations, and to select assumptions based upon that application of professional judgment."

## Investment Return Assumption

### Overview

The investment return assumption used in actuarial valuations should be set in accordance with Actuarial Standard of Practice No. 27. Beginning with valuation dates after September 30, 2014, the ASOP eliminates the requirement that the investment return assumption falls within a "best-estimate range of anticipated future experience." The new standard requires each economic assumption be set based on the actuary's estimate of future experience or on the actuary's observations of market estimates. Therefore, the assumption should be set based on the long-term expectation of the plan as determined by the investment policy statement, target asset allocation and capital market assumptions.

### Current Assumption

The current assumption is 7.50% net of investment-related expenses.

### Experience and Analysis

*Historical Returns*

ASOP No. 27 states that the actuary should evaluate relevant data, such as recent and long-term historical economic data, without giving undue weight to recent experience. Historical experience is not a reliable indicator of future experience. Future performance by asset class may vary significantly from historical performance and the current (and target) asset allocation of the trust, which significantly impacts future performance, is likely different than prior allocations.

Over the past 5 years, the average net-of-fee return is 10.4% but the average 10-year return is only 6.90%. During those 10 years, the annual net-of-fee return has exceeded the 7.50% assumption 60% of the time.

*Expected Return from Investment Consultant*

In determining the investment return assumption, we determine the average rate of return the Fund expects to achieve based on the target allocation along with the corresponding capital market assumptions. Foster & Foster is an actuarial firm, and we do not have the required expertise to produce our own capital market assumptions. As a result, we worked with your investment consultant, Marquette Associates, Inc. (Marquette), to determine the Fund's expected return.

The Fund's current investment policy statement is based on recommendations of Marquette. The current target allocations are as follows:

| Asset Class | Target Allocation |
|---|---|
| *Total Fixed Income* | |
| Broad Fixed Income | 15.0% |
| Core Plus Fixed Income | 8.0% |
| Global Fixed Income | 7.0% |
| | |
| *Total U.S. Equity* | |
| Large-Cap Core | 13.0% |
| Large-Cap Value | 8.0% |
| Mid-Cap Core | 4.0% |
| Mid-Cap Value | 6.0% |

| | |
|---|---|
| Small-Cap Core | 4.0% |
| Small-Cap Value | 7.0% |
| | |
| *Total Non-U.S. Equity* | |
| Non-U.S. Large-Cap Core | 11.0% |
| Non-U.S. Small-Cap Core | 6.0% |
| Emerging Market | 6.0% |
| | |
| *Total Real Assets* | |
| Real Estate | 5.0% |
| **Total** | **100.0%** |

Based on this target allocation and Marquette's 10-year capital market assumptions, the average annualized net-of-fee return is 7.1% with an average volatility of 12.7%.

*Other Investment Consultants*

We referenced Horizon Actuarial Services, LLC, 2018 survey of other consulting firms to assess how Marquette's return expectations compare to other consulting firms. The 2018 survey is based upon the capital market assumptions of 34 investment advisors participating in the survey, one of which is Marquette. Of the participating advisors, 21 provided one set of assumptions for varying terms of 10 to 15 years. The remaining 13 advisors provided assumptions over both shorter-term (five to 10 years) and longer-term (20 years or more) horizons. The survey refers to the longer term returns as 20-year assumptions and states that the longer-term horizon is more appropriate for mature ongoing pension plans without solvency issues.

We mapped the District's target portfolio allocation to the average 20-year survey assumptions. Using the survey's average expected returns for all asset categories, and the associated standard deviation and covariance matrix, but substituting the District's inflation assumption of 2.50%, the resulting expected long-term nominal return is 7.21%. The returns in the survey are generally considered to be indexed and net of fees, so they are comparable to the assumptions used to determine the expected return of 7.1% described above. Therefore, the 7.50% expected return assumption is higher than assumptions used by other investment advisors for the plan's specific portfolio allocation.

**Recommended Assumption**

Based on our analysis, it is our estimate that future net-of-fee investment returns will be 7.25%. As a result, we recommend lowering the assumption from 7.50% to 7.25%.

## Salary Increases

### Overview

The salary increase assumption is used to project a member's salary from the valuation date until the assumed retirement age. Salary increase assumptions are typically represented as a flat salary scale assumption or as a service-based assumption. A flat salary scale assumption assumes that a member will get the same rate of salary increase for all years, whereas a service-based table may assume different rates based on the member's longevity with the Fund.

The salary increase assumption plays an important role in measuring individual pension costs and obligations.

### Current Assumption

Currently, the valuation assumes a service-related salary scale with rates grading from 7.00% to 4.25%.

### Experience

On the following pages, we have included a service-based chart that compares the actual experience to the current assumption. The average salary increases over the studied period was 4.32%, less than the assumed 4.60% increases. As can be seen in the following table and graph, members received higher salary increases at 5-, 10-, 15- and 20-year service points. and lower than average salary increases later in their careers.

- Table 7: Average Salary Increases by Service
- Graph 7: Average Salary Increases by Service

### Recommended Assumption

Given these results, we propose adjusting the current salary increase table to reflect bumps in salary at the 5-, 10-, 15- and 20-year service points and lowering the assumed increases for service above 20 years from 4.25% to 3.50%. On average, the assumed rate of increase is 4.47%.

# Metropolitan Water Reclamation District

# Retirement Fund

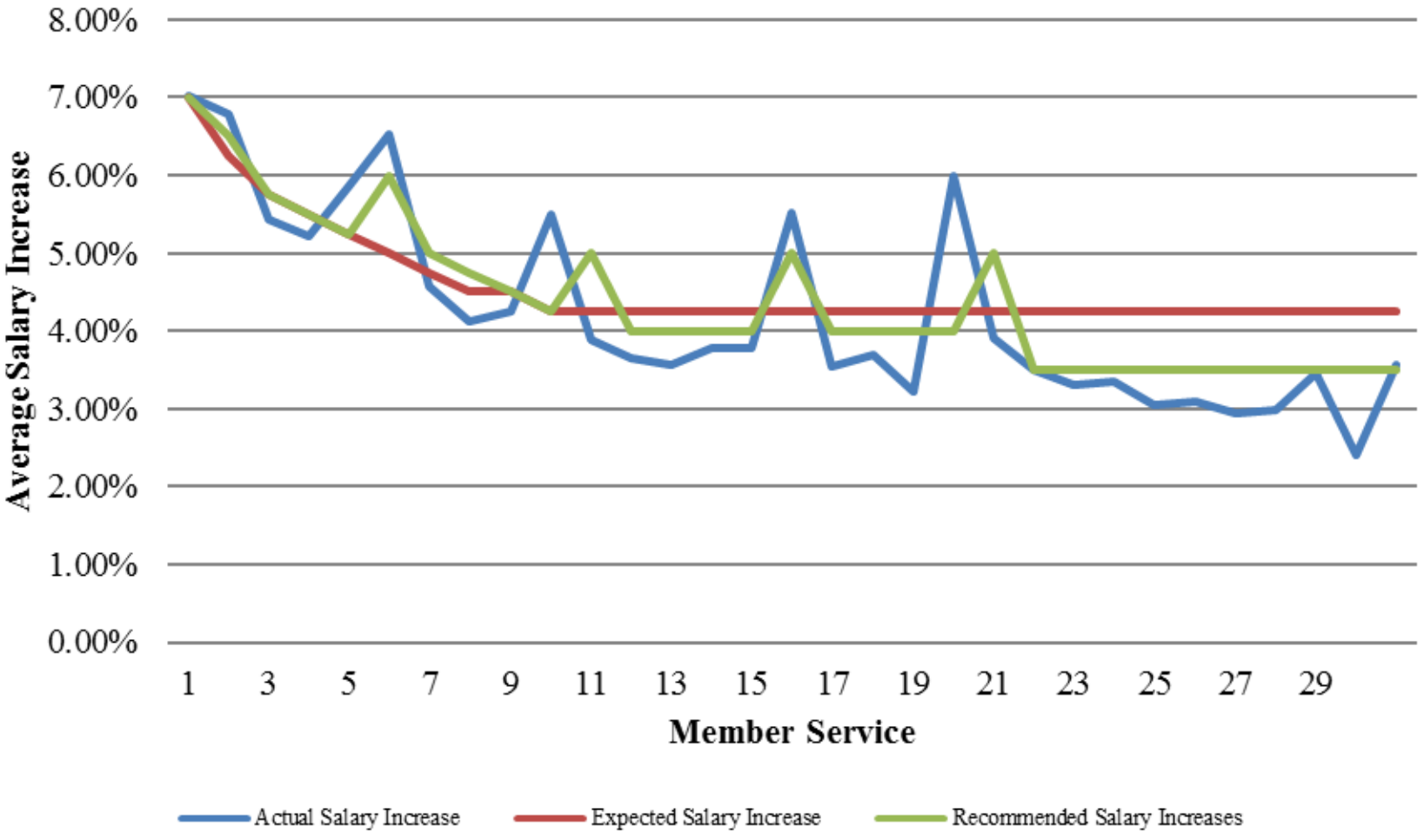
Table 7: Average Salary Increases by Service*

| Service | Eligible Members | Prior Year Salary** | Actual Salary** | Expected Salary** | Actual Salary Increase | Expected Salary Increase | Recommended Salary Increase |
|---|---|---|---|---|---|---|---|
| 0 | 493 | 35,958,332 | 38,481,388 | 38,475,415 | 7.02% | 7.00% | 7.00% |
| 1 | 314 | 24,185,598 | 25,827,775 | 25,697,197 | 6.79% | 6.25% | 6.50% |
| 2 | 261 | 21,254,970 | 22,410,697 | 22,477,131 | 5.44% | 5.75% | 5.75% |
| 3 | 256 | 20,632,039 | 21,709,602 | 21,766,801 | 5.22% | 5.50% | 5.50% |
| 4 | 287 | 22,675,251 | 24,002,432 | 23,865,701 | 5.85% | 5.25% | 5.25% |
| 5 | 358 | 28,831,948 | 30,716,395 | 30,273,545 | 6.54% | 5.00% | 6.00% |
| 6 | 398 | 33,697,136 | 35,239,349 | 35,297,750 | 4.58% | 4.75% | 5.00% |
| 7 | 408 | 35,270,315 | 36,725,189 | 36,857,479 | 4.12% | 4.50% | 4.75% |
| 8 | 393 | 34,786,153 | 36,264,466 | 36,351,530 | 4.25% | 4.50% | 4.50% |
| 9 | 315 | 28,652,866 | 30,230,124 | 29,870,613 | 5.50% | 4.25% | 4.25% |
| 10 | 260 | 24,138,074 | 25,074,920 | 25,163,943 | 3.88% | 4.25% | 5.00% |
| 11 | 293 | 27,241,854 | 28,237,695 | 28,399,632 | 3.66% | 4.25% | 4.00% |
| 12 | 315 | 29,552,739 | 30,603,425 | 30,808,730 | 3.56% | 4.25% | 4.00% |
| 13 | 331 | 31,106,053 | 32,282,040 | 32,428,060 | 3.78% | 4.25% | 4.00% |
| 14 | 368 | 34,975,013 | 36,294,390 | 36,461,451 | 3.77% | 4.25% | 4.00% |
| 15 | 396 | 38,523,947 | 40,646,462 | 40,161,215 | 5.51% | 4.25% | 5.00% |
| 16 | 332 | 33,909,117 | 35,107,652 | 35,350,255 | 3.53% | 4.25% | 4.00% |
| 17 | 267 | 28,027,726 | 29,064,510 | 29,218,905 | 3.70% | 4.25% | 4.00% |
| 18 | 228 | 24,273,135 | 25,053,398 | 25,304,743 | 3.21% | 4.25% | 4.00% |
| 19 | 207 | 20,894,211 | 22,144,845 | 21,782,215 | 5.99% | 4.25% | 4.00% |
| 20 | 194 | 20,041,494 | 20,826,125 | 20,893,258 | 3.92% | 4.25% | 5.00% |
| 21 | 251 | 25,785,734 | 26,686,663 | 26,881,628 | 3.49% | 4.25% | 3.50% |
| 22 | 304 | 31,595,275 | 32,642,147 | 32,938,075 | 3.31% | 4.25% | 3.50% |
| 23 | 298 | 31,615,659 | 32,675,328 | 32,959,325 | 3.35% | 4.25% | 3.50% |
| 24 | 296 | 31,883,446 | 32,857,531 | 33,238,493 | 3.06% | 4.25% | 3.50% |
| 25 | 280 | 30,069,257 | 30,996,937 | 31,347,201 | 3.09% | 4.25% | 3.50% |
| 26 | 223 | 23,960,089 | 24,664,389 | 24,978,393 | 2.94% | 4.25% | 3.50% |
| 27 | 163 | 18,024,751 | 18,563,975 | 18,790,802 | 2.99% | 4.25% | 3.50% |
| 28 | 88 | 9,859,822 | 10,200,063 | 10,278,865 | 3.45% | 4.25% | 3.50% |
| 29 | 48 | 5,553,782 | 5,687,256 | 5,789,818 | 2.40% | 4.25% | 3.50% |
| 30+ | 82 | 8,804,721 | 9,118,119 | 9,178,921 | 3.56% | 4.25% | 3.50% |
| **Total** | **8,707** | **815,780,507** | **851,035,287** | **853,287,090** | **4.32%** | **4.60%** | **4.47%** |

*Data from December 31, 2012 through December 31, 2017.

# Graph 7: Average Salary Increases

## Met Water Reclamation District Retirement Fund



## Inflation/Tier 2 Cost-of-Living Adjustment

### Overview

The cost-of-living adjustment provisions for the fund vary by benefit Tier. Currently, for Tier 1 members, the cost-of-living adjustment (COLA) for the plan is a flat 3.00%, and the valuation does not require a COLA assumption for this Tier. The 3.00% increases specified in the statute are valued.

However, the pension changes introduced in 2011 provide for the following COLA for Tier 2 members: An annual increase each January 1 equal to the lesser of 3.00% or one-half of the annual unadjusted percentage increase in the Consumer Price Index-Urban (CPI-U) for the 12 months ending with the September proceeding each November 1. The COLA is applied to the original pension amount after the first anniversary of the pension start date. Since the COLA will vary depending on the value of the CPI-U, future valuations will need to reflect a COLA assumption for Tier 2 members.

### Current Assumption

Currently, the fund assumes a 2.50% inflation assumption, resulting in a 1.25% COLA increase for Tier 2 members.

### Historical Inflation

Inflation has been relatively low over the past 20 years, particularly over the last five years. The table below shows the average annual historical change in the CPI-U, over various periods.

**Average Annual Increase Consumer Price Index - All Urban Consumers**

Periods Ending December 2017

| | |
|---|---|
| Last 5 years | 1.4% |
| Last 10 years | 1.6% |
| Last 20 years | 2.1% |

### Forecasts of Inflation

The Federal Reserve Bank of Philadelphia conducts a quarterly survey of the Society of Professional Forecasters and publishes a mid-term expectation. Their most recent forecast (third quarter of 2018) predicts average inflation over the next ten years (2018-2027) will be 2.20%. The Philadelphia Fed's Livingston Survey summarizes the forecasts of economists from industry, government, banking, and academia. The June 2018 report shows an average 10-year inflation expectation of 2.28%.

The Social Security Administration's 2018 Trustees Report includes the Office of the Chief Actuary's projection of ultimate long-term (75 year) average annual inflation. The intermediate cost assumption is 2.60%. The report provides a low-to-high range of 2.00% to 3.20%.

*Forecasts from Investment Consulting Firms*

Marquette Associates, the plan's investment consultant currently uses an inflation assumption of 2.90%.

Horizon Actuarial Services, LLC, compiles and summarizes expected returns and volatility by asset class for 35 different investment consulting firms. The results of the survey are provided in a report titled Horizon Survey of Capital Market Assumptions: 2018 Edition. Thirteen of the participating firms provided short-term and long-term assumptions. The report defines the short-term horizon as 10 years and the long-term horizon as 20-years. The average inflation assumption used by these 13 firms for the short-term horizon is 2.41%, while the average inflation assumption used for the long-term horizon is 2.47%.

**Recommended Assumption**

The Federal Reserve forecaster survey responses would appear to support an inflation assumption of 20 to 30 basis points below the current assumption. However, these are 10-year forecasts and longer-term forecasts (25-30 years) would likely result in forecasts closer to the current assumption. This is supported by the much higher inflation assumption used by the Social Security administration in their intermediate cost projection, as well as the short-term and long-term assumptions from the Horizon Actuarial Services survey. Therefore, we recommend retaining the 2.50% long-term inflation assumption and resulting 1.25% Tier 2 COLA increase assumption.

## Payroll Growth Rate

### Overview

The payroll growth rate is the assumption used to predict how the aggregate payroll of a fund will increase on average from one year to the next. It is a necessary assumption when valuing a pension fund because it is used for purposes of amortizing the unfunded actuarial liabilities. Currently, the payroll growth assumption is equal to 3.70% per year.

The payroll growth assumption should reflect factors other than the expected individual salary increases year over year. In addition, it is important to consider the growth (or reduction) in the active population for a Fund. For example, if each active member of a population happens to receive a 5.50% salary increase, but in that same time no members terminate employment and 5 additional members are hired onto the workforce, then the payroll will have grown by greater than 5.50% for that year. Likewise, the aggregate payroll of a fund could decrease from one year to the next if several people retire or terminate over the course of the year. The payroll for any fund is also affected as longer service members who are earning higher salaries begin to retire and are replaced with new entrants with lower pay. The purpose of the payroll growth rate is to determine a long-term expected average of the rate in which payroll will grow, even if the year-over-year experience does not always follow the pattern of the assumption.

### Experience

In the course of this analysis, we have determined that the average payroll growth was 2.40% over the studied time period. The population was relatively stable over the studied time period.

### Recommended Assumption

Given the realized 2.40% payroll growth over the studied period and the recommended 2.50% inflation assumption, we recommend lowering the payroll growth assumption from the current 3.70% assumption to 3.00%.

IMPACT OF RECOMMENDED ASSUMPTIONS

Below is an analysis of the impact of the recommended valuation assumptions on the December 31, 2017 accrued liability, normal cost and actuarially determined contribution.

**Impact on Accrued Liability**

| Assumption | Accrued Liability | Dollar Change | Percentage Change |
|---|---|---|---|
| Baseline | 2,497,890,179 | | |
| Retirement Rates | 2,504,055,497 | 6,165,318 | 0.25% |
| Withdrawal Rates | 2,500,051,305 | 2,161,126 | 0.09% |
| Mortality Rates | 2,483,969,290 | (13,920,889) | -0.56% |
| Salary Increases | 2,474,081,176 | (23,809,003) | -0.95% |
| Interest Rate - 7.25% | 2,565,088,563 | 67,198,384 | 2.69% |
| Interest Rate - 7.00% | 2,635,279,378 | 137,389,199 | 5.50% |
| All Changes - 7.25% | 2,534,968,269 | 37,078,090 | 1.48% |
| All Changes - 7.00% | 2,603,750,358 | 105,860,179 | 4.24% |

**Impact on Total Normal Cost**

| Assumption | Total Normal Cost | Dollar Change | Percentage Change |
|---|---|---|---|
| Baseline | 31,453,131 | | |
| Retirement Rates | 31,525,945 | 72,814 | 0.23% |
| Withdrawal Rates | 30,937,756 | (515,375) | -1.64% |
| Mortality Rates | 31,356,293 | (96,838) | -0.31% |
| Salary Increases | 30,642,318 | (810,813) | -2.58% |
| Interest Rate - 7.25% | 33,417,445 | 1,964,314 | 6.25% |
| Interest Rate - 7.00% | 35,523,587 | 4,070,456 | 12.94% |
| All Changes - 7.25% | 32,026,046 | 572,915 | 1.82% |
| All Changes - 7.00% | 34,027,258 | 2,574,127 | 8.18% |

**Impact on Actuarially Determined Contribution**

| Assumption | Employer's Share of Normal Cost | Supp. Cost (Amort. of UAAL) | ADC | Dollar Change | Percentage Change |
|---|---|---|---|---|---|
| Baseline | 12,010,599 | 52,977,984 | 64,988,583 | | |
| Retirement Rates | 12,083,413 | 53,291,537 | 65,374,950 | 386,367 | 0.6% |
| Withdrawal Rates | 11,495,224 | 53,087,893 | 64,583,117 | (405,466) | -0.6% |
| Mortality Rates | 11,913,761 | 52,270,002 | 64,183,763 | (804,820) | -1.2% |
| Salary Increases | 11,199,786 | 51,767,117 | 62,966,903 | (2,021,680) | -3.1% |
| Interest Rate - 7.25% | 13,974,913 | 56,395,527 | 70,370,440 | 5,381,857 | 8.3% |
| Interest Rate - 7.00% | 16,081,055 | 59,965,257 | 76,046,312 | 11,057,729 | 17.0% |
| Payroll Growth Rate | 12,010,599 | 57,669,326 | 69,679,925 | 4,691,342 | 7.2% |
| All Changes - 7.25% | 12,583,514 | 58,030,271 | 70,613,785 | 5,625,202 | 8.7% |
| All Changes - 7.00% | 14,584,726 | 59,950,495 | 74,535,221 | 9,546,638 | 14.7% |

ASSUMPTION SETS

**Recommended Assumptions**

Interest Rate

7.25%.

Salary Increases

| Service | Salary Increase Rate |
|---|---|
| 0 | 7.00% |
| 1 | 6.50% |
| 2 | 5.75% |
| 3 | 5.50% |
| 4 | 5.25% |
| 5 | 6.00% |
| 6 | 5.00% |
| 7 | 4.75% |
| 8 | 4.50% |
| 9 | 4.25% |
| 10 | 5.00% |
| 11 - 14 | 4.00% |
| 15 | 5.00% |
| 16 - 19 | 4.00% |
| 20 | 5.00% |
| 21+ | 3.50% |

Cost-of-Living Adjustment - Annuitants

| | |
|---|---|
| Members Hired On Or After January 1, 2011 | 1.25% |
| Members Hired Before January 1, 2011 | 3.00% |

Payroll Growth

3.00%

Load for Reciprocal Benefits

1.5% of active member costs and liabilities.

Percent Married

76%

Spousal Age Difference

Spouse of male member assumed to be 4 years younger than member; Spouse of female member assumed to be 4 years older than member.

Mortality Rates

RP-2000 Combined Healthy Mortality Table with Generational Mortality Improvements (Scale AA). Female rates are adjusted by a factor of 1.04 and male rates are unadjusted.

Retirement Rates

| Age | Retirement Rate |
|---|---|
| 50 - 59 | 7% |
| 60 | 20% |
| 61 - 64 | 10% |
| 65 | 15% |
| 66 | 18% |
| 67 | 25% |
| 68 | 15% |
| 69 | 30% |
| 70 | 35% |
| 71 - 74 | 20% |
| 75 | 100% |

Termination Rates

| Service | Male Rate | Female Rate |
|---|---|---|
| 0 | 5.00% | 7.75% |
| 1 | 3.50% | 6.75% |
| 2 | 3.50% | 5.75% |
| 3 | 2.60% | 4.75% |
| 4 | 2.24% | 4.52% |
| 5 | 2.15% | 4.49% |
| 6 | 1.75% | 4.19% |
| 7 | 1.70% | 3.94% |
| 8 | 1.65% | 3.74% |
| 9 | 1.55% | 3.54% |
| 10 | 1.55% | 3.34% |
| 11 | 1.55% | 3.14% |
| 12 | 1.45% | 2.94% |
| 13 | 1.40% | 2.85% |
| 14 | 1.35% | 2.52% |
| 15 | 1.20% | 2.52% |
| 16+ | 1.00% | 2.52% |

Disability Rates

| Age | Disability Rates |
|---|---|
| 20 | 0.002% |
| 25 | 0.003% |
| 30 | 0.006% |
| 35 | 0.014% |
| 40 | 0.033% |
| 45 | 0.065% |
| 50 | 0.120% |
| 55 | 0.225% |
| 60 | 0.490% |
| 65 | 0.000% |

**Current Assumptions**

Interest Rate: 7.50%

Salary Increases

| Service | Salary Increase Rate |
|---|---|
| 0 | 7.00% |
| 1 | 6.25% |
| 2 | 5.75% |
| 3 | 5.50% |
| 4 | 5.25% |
| 5 | 5.00% |
| 6 | 4.75% |
| 7 | 4.50% |
| 8 | 4.50% |
| 9+ | 4.25% |

Cost-of-Living Adjustment - Annuitants

| | |
|---|---|
| Members Hired On Or After January 1, 2011 | 1.25% |
| Members Hired Before January 1, 2011 | 3.00% |

Payroll Growth: 3.70%

Load for Reciprocal Benefits: 1.5% of active member costs and liabilities.

Percent Married: 76%

Spousal Age Difference: Spouse of male member assumed to be 4 years younger than member; Spouse of female member assumed to be 4 years older than member.

Mortality Rates: RP-2000 Combined Healthy Mortality Table with Generational Mortality Improvements (Scale AA).

Retirement Rates

| Age | Retirement Rate |
|---|---|
| 50 - 59 | 6% |
| 60 - 64 | 13% |
| 65 | 15% |
| 66 - 67 | 19% |
| 68 - 69 | 20% |
| 70 - 74 | 25% |
| 75 | 100% |

Termination Rates

| Service | Male Rate | Female Rate |
|---|---|---|
| 0 | 4.000% | 5.733% |
| 1 | 3.480% | 4.973% |
| 2 | 3.089% | 5.064% |
| 3 | 2.604% | 4.759% |
| 4 | 2.245% | 4.518% |
| 5 | 1.780% | 4.490% |
| 6 | 1.561% | 4.193% |
| 7 | 1.500% | 3.945% |
| 8 | 1.500% | 3.646% |
| 9 | 1.500% | 2.342% |
| 10 | 1.502% | 2.054% |
| 11 | 1.391% | 1.946% |
| 12 | 1.343% | 1.898% |
| 13 | 1.244% | 1.859% |
| 14 | 1.189% | 1.772% |
| 15 | 1.111% | 1.772% |
| 16 | 0.985% | 1.772% |
| 17+ | 0.500% | 1.772% |

Disability Rates

| Age | Disability Rates |
|---|---|
| 20 | 0.002% |
| 25 | 0.003% |
| 30 | 0.006% |
| 35 | 0.014% |
| 40 | 0.033% |
| 45 | 0.065% |
| 50 | 0.120% |
| 55 | 0.225% |
| 60 | 0.490% |
| 65 | 0.000% |