



Marin County Employees' Retirement Association

Actuarial Audit of June 30, 2017 Valuation

Prepared by:

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November 29, 2018

Board of Retirement
Marin County Employees' Retirement Association
One McInnis Pkwy, Suite 100
San Rafael, CA 94903

Re: Actuarial Audit of June 30, 2017 Valuation

Dear Board Members:

The enclosed report presents the findings from our review of the June 30, 2017 actuarial valuation and the 2017 actuarial experience study performed by Cheiron for the Marin County Employees' Retirement Association (MCERA). An overview of our major findings is included in the Executive Summary section of the report. More detailed commentary on our review process is included in the latter sections.

All calculations are based on MCERA's plan provisions and the actuarial assumptions adopted by the Retirement Board. The plan provisions, assumptions and methods used are the same as those disclosed in Cheiron's June 30, 2017 valuation report. As discussed in our report, we believe the package of actuarial assumptions and methods is reasonable (taking into account the experience of MCERA and reasonable expectations). Nevertheless, the emerging costs will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements presented in this report due to factors such as the following:

- Plan experience differing from the actuarial assumptions,
- Future changes in the actuarial assumptions,
- Increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as potential additional contribution requirements due to changes in the Plan's funded status), and
- Changes in the plan provisions or accounting standards.

Due to the scope of this assignment, we did not perform an analysis of the potential range of such measurements.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by MCERA's staff. This information includes, but is not limited to, statutory provisions, employee data, and financial information. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes. Since the audit results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Actuarial Standards of Practice promulgated by the Actuarial Standards Board and the applicable Code of Professional Conduct, amplifying Opinions, and supporting Recommendations of the American Academy of Actuaries.

Milliman's work product was prepared exclusively for MCERA for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning MCERA's operations, and uses MCERA's data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the plan sponsors. We are not aware of any relationship that would impair the objectivity of our work.

We would like to express our appreciation to both the Cheiron and MCERA staff for their assistance in supplying the data and information on which this report is based.

We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We respectfully submit the following report, and we look forward to discussing it with you.

Sincerely,



Nick J. Collier, ASA, EA, MAAA
Consulting Actuary

NJC/DRW/nlo



Daniel R. Wade, FSA, EA, MAAA
Consulting Actuary

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Section 1 Summary of the Findings



Purpose and Scope of the Actuarial Audit

In this actuarial audit, we independently calculated the key results from the June 30, 2017 actuarial valuation and reviewed the actuarial assumptions used in the valuation. The purpose of this audit is to provide an opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, valuation results and contribution rates. The following tasks were performed in this audit:

- ✓ Evaluation of the data used in the valuation,
- ✓ Full independent replication of the key valuation results,
- ✓ Confirmation that the actuarial assumptions are reasonable and appropriate, and
- ✓ Analysis of valuation results and reconciliation of material differences (if any).

Audit Conclusion

Actuarial Valuation

Based upon our review of the June 30, 2017 actuarial valuation, we found the aggregate results were reasonable. The following table shows that our independent calculations are close to those determined by Cheiron based on the methods and assumptions used in the valuation. Given the myriad of calculations and differences in actuarial software between firms, we would not expect to match Cheiron's calculations exactly; however, the overall results indicate a high level of consistency.

Note that we have shown the employer contribution rate and funded ratio for all employers participating in MCERA in aggregate. For key measurements, we have shown comparisons for each employer. Further analysis by agency and tier is shown in Appendix A.

	Cheiron	Milliman
Employer Contribution Rate	31.12%	30.92%
Funded Ratio	84.4%	84.4%

We have recommended some changes that we think should be implemented in future valuations and have included several items to be considered in the future. We discussed our three recommended changes for the 2018 valuation that affect the calculation of liabilities with Cheiron and they are planning to implement them. Note that we have a fourth recommended change that affects the disclosure of assumptions and methods, but does not impact the calculation of liabilities. None of the recommended changes significantly impact the aggregate results of the 2018 valuation. These recommendations and other considerations for the future are listed at the end of this section of the report.

Milliman completed a previous actuarial audit for MCERA in 2013. We note that Cheiron's 2017 valuation report accurately reflects the recommended changes from that report.

Statement of Key Findings

Membership Data

We performed tests on both the raw data supplied by MCERA staff and the processed data used by Cheiron in the valuation. Based on this review, we feel the individual member data used is appropriate and complete. A summary is shown in the table below:

	Cheiron	Milliman	Ratio Cheiron/Milliman
Active Members			
Total Number	2,685	2,685	100.0%
Average Age	46.8	46.8	100.0%
Average Service	10.6	10.6	100.0%
Average Compensation	\$ 90,859	\$ 90,917	99.9%
Retirees and Survivors			
Total Monthly Benefit (in \$millions)	\$ 134.79	\$ 135.09	99.8%
Average Age	70.1	70.3	99.8%

Actuarial Value of Assets

We have reviewed the allocation of the assets into each valuation subgroup used in the June 30, 2017 valuation. We found the calculations to be reasonable and the methodology to be appropriate and in compliance with actuarial standards of practice. We note that the actuarial valuation report does not display the development of the allocation of assets into each valuation subgroup.

Actuarial Liabilities and Normal Cost

We independently calculated the normal cost and liabilities of MCERA. Except for the three recommended changes to the calculations of liabilities, we found that all significant benefit provisions were accounted for in an accurate manner, the actuarial assumptions and methods are being applied correctly, and that our total liabilities matched those calculated by Cheiron closely. The few areas of difference were limited to specific groups, and, in our opinion, the overall impact on the valuation was not material.

A summary of the Actuarial Accrued Liability (AAL) is shown in the table below. Note that the line for the County of Marin also includes the Courts and other special districts.

	AAL (\$millions)		Ratio Cheiron/Milliman
	Cheiron	Milliman	
County of Marin	\$ 1,981.7	\$ 1,980.2	100.1%
Novato FPD	183.3	184.8	99.2%
City of San Rafael	557.6	558.2	99.9%
Total AAL	\$ 2,722.6	\$ 2,723.2	100.0%

Statement of Key Findings

Actuarial Liabilities and Normal Cost (continued)

The total normal cost rate for each employer is shown in the following table.

	Total Normal Cost		Ratio Cheiron/Milliman
	Cheiron	Milliman	
County of Marin	22.92%	22.79%	100.6%
Novato FPD	39.31%	39.07%	100.6%
City of San Rafael	29.88%	29.66%	100.8%

As discussed at the end of this section, we identified a few areas where the benefit provisions and assumptions were not being accurately reflected. We discussed these areas with Cheiron, and they will be implementing changes to reflect our comments in the 2018 valuation. Reflecting these changes will result in an increase in the AAL for current and future deferred vested member benefits for some groups and a small shift in the Normal Cost Rate for PEPRA members between Safety and Miscellaneous members; however, the overall impact on the valuation should be minor.

Member Contribution Rates

We reviewed the current member contribution rates. For the non-PEPRA members, we found both the basic and COLA member rates were accurate. For the COLA piece, we have one recommendation to be considered for future valuations regarding the timing of when the COLA is assumed to be paid during the year.

Member contribution rates for sample ages are shown in the following exhibit, based on the June 30, 2017 valuation.

Plan	Member Contribution Rate (Basic + COLA + Cost Share)		Cheiron / Milliman Ratio
	Cheiron	Milliman	
Miscellaneous Plans			
<u>County & Courts Misc. Tier 3, 3A & 4</u>			
Entry Age 25	8.44%	8.47%	99.6%
Entry Age 35	9.24%	9.22%	100.2%
Entry Age 45	10.58%	10.57%	100.1%
<u>San Rafael Misc Tier 1</u>			
Entry Age 25	10.47%	10.43%	100.4%
Entry Age 35	12.80%	12.72%	100.6%
Entry Age 45	15.11%	15.02%	100.6%
Safety Plans			
<u>County Tier 2A</u>			
Entry Age 25	15.54%	15.63%	99.4%
Entry Age 35	17.24%	17.19%	100.3%
Entry Age 45	18.47%	18.41%	100.3%
<u>Novato Safety Tier 1</u>			
Entry Age 25	15.67%	15.48%	101.2%
Entry Age 35	18.36%	18.14%	101.2%
Entry Age 45	20.46%	20.11%	101.7%

Statement of Key Findings

Member Contribution Rates (continued)

For PEPRA members we were relatively close on the member contribution rates; however, there were greater differences than we observed in other areas of the valuation. We discussed the differences with Cheiron, and they identified an issue with the treatment of the service death benefit, which they will be revising in the 2018 valuation. This change will result in a slightly lower Normal Cost Rate for Miscellaneous PEPRA members and slightly higher Normal Cost Rate for Safety PEPRA members, all other things being equal. As the member contribution rates for PEPRA members are equal to 50% of the total Normal Cost Rates, there will be a similar impact on the member rates.

Plan	Total Member Contribution Rate		Cheiron / Milliman Ratio
	Cheiron	Milliman	
Miscellaneous Plans with 2% COLA			
All Entry Ages	9.30%	9.10%	102.2%
Safety Plans with 2% COLA			
All Entry Ages	13.98%	14.29%	97.8%

Funding

We reviewed the application of the funding method and find it is reasonable and that it meets generally accepted actuarial standards. Based on MCERA's funding methods and assumptions, we believe the employer contribution rates are appropriately calculated, although we recommend for future valuations that Cheiron review the first year payroll increase used in the amortization of the Unfunded Actuarial Accrued Liability (UAAL). A comparison of the funded ratios calculated by Cheiron and Milliman is shown in the table below. All match within a reasonable tolerance.

	Funded Ratio		Ratio Cheiron/Milliman
	Cheiron	Milliman	
County of Marin	86.8%	86.9%	99.9%
Novato FPD	89.1%	88.4%	100.8%
City of San Rafael	74.6%	74.5%	100.1%

A summary of contribution rates by employer as a percentage of payroll is shown in the following table. The rates by employer matched closely. A more detailed comparison of the contribution rates by each agency and tier is shown in Appendix A-2.

	Employer Contribution Rate		Ratio Cheiron/Milliman
	Cheiron	Milliman	
County of Marin	25.32%	25.26%	100.3%
Novato FPD	49.05%	48.83%	100.4%
City of San Rafael	61.76%	61.51%	100.4%

Statement of Key Findings

Actuarial Assumptions (Economic)

We reviewed the economic assumptions used in the valuation and found them to be reasonable. The economic assumptions used were adopted based on Cheiron's Actuarial Experience Study completed in December 2017.

We have the following comments regarding the economic assumptions:

- Our analysis supports the long-term expected rate of return on assets (discount rate) of 7.00%, given MCERA's assumptions for inflation and the capital market assumptions used in Cheiron's analysis. As noted in Cheiron's report, most investment consultants are projecting lower returns over the shorter term; however, we believe the 7.00% assumption is reasonable for the long-term horizon of pension funding.
- The inflation assumption of 2.75% is reasonable.
- The real wage growth assumption of 0.25% is on the low end of what we typically recommend, but we believe it is reasonable.
- The overall package of economic assumptions is in line with what we recommend to our retained clients.

Actuarial Assumptions (Demographic)

We reviewed the analysis and recommendations for the Actuarial experience study for July 1, 2014 through June 30, 2017. Based on this review, we believe the demographic assumptions used in the valuation are reasonable.

Reports

Cheiron's reports meet the applicable actuarial standards of practice. We felt that the amount of disclosure included in the report was commensurate with the complexity of MCERA. We are recommending a few changes be made to the 2018 valuation that will provide better disclosure, and we have added other comments for consideration in future valuation reports.

Recommendations and Other Items to Consider in the Future

There are a few areas that we comment on in this report where MCERA and Cheiron may wish to consider a change in the future. We have provided references to the section of the report where more detailed information can be found. Note that we have discussed with Cheiron the first three recommended changes, which will affect the liability calculations, and they have indicated these changes will be included in the 2018 valuation.

Recommended Changes

We recommend that Cheiron implement the following changes in the 2018 valuation:

- ✓ Revising the service death benefit calculations for active PEPRA members to correctly align with the Miscellaneous and Safety assumptions (page 12).
- ✓ Revising the assumed age factor used in the calculation of liabilities for current deferred vested members to correctly align with the updated assumed deferred retirement ages (page 11).
- ✓ Revising the calculation of liabilities for the active member reciprocal benefit to reflect updated assumed deferred retirement ages for PEPRA members (page 12).
- ✓ Adding and modifying disclosures in the valuation report (Incorrect or Missing Information in Section 9).

Changes to be Considered

We recommend that Cheiron and MCERA consider the following for future valuations and experience studies:

- ✓ Adding an assumption for sick leave credit conversion for PEPRA members. (page 34).
- ✓ Modifying the calculation of the UAAL amortization rate to be consistent with the assumption that members will leave active service in the first year in the next valuation (page 18).
- ✓ Adjusting the assumed timing of COLA payments in the calculation of the member COLA contribution rate for non-PEPRA members in the next experience study (page 15).
- ✓ Adding and modifying disclosures in the next valuation report (Other Comments for Consideration in Section 9).
- ✓ Adopting lower retirement rates for PEPRA tiers in the next experience study (Section 8).

Section 2 Membership Data

Audit Conclusion



We performed tests on both the raw data supplied by MCERA staff and the processed data used by Cheiron in the valuation. Based on this review, we feel the individual member data used is appropriate and complete.

Comments

Overall, the data process appears to be thorough and accurate. We would add the following comments:

- **Raw Data:** We were provided with the same data that was given by MCERA staff to Cheiron for use in the actuarial valuation.

Completeness: The data contained all the necessary fields to perform the actuarial valuation.

Quality: Although we did not audit the data at the source, we performed some independent checks to confirm the overall reasonableness of the data. We compared the total retiree and beneficiary benefit amounts on the MCERA data with the actual benefit payments made, as reported in MCERA's financial statements. We also compared the total active member compensation on the MCERA data with the estimated active payroll for the prior year. The estimated payroll was based on the actual employer contribution amounts divided by the applicable employer contribution rates for the prior year. Based on this analysis, we found the data to be reasonable.

- **Parallel Data Processing:** We performed independent edits on the raw data and then compared our results with the valuation data used by Cheiron. We found our results to be very consistent.

Our results did not match exactly; however, this is understandable since Cheiron, as the retained actuary, has more extensive data editing procedures. Overall, each data key component matched within an acceptable level, and we believe the individual member data used by Cheiron was appropriate for valuation purposes.

**Comments
(continued)**

A summary of the data in aggregate is shown in Exhibit 2-1. The “Milliman” column reflects the MCERA data after adjustments by Milliman. The “Cheiron” column reflects the actual data used in Cheiron’s valuation.

In addition to the total statistics, we reviewed individual data and summaries by tier. In our opinion, there was a very close match between the data provided by MCERA and the valuation data used by Cheiron. Note that there were some small differences in the retiree data. This appeared to be primarily because Cheiron reflected information on alternate payees from prior valuations that we did not account for.

**Exhibit 2-1
Member Statistics as of June 30, 2017**

	Cheiron	Milliman	Ratio Cheiron/Milliman
<i>Active Members</i>			
Total Number	2,685	2,685	100.0%
Average Age	46.8	46.8	100.0%
Average Service	10.6	10.6	100.0%
Average Compensation	\$ 90,859	\$ 90,917	99.9%
<i>Retirees and Survivors</i>			
Members in Payment	3,141	3,134	100.2%
Average Age	70.1	70.3	99.8%
Average Annual Benefit	\$ 42,912	\$ 43,104	99.6%
<i>Vested Terminated Members</i>			
Total Number	668	659	101.4%
Average Age	48.4	48.4	99.9%

Section 3 Actuarial Value of Assets

Audit Conclusion



We have reviewed the allocation of the assets into each valuation subgroup used in the June 30, 2017 valuation. We found the calculations to be reasonable and the methodology to be appropriate and in compliance with actuarial standards of practice. We note that the actuarial valuation report does not display the development of the allocation of assets into each valuation subgroup.

Comments

Unlike most public retirement systems, there is no smoothed actuarial value of assets calculated for MCERA. Instead, the market value is used and there is a phase-in of the amortization schedule used to fund the Unfunded Actuarial Accrued Liability. The result is similar to the contribution pattern that would arise if a five-year asset smoothing method were used.

Cheiron separates the market value of assets (less the Contingency reserve) by employer for the County of Marin, the Novato Fire Protection District and City of San Rafael plans. In addition, assets are allocated by valuation subgroup as shown on page 20 of the June 30, 2017 actuarial valuation report.

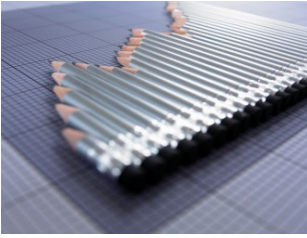
The process for dividing the assets into the valuation subgroups varies from employer to employer. For Novato, the assets are divided between Miscellaneous and Safety, based on the Actuarial Accrued Liability. San Rafael and the County are divided in proportion to a projection of the assets from the prior year. The projection is done with interest and expected contributions for the group during the year. For San Rafael, the projection also reflects expected benefit payments, while for the County, the projection used for allocating into subgroup does not reflect expected benefit payments. This means that the procedure for allocating the assets into valuation subgroup within each employer is different for each of the three employers.

Cheiron explained that these differences were based on work done by the prior actuary. They also noted that the slightly different approaches do not cause any shift in assets between employers. We believe that Cheiron should consider disclosing these differences in the actuarial valuation report. This also may be something that MCERA and Cheiron want to review the next time changes in funding methods are considered.

We reviewed the calculations used by Cheiron and found them to be reasonable. Note that page 20 of the actuarial valuation report only shows the results of the process of allocating assets into the various valuation subgroups. It does not show the calculations done to arrive at that allocation. We believe that Cheiron should consider adding those calculations to the actuarial valuation report so that a reader could follow the development of the assets used.

Section 4 Actuarial Liabilities

Audit Conclusion



We independently calculated the normal cost and liabilities of MCERA. We found that all significant benefit provisions and assumptions were accounted for in an accurate manner (with a few exceptions that we have noted) and that our total liabilities matched those calculated by Cheiron closely. The few areas of difference were limited to specific groups, and, in our opinion, the overall impact on the valuation was not material.

Comments

We independently calculated the liabilities for all members based on the following:

Data: We used the same data used by Cheiron in their valuation. As discussed in Section 2, we confirmed that this data was consistent with the data provided by MCERA staff.

Assumptions: We used the assumptions disclosed in the June 30, 2017 actuarial valuation report. This information was provided to us electronically by Cheiron. We confirmed the assumptions were consistent with those adopted based on the recent experience study report.

Methods: We used the actuarial methods disclosed in the June 30, 2017 actuarial valuation report. This was supplemented by discussions between Cheiron and Milliman on the technical application of these methods.

Benefits: We obtained this information from the MCERA website and the relevant law.

We then performed a full replication of Cheiron's valuation as of June 30, 2017. Based on this valuation, we completed a detailed comparison of the AAL computed in our independent valuation and the amounts reported by Cheiron.

**Comments
(continued)**

Exhibit 4-1 shows a summary of this analysis for each member type. The results for each group were reasonable, and our calculated AAL values match closely with those reported in the valuation.

We did note one difference with the inactive deferred members. The assumption is that deferred members retire at a specific age (generally age 58 for Miscellaneous members and age 50 or 55 for Safety members). The member's benefit is then estimated based on the member's service, assumed compensation, and the applicable age factor specified in the '37 Act. For groups where the assumed retirement age changed due to the new assumptions adopted for the 2017 valuation, we observed that Cheiron was using the age factor based on the prior assumed retirement age. Cheiron confirmed this and will be revising their procedures for the 2018 valuation.

**Exhibit 4-1
Actuarial Accrued Liability by Member Type**

(Dollar Amounts in Millions)

	Cheiron	Milliman	Ratio Cheiron/Milliman
Retiree	\$ 1,750.6	\$ 1,743.9	100.4%
Inactive	101.2	102.5	98.7%
Active	<u>870.9</u>	<u>876.7</u>	99.3%
Total AAL	\$ 2,722.7	\$ 2,723.1	100.0%

Appendix A-1 shows the total (accrued and future) present value of benefits (PVB) for current active members by employer, with a further breakdown by benefit type. Similar to the AAL, our calculated PVB was close to Cheiron's in total; however, there was some difference on the deferred vested and death benefits as noted below. A summary of the total present value of benefits for active members is shown in the following table:

**Exhibit 4-2
Active Present Value of Benefits by Benefit Type**

(Dollar Amounts in Millions)

	Cheiron	Milliman	Ratio Cheiron/Milliman
Service Retirement	\$ 1,224.2	\$ 1,241.0	98.6%
Deferred Vested & Refund	43.0	44.7	96.3%
Disability	73.6	73.6	100.1%
Death from Active Status	<u>14.5</u>	<u>13.6</u>	106.1%
Total Active PVB	\$ 1,355.3	\$ 1,372.9	98.7%

**Comments
(continued)**

Note that there will always be differences in the calculated liabilities when different software is used by different actuaries; however, the results should not deviate significantly. The two areas where we observed differences in the active PVB calculations were for the service death benefit and the deferred benefit for reciprocal members. We have discussed both with Cheiron, and they agreed with our comments and will be reflecting the recommended changes in the 2018 valuation.

For PEPRA members, Cheiron inadvertently applied the service death rates to Miscellaneous members instead of Safety members. This resulted in there being liabilities and Normal Costs for the service death benefit assigned to Miscellaneous members where there should have been none. Conversely, the liabilities and Normal Costs for the service death benefit that should have been assigned to Safety members were missed.

The valuation assigns a liability for members who are assumed to leave active service in the future. A portion of that liability reflects that the member may go to work for a reciprocal agency and therefore be entitled to have his or her benefit reflect compensation increases at the other agency until assumed retirement. For PEPRA members, Cheiron did not update this calculation to reflect the new deferred retirement age adopted for the 2017 valuation. Therefore, the projected deferred retirement benefit for future PEPRA reciprocal members was understated.

Note that these differences also affected the total AAL calculated; however, when aggregated, the differences are not material as these pieces comprise a relatively small portion of MCERA's total liabilities.

Even after factoring in the issues with the active service death benefit and the active deferred benefit, the overall level of consistency we found in this audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of MCERA based on the assumptions and methods.

Exhibit 4-3 shows a breakdown of the Actuarial Accrued Liability by employer. The results for each employer were reasonable, and our calculated AAL values match closely with those reported in the valuation.

Exhibit 4-3
Actuarial Accrued Liability by Employer
(Dollar Amounts in Millions)

	AAL (\$millions)		Ratio Cheiron/Milliman
	Cheiron	Milliman	
County of Marin	\$ 1,981.7	\$ 1,980.2	100.1%
Novato FPD	183.3	184.8	99.2%
City of San Rafael	557.6	558.2	99.9%
Total AAL	\$ 2,722.6	\$ 2,723.2	100.0%

**Comments
(continued)**

In addition to reviewing the liabilities in total, we also received selected results from a number of individuals included in the valuation. We were able to match closely on these individuals, except in the areas described above.

There is a technical issue with the timing of the benefit payments. In a valuation, the actuary first projects the future benefit payments for the retiree members based on the data and assumptions. The actuary then places a value on each future benefit expected to be paid based on the investment return assumption. A dollar paid in the future is less than a dollar paid today due to the time value of money.

In Cheiron’s calculations, they are effectively treating the benefit payments as being paid on the first of the month. Our understanding is that MCERA’s benefit payments are made at the end of the month. We set up our valuation to be consistent with Cheiron’s approach so this did not cause any differences. If we had not made this adjustment, our liabilities would have been slightly lower (about .5%). Although we think that using our method (payments at the end of the month) is more technically precise, we believe Cheiron’s method is reasonable.

We also looked at the normal cost rate (the allocated cost of benefits earned during the year). In the many audits we have performed, this is usually the area where we see the greatest differences. Although there were some differences, the overall match was quite close and deviation by employer fell well within an acceptable level.

Based on these results, we feel that Cheiron’s calculated normal cost rate is reasonable.

**Exhibit 4-4
Comparison of Normal Cost Rate
(Expressed as a Percentage of Payroll)**

	Cheiron	Milliman	Ratio Cheiron/Milliman
County of Marin (including Courts and Special Districts)			
Total Normal Cost	22.92%	22.79%	100.6%
Member	<u>10.71%</u>	<u>10.64%</u>	100.6%
Employer Normal Cost	12.21%	12.15%	100.5%
Novato Fire Protection District			
Total Normal Cost	39.31%	39.07%	100.6%
Member	<u>14.65%</u>	<u>14.66%</u>	99.9%
Employer Normal Cost	24.66%	24.41%	101.0%
City of San Rafael			
Total Normal Cost	29.88%	29.66%	100.8%
Member	<u>12.48%</u>	<u>12.47%</u>	100.1%
Employer Normal Cost	17.40%	17.19%	101.2%
Totals			
Total Normal Cost	24.45%	24.30%	100.6%
Member	<u>11.09%</u>	<u>11.03%</u>	100.5%
Employer Normal Cost	13.36%	13.27%	100.7%

Section 5 Member Contribution Rates

Audit Conclusion



We reviewed the current member contribution rates. For the non-PEPRA members, we found both the basic and COLA member rates were accurate. For the COLA piece, we have one recommendation to be considered for future valuations regarding the timing of when the COLA is assumed to be paid during the year.

For PEPRA members, we were relatively close on the member contribution rates; however, we have one recommended change to the treatment of the service death benefit, which Cheiron will be reflecting in the 2018 valuation.

Comments

For non-PEPRA members, member contributions are of two types: basic contributions and cost-of-living contributions. Basic contributions for each member class are defined in the County Employees Retirement Law with a specified percentage factor and assumed retirement age. PEPRA member contribution rates are equal to one-half the total Normal Cost Rate as discussed later.

Note that for groups with the benefit formulas based on a final average salary period equal to one year, the final period for the determination of member contribution rates is also equal to one year. For groups using a three-year period for benefits, the three-year period is also used for the determination of member contribution rates.

Basic member contributions are determined using the Entry Age Normal Actuarial Cost Method and the following actuarial assumptions:

- ✓ Assumed rate of return on assets
- ✓ Individual salary increase rate (wage growth + merit)
- ✓ Mortality for members after service retirement
- ✓ The COLA is not included (for the basic member rate calculation)
- ✓ Pre-retirement decrements are excluded (i.e., 100% probability of reaching assumed retirement age)

The determination of the member cost-of-living contributions is based on Section 31873 of the County Employees Retirement Law. This section requires that the cost of this benefit be shared equally between members and the employer. There is a cap on the member COLA contribution rates applied to some groups, and some groups are paying additional employee contributions as a result of bargaining agreements. The member contribution rates also reflect a 4.8% load for administrative expenses.

**Comments
(continued)**

For the non-PEPRA member contribution rates, we found our results to be consistent with Cheiron’s. Member contribution rates for sample ages are shown in the following exhibit.

**Exhibit 5-1
Sample Member Contribution Rates⁽¹⁾**

Plan	Member Contribution Rate (Basic + COLA + Cost Share)		Cheiron / Milliman Ratio
	Cheiron	Milliman	
Miscellaneous Plans			
<u>County & Courts Misc. Tier 3, 3A & 4</u>			
Entry Age 25	8.44%	8.47%	99.6%
Entry Age 35	9.24%	9.22%	100.2%
Entry Age 45	10.58%	10.57%	100.1%
<u>San Rafael Misc Tier 1</u>			
Entry Age 25	10.47%	10.43%	100.4%
Entry Age 35	12.80%	12.72%	100.6%
Entry Age 45	15.11%	15.02%	100.6%
Safety Plans			
<u>County Tier 2A</u>			
Entry Age 25	15.54%	15.63%	99.4%
Entry Age 35	17.24%	17.19%	100.3%
Entry Age 45	18.47%	18.41%	100.3%
<u>Novato Safety Tier 1</u>			
Entry Age 25	15.67%	15.48%	101.2%
Entry Age 35	18.36%	18.14%	101.2%
Entry Age 45	20.46%	20.11%	101.7%

1. Includes administrative expenses.

In our calculations, we used the same methods and assumptions as Cheiron. We are recommending one change be considered in the calculation of the COLA contribution rate for future valuations. Cheiron is effectively assuming that all members leave active service on June 30th and therefore receive their first COLA after nine months of retirement. This is inconsistent with actual practice and the valuation assumption that members retire mid-year. We recommend consideration be given to changing this assumption to be either:

- 3-month wait for COLA: This would be equivalent to assuming members leave active service on December 31st of a given year. It would be consistent with the valuation assumption that members leave active service mid-year and close to when members actually retire in practice.
- 6-month wait for COLA: Using a 6-month wait is equivalent to assuming members retire evenly throughout the year.

**Comments
(continued)**

For PEPRA members, we were relatively close on the member contribution rates; however, there were greater differences than we observed in other areas of the valuation. We discussed the differences with Cheiron, and they identified an issue with the treatment of the service death benefits, which they will be revising in the 2018 valuation.

For PEPRA members, Cheiron inadvertently applied the service death rates to Miscellaneous members instead of Safety members. This resulted in there being liabilities and Normal Costs for the service death benefit assigned to Miscellaneous members where there should have been none. Conversely, the liabilities and Normal Costs for the service death benefit that should have been assigned to Safety members were missed.

This change will result in a slightly lower contribution rates for Miscellaneous PEPRA members and slightly higher contribution rates for Safety PEPRA members in the 2018 valuation, all other things being equal. A comparison of our calculated member contribution rates for PEPRA groups is shown in the following table.

Plan	Total Member Contribution Rate		Cheiron / Milliman Ratio
	Cheiron	Milliman	
Miscellaneous Plans, All Entry Ages			
2% COLA	9.30%	9.10%	102.2%
4% COLA	10.92%	10.80%	101.1%
Safety Plans, All Entry Ages			
2% COLA	13.98%	14.29%	97.8%
3% COLA	17.18%	17.64%	97.4%
4% COLA	16.30%	16.66%	97.8%

Section 6 Funding

Audit Conclusion



We reviewed the application of the funding method and find it is reasonable and that it meets generally accepted actuarial standards. Based on MCERA's funding methods and assumptions, we believe the employer contribution rates are appropriately calculated, although there is one change we recommend that Cheiron consider for future valuations.

Comments

We independently calculated the employer contribution rates based on our parallel valuation. We found that all rates were reasonable and matched closely to Cheiron's calculation in total. A summary comparison of our results is shown below. Note that an analysis by agency and tier is shown in Appendix A-2.

Total Employer Contribution Rates

Exhibit 6-1
Comparison of Combined Employer Contribution Rate
 (as a Percentage of Payroll)

	Cheiron	Milliman	Ratio Cheiron/Milliman
County of Marin			
Employer Normal Cost Rate	12.20%	12.24%	99.7%
UAAL Rate	11.95%	11.94%	100.1%
Admin. Expense Rate	1.17%	1.17%	100.0%
Total Employer Contribution	25.32%	25.35%	99.9%
Novato FPD			
Employer Normal Cost Rate	24.66%	24.48%	100.7%
UAAL Rate	22.12%	22.16%	99.8%
Admin. Expense Rate	2.27%	2.26%	100.4%
Total Employer Contribution	49.05%	48.90%	100.3%
City of San Rafael			
Employer Normal Cost Rate	17.40%	17.30%	100.6%
UAAL Rate	41.50%	41.47%	100.1%
Admin. Expense Rate	2.86%	2.85%	100.4%
Total Employer Contribution	61.76%	61.62%	100.2%
Total			
Employer Normal Cost Rate	13.35%	13.36%	99.9%
UAAL Rate	16.33%	16.22%	100.7%
Admin. Expense Rate	1.44%	1.44%	100.0%
Total Employer Contribution	31.12%	31.02%	100.3%

Contribution Adequacy

The Conference of Consulting Actuaries Public Plans Community (CCA PPC) has published a paper on model actuarial funding policies which includes guidance for pension funding. MCERA's method of funding new UAAL layers due to assumptions and experience gains and losses over closed 22-year or 24-year periods, respectively, falls in the Acceptable Practices category, as it is similar to a traditional 20-year amortization after factoring in the ramp-up and ramp-down periods.

There will always be a competition between providing strong funding to the plan and having reasonable contribution rates for the employer. We believe that MCERA's funding policy strikes a reasonable balance between the two.

We would note that it is possible, albeit unlikely, for a calculated contribution rate under this method to be less than a 30-year amortization of the aggregate UAAL, which is the minimum required under the '37 Act. This comparison should be done every year to make sure that the contribution rate meets this requirement.

Additional Comments on the UAAL Amortization

There are two nuances to the method Cheiron uses to calculate the UAAL amortization rate that we believe are worth mentioning. We recommend that the method used to project payroll be reviewed for future valuations.

1. Payroll Projection

For purposes of calculating the recommended employer contribution rates, in the year following the valuation date, Cheiron uses a first year payroll amount that assumes all current active members remain active for the full first year. We find this approach is not consistent with the assumption used in the valuation of liabilities where terminating and retiring members are assumed to leave in the middle of the year. The result is that Cheiron is effectively assuming an approximate 4% increase in payroll in the first year and a 3% increase in the following years. Assuming a slightly higher payroll results in slightly lower employer contributions rates than we would have calculated. Note that for purposes of our replication calculations we used Cheiron's method.

We discussed this issue with Cheiron. They feel the current method is reasonable, but they will consider our comments for the 2018 valuation. In particular, they point out that in practice the timing of compensation increases and hiring is not uniform throughout the year, so there may be some offsetting understatement of increases in payroll under the current method. However, in our opinion, if these timing issues are considered for the payroll, then they should also be reflected in the liability calculations. We recommend that the method used to project payroll be reviewed for future valuations.

2. Contribution Lag

There is another area where Cheiron uses a slightly different method in the calculation of the UAAL amortization payment than we generally do. We believe that our method is more technically consistent with actual practice, although we feel Cheiron's approach is reasonable and is commonly used by other public plan actuaries.

**Additional Comments
on the UAAL
Amortization
(continued)**

The June 30, 2017 valuation sets the recommended contribution rates effective July 1, 2018. Cheiron does not account for this one-year lag in the implementation of the contribution rates. In our valuation work, we generally make an adjustment to account for this lag in contributions; however, based on our experience, both approaches are common among actuaries working with public sector retirement systems.

One thing MCERA should be aware of is that in periods of rising contribution rates, the current approach will cause an actuarial loss in the following year. In Cheiron's calculation of the employer contribution rates, they are effectively assuming that the increased contribution rates calculated in the 2017 valuation will be implemented on July 1, 2017; however, in practice the new rates will not go into effect until July 1, 2018. Cheiron's approach will result in slightly lower calculated rates than our standard method in the valuation year if employer contribution rates will increase the next year. All else being equal, this will cause a slight rise in the next year's employer contribution rates (assuming contribution rates are increasing). Conversely, in periods of declining contribution rates, an actuarial gain on contribution rates would be expected.

Actuarial Cost Method

MCERA uses the Entry Age Actuarial Cost Method. We agree that it is appropriate for valuing the costs and liabilities of MCERA and is the cost method that we usually recommend.

Purpose of a Cost Method: The purpose of any cost method is to allocate the cost of future benefits to specific time periods. Most public plans follow one of a group of generally accepted funding methods, which allocate the cost over the members' working years. In this way, benefits are financed during the time in which services are provided

Most Common Public Plan Cost Method (Entry Age): The most common cost method used by public plans is the Entry Age Actuarial Cost Method. The focus of the Entry Age Cost Method is the level allocation of costs over the member's working lifetime. For a public plan, this means current taxpayers pay their fair share of the pensions of the public employees who are currently providing services. Current taxpayers are not expected to pay for services received by a past generation, nor are they expected to pay for the services that will be received by a future generation. The cost method does not anticipate increases or decreases in allocated costs.

The 2017 Public Fund Survey shows that about 70% of the retirement systems surveyed are using the Entry Age Cost Method. We believe that the use of this cost method satisfies the requirements of CERL 31453.5.

For GASB Statements No. 67 and No. 68, the Entry Age Actuarial Cost Method is the only permissible cost method for financial reporting purposes.

The Entry Age Actuarial Cost Method with separate normal cost rates calculated for each plan falls in the "Model Practice" category under the Actuarial Funding Policies and Practices for Public Pension Plans guidelines issued by the California Actuarial Advisory Panel.

Section 7 Actuarial Assumptions (Economic)

Audit Conclusion



We reviewed the economic assumptions used in the valuation and found them to be reasonable. The economic assumptions used were adopted based on Cheiron's Actuarial Experience Study completed in December 2017.

We have the following comments regarding the economic assumptions:

- Our analysis supports the long-term expected rate of return on assets (discount rate) of 7.00%, given MCERA's assumptions for inflation and the capital market assumptions used in Cheiron's analysis. As noted in Cheiron's report, most investment consultants are projecting lower returns over the shorter term; however, we believe the 7.00% assumption is reasonable for the long-term horizon of pension funding.
- The inflation assumption of 2.75% is reasonable.
- The real wage growth assumption of 0.25% is on the low end of what we typically recommend, but we believe it to be reasonable.
- The overall package of economic assumptions is in line with what we recommend to our retained clients.

Comments

The purpose of the actuarial valuation is to analyze the resources needed to meet the current and future obligations of the system. To provide the best estimate of the long-term funded status of the system, the actuarial valuation should be predicated on methods and assumptions that will estimate the future obligations of the system in a reasonable manner.

An actuarial valuation uses various methods and two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its long-term impact on the system, or to the operation of the system itself. Demographic assumptions are based on the emergence of the specific experience of the system's members. This section of the report will focus on the economic assumptions. The following section will address the demographic assumptions.

Actuarial Standard of Practice No. 27: Selection of Economic Assumptions

The Actuarial Standards Board has adopted Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans, such as MCERA.

As no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. ASOP 27 explicitly advise the actuary not to give undue weight to recent experience.

Actuarial Standard of Practice No. 27: Selection of Economic Assumptions (continued)

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

After completing the selection process, the actuary should review the set of economic assumptions for consistency. This may entail the actuary using the same inflation component in each of the economic assumptions selected.

An actuary's estimate with respect to a particular measurement of pension obligations may change from time to time due to changing conditions or emerging plan experiences. Even if assumptions are not changed, we believe that the actuary should be satisfied that each of the economic assumptions selected for a particular measurement complies with Actuarial Standard of Practice No. 27, unless that assumption has been prescribed by someone with the authority to do so.

Economic Assumptions

Based on the information and economic environment present as of the date of Cheiron's analysis, we believe the economic assumptions used by Cheiron in the June 30, 2017 actuarial valuation are reasonable. We also believe the economic assumptions are reasonable to be used in the 2018 valuation.

The economic assumptions used in the June 30, 2017 actuarial valuation are as follows:

Assumption	Rate
Price Inflation	2.75%
Real Investment Return	<u>4.25%</u>
Total Investment Return	7.00%
Price Inflation	2.75%
Real Wage Growth	<u>0.25%</u>
Total Wage Growth	3.00%
Payroll Growth	3.00%

The Board should be aware that the measured liabilities and normal cost are directly impacted by these important assumptions. The most critical assumption in determining the present value of benefits is the total investment return assumption.

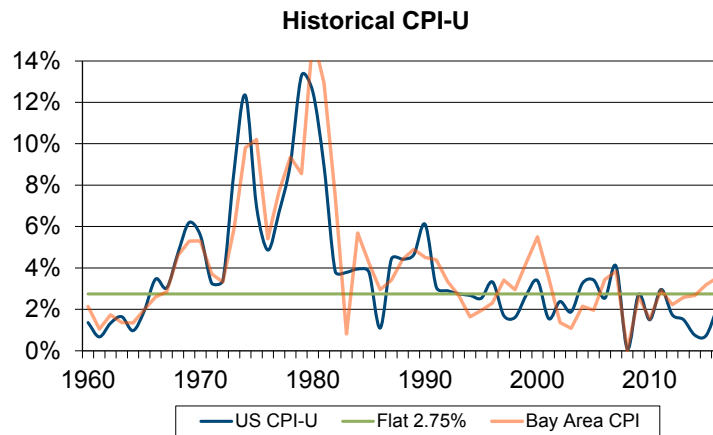
In our opinion, the current package of economic assumptions is reasonable. The following portion of this report discusses four of the key economic assumptions (inflation, wage growth, investment return, and COLA).

Inflation

Use in the Valuation: Inflation, as referred to here, means price inflation. The inflation assumption has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, general wage increases, payroll increase, and the cost-of-living adjustments for current and future retirees and survivors.

There is expected to be a long-term relationship between inflation and the investment return assumption. The basic principle is that the investors demand a “real return” – the excess of actual investment returns over inflation. If inflation rates are expected to be high, investors will demand expected investment returns that are also expected to be high enough to exceed inflation, while lower inflation rates will result in lower demanded expected investment returns, at least in the long run.

Historical Perspective: The data for inflation shown below is based on the national Consumer Price Index, US City Average, All Urban Consumers (CPI-U) as published by the Bureau of Labor Statistics.



We have also shown Bay Area inflation. As noted by Cheiron in their experience study, national and local inflation have tracked fairly closely over the period, although Bay Area inflation has been higher the last few years.

There are numerous ways to review historical data, with significantly differing results. As Cheiron mentioned, historical inflation over the past 10 years, or even 30 years, is significantly lower than an historical perspective that includes the high inflation rates of the 1970s and early 1980s. The average over the last 30 years has been 2.6%.

Forecasts of Inflation: As Cheiron discussed, since the U.S. Treasury started issuing inflation indexed bonds (TIPS), it is possible to determine the approximate rate of inflation anticipated by the financial markets by comparing the yields on inflation indexed bonds with traditional fixed government bonds. As of June 30, 2017, market prices suggested investors expected inflation to be about 1.8% over the next 30 years. This has been gradually trending up and current expectations as of October, 2018 are about 2.1%.

Inflation (continued)

Although most investment consultants and economists forecast lower inflation, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2016 Trustees Report, the projected ultimate average annual increase in the CPI under the intermediate cost assumptions was 2.60%.

Peer System Comparison: Although assumptions should not be set based on what other systems are doing, it is informative to see how MCERA compares.

According to the *National Association of State Retirement Administrators (NASRA) Public Fund Survey* (a survey of approximately 200 large municipal and statewide systems), the average inflation assumption for statewide systems has been steadily declining. As of June 30, 2017, the median assumption was 3.00%, and has decreased to 2.75% as of October, 2018.

Conclusion: We believe that a 2.75% assumption is reasonable for an actuarial valuation of a retirement system. As noted, long-term forecasts are for a somewhat lower level of inflation, so we feel that the recent change from 3.00% to 2.75% was a good change. This assumption should continue to be monitored in the future.

General Wage Growth

Use in the Valuation: Estimates of future salaries are based on two types of assumptions. Rates of increase in the general wage level of the membership are directly related to inflation, while individual salary increases due to promotion and longevity (referred to as the merit scale) occur even in the absence of inflation. This section will address the general wage growth assumption (price inflation plus productivity increases). The merit scale is discussed in Section 8 of this report (demographic assumptions).

The current wage growth assumption is 0.25% above the price inflation rate, or 3.00% per year. Note that the 3.00% includes increases in wages due to productivity as discussed below.

Historical Perspective: As Cheiron demonstrated, historical measures for general wage growth vary widely depending upon the data source, consideration of mean vs. median, and how far back it is measured.

We have used statistics from the Social Security Administration on the National Average Wage. Using this data implies real wage growth of about 0.6% over the past 50 years.

Forecasts for Future Wage Growth: Wage inflation has been projected by the Office of the Chief Actuary of the Social Security Administration. In the 2017 Trustees Report, the long-term ultimate annual increase in the National Average Wage was estimated to be 1.2% higher than the Social Security intermediate ultimate inflation assumption of 2.6% per year.

**General Wage Growth
(continued)**

Conclusion: We believe that the current estimate of 0.25% is a reasonable estimate of future real wage growth, but at the low end of the range of what we would consider to be reasonable. Cheiron notes that other financial stresses on governmental entities, such as health care costs and pension contributions, have outpaced inflation and are likely to have a negative impact on future salary increases.

**Payroll Increase
Assumption**

The UAAL is amortized as a level percentage of payroll in determining contribution rates as a percentage of pay. The current payroll increase assumption is equal to the general wage growth assumption of 3.00%. It is our general recommendation to set these two assumptions equal, unless there is a specific circumstance that would call for an alternative assumption. Therefore, we agree with this assumption. Our only caveat is that we are recommending a change be considered to the treatment of the projected payroll in the first year, as discussed in Section 6 (Additional Comments on the UAAL Amortization), which we believe is not technically consistent with the 3.0% increase assumption.

**Cost-of-Living
Adjustments (COLAs)**

Every April, retirees and survivors receive cost-of-living adjustments (COLAs) equal to the CPI increases, but capped at 2%, 3%, or 4% based on agency and tier. Since the cap is more restrictive on the upside than the downside, it is reasonably expected that the average COLA received will be less than CPI, even when factoring in the "COLA Bank." For example, with a 3% COLA, the maximum the COLA can exceed 2.75% CPI is 0.25%, but it could potentially be less by 2.75%, or more in some circumstances.

Cheiron recommended COLA growth assumption of 1.9%, 2.6%, and 2.7% for those with maximums of 2%, 3%, or 4%, respectively. Those recommendations were based on simulations Cheiron performed, which reflected the cap, COLA Bank, inflation expectations, and volatility in inflation.

We believe the COLA assumptions are reasonable.

**Investment Return
(Discount Rate)**

Use in the Valuation: The investment return assumption is one of the primary determinants in the calculation of the expected cost of MCERA's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct impact on the calculations of actuarial accrued liabilities, normal cost, and member and employer contribution rates.

The discount rate is the rate used to discount future benefit payments into an actuarial present value. The traditional actuarial approach used for public sector funding sets the discount rate equal to the expected investment return. Under current standards set by the GASB, the "discount rate" should reflect the long-term expected rate of return on pension plan investments to the extent that the pension plan's assets are expected to be sufficient to pay benefits.

The current net investment return assumption of 7.00% per year includes two components: (1) inflation of 2.75% and (2) a net real rate of return equal to 4.25%. This approach of dividing the net return into separate pieces is called the "building block" method.

**Investment Return
(Discount Rate)
(continued)**

Long-term Expected Investment Return: As of 2017, the five investment consultants included in Cheiron's analysis were projecting a nominal expected return for the short-term future (generally, the next 10 years) of 6.26%, on average. Usually, when setting the long-term investment return assumption, actuaries are looking at longer periods. Cheiron reflected this by also looking at investment consultants with longer-term time horizons (20 to 30 years). On average, this group has an expected return of greater than 7.0%. Reflecting both the short- and long-term expectations, Cheiron concludes that the 7.0% assumption is reasonable. We agree that this is a reasonable conclusion based on their analysis.

As noted above, investment consultants generally have different outlooks in the short and long terms. Additionally, there will always be differences of opinions on capital markets assumptions. Therefore, the capital market assumptions selected for the analysis can materially affect the expected return for the portfolio. We concur with Cheiron's approach of considering a variety of investment consultants, as well as short- and long-term expectations. We also agree with their comment that, in the short term (10 years or less), it is more likely than not that MCERA will experience actuarial losses due to investment experience.

Conclusion: We find the 7.0% expected return assumption is reasonable for funding and financial reporting purposes.

Section 8 Actuarial Assumptions (Demographic)

Audit Conclusion



We completed a high-level review of the valuation assumptions that were adopted based on Cheiron's Actuarial Experience Study for July 1, 2014 through June 30, 2017. Based on this review, we believe the demographic assumptions used in the valuation are reasonable.

Comments

Studies of demographic experience involve a detailed comparison of actual and expected experience. If the actual experience differs significantly from the overall expected results, or if the actual pattern does not follow the expected pattern, new assumptions are considered. Recommended revisions normally are not an exact representation of the experience during the observation period. Judgment is required to predict future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

We did not independently perform the detailed calculations of the actual and expected rates that Cheiron did, but we reviewed the assumptions based on our experience with similar systems, including a comparison of MCERA with peer systems for three key assumptions.

Actuarial Standard of Practice No. 35: Selection of Demographic Assumptions

Actuarial Standard of Practice No. 35 (ASOP 35) governs the selection of demographic and other noneconomic assumptions for measuring pension obligations. ASOP 35 states that 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. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. 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 over the measurement period.

Actual-to-Expected Ratio

In performing an experience study, an actuary will compare the actual results of the study with those the assumptions would have predicted. This comparison is called the Actual-to-Expected (A/E) ratio. If, for example, the A/E ratio for service retirement is 120%, this would indicate that the actual number of service retirements exceeded the number expected by the assumptions by 20%.

As noted, we did not independently calculate the A/E ratios, but we do comment on some of these ratios determined by Cheiron.

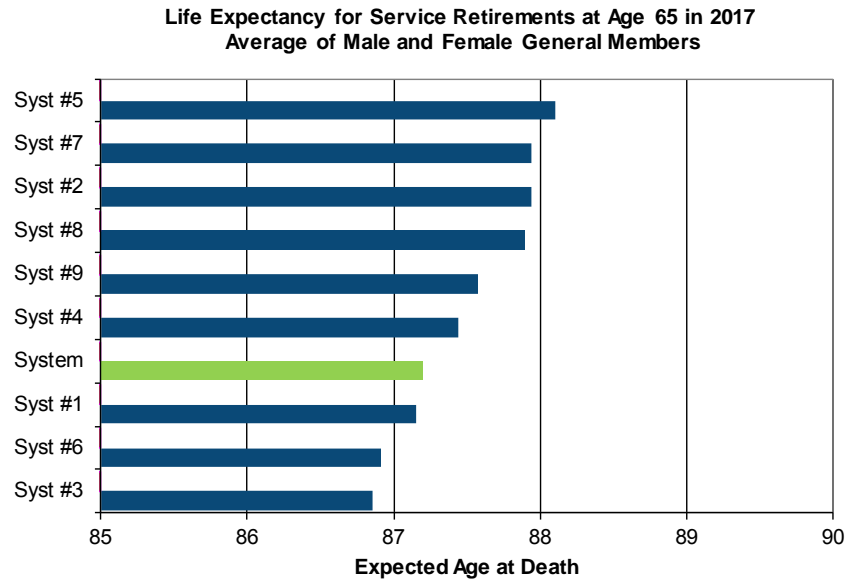
Post-Retirement Mortality

We reviewed Cheiron results for the probability of death for healthy and disabled retired members (service retirements) and found them to be reasonable, although possibly higher than we might have recommended for males based on the experience. We have the following additional comments:

- **Generational Mortality:** The valuation uses a generational mortality approach, which is a more explicit method to project mortality improvement, as compared to the static mortality tables that were common previously. We agree with this approach. To project future mortality, the MP-2017 projection scale was adopted. This is the most recent projection table from the Society of Actuaries, and we believe it is reasonable estimate of expected future improvements in mortality.
- **Differences by Benefit Amount:** Cheiron's mortality analysis weights the results by benefit amount. Traditionally mortality studies have focused on the actual counts with no adjustment for benefit amount, although the benefit-weighted approach is becoming more prevalent. We strongly agree with Cheiron's approach. Our analysis over the years has consistently shown that retirees with above-average benefit amounts tend to live longer than those with below-average benefit amounts. This means that although a mortality table may be accurately predicting the number of deaths, it may be overstating the release of liability expected when retirees die, which is what impacts the valuation. By using a weighted approach, Cheiron is accounting for this, and this should result in a more accurate valuation.
- **Recommended Tables:** Although we believe Cheiron's recommendations are reasonable, we note that the actual-to-expected ratio using the recommended tables for both males and females is 90%. For males only, the ratio is 81%. This means that the mortality tables are projecting 19% more deaths (weighted by benefits) than occurred in the prior three-year period, and if future experience follows actual experience for the recent period, actuarial losses will occur. It should be noted that the given the amount of data included in the study, the results are only partially credible from a statistical perspective, so some actuarial judgment is required. We recommend that this trend (MCERA male mortality experience being less than the base CalPERS table) be monitored closely in the future.
- **Mortality Tables for Member Contribution Rates:** The new mortality tables to be used for member contribution rates do not use generational mortality due to the administrative complexity that would be required. Instead, as recommended by Cheiron, future improvements are projected to a fixed point in time in the future (2037). Using this projection provides a reasonable estimate of the average future mortality expected for non-PEPRA contributory members. We agree this approach is reasonable.

Post-Retirement Mortality – Life Expectancy Comparison

We also compared MCERA's mortality rates with those from other California retirement systems and found them to be reasonably consistent with the assumptions used in those other systems. The graph shows the expected lifetime (represented by average projected age at death) for an average MCERA Miscellaneous member (green bar) along with several other California retirement systems.



The graph shows MCERA is slightly on the low side, but all of the systems are closely bunched.

For reference, the other systems we included in this analysis were:

- Contra Costa County Employees' Retirement Association
- Los Angeles County Employees Retirement Association
- Orange County Employees' Retirement System
- San Diego City Employees' Retirement System
- San Diego County Employees' Retirement Association
- San Francisco City & County Employees' Retirement System
- San Mateo County Employees' Retirement Association
- Santa Barbara County Employees' Retirement System
- Sonoma County Employees' Retirement Association

Longevity and Promotion Salary Increases

We reviewed the individual salary increase assumptions due to merit (longevity and promotion). These increases are in addition to the assumed increases due to general wage inflation. For MCERA, the general wage growth is assumed to equal CPI plus 0.25%.

We looked at the magnitude of the assumed increases. The valuation assumes 0.75% merit increases (in addition to general wage inflation) for all Miscellaneous members with more than 10 years of service, and higher increases for 10 or less years of service. For Safety members, the ultimate increase is assumed to be 1.25%. This is in line with what we have seen with other systems.

In total, we believe that the assumptions for merit salary increases are reasonable and consistent with the results with the results of the experience study.

Rates of Service Retirement

We reviewed the rates of service retirement. The current assumptions vary by membership class (Miscellaneous vs. Safety) and age. Higher retirement rates are assumed for those with more years of service. Higher retirement rates for longer service are consistent with what we have observed in other retirement systems. We agree that these factors are significant in projecting retirement rates.

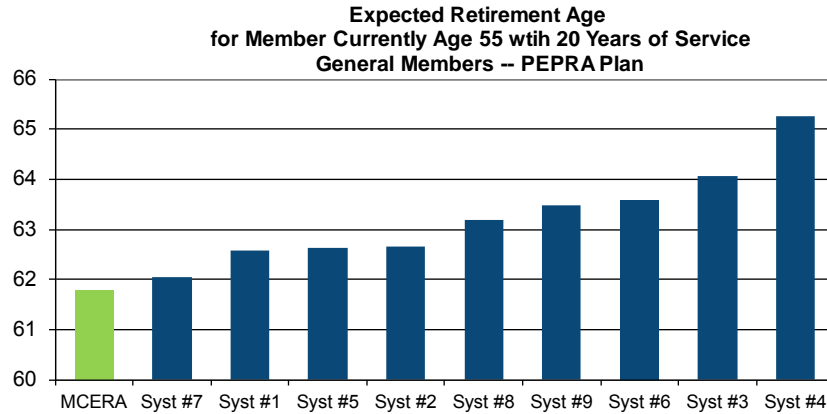
Retirement rates are hard to predict for new tiers, since there is generally no relevant experience on which to base the assumptions. For the tiers with the new PEPRA formulas, the benefit level is lower than the legacy tiers, so we would expect retirements would occur later on average. Cheiron notes this in the experience study, but does not recommend separate retirement rates for the new tiers, as their analysis shows that normal costs are not very sensitive to changes in retirement rates.

We also compared MCERA's service retirement rates for the Safety and Miscellaneous PEPRA plans with those from other California retirement systems by analyzing the average expected retirement age.

We found MCERA's expected retirement age for Miscellaneous/General members to be earlier than other comparable systems. In particular, we note that the expected MCERA retirement age of 62 is not consistent with our expectation of later retirement ages. As noted by Cheiron, this may not have a significant impact on the results. However, if the assumptions change significantly, this may not always be the case.

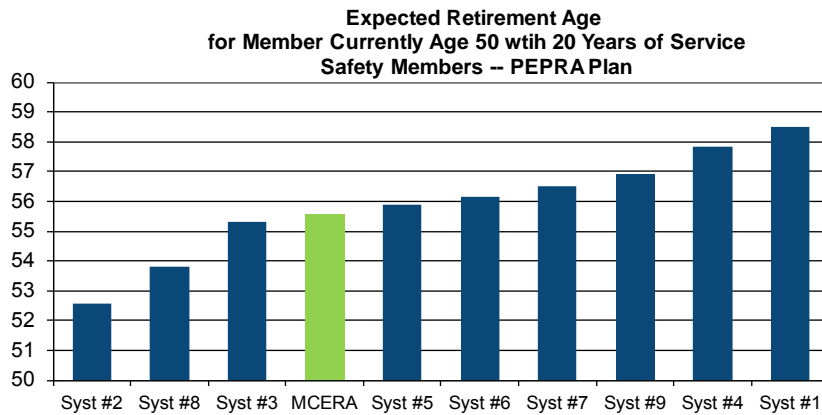
Rates of Service Retirement (continued)

Also, if cash flow projections are performed, the current retirement assumptions may not accurately project future payments. The following graph shows MCERA’s expected retirement age (green bar) for General members along with several other California retirement systems.



We also compared MCERA’s service retirement rates for the Safety PEPRA plans with those from other California retirement systems by analyzing the average expected retirement age.

We found MCERA’s expected retirement age to be relatively consistent with the assumptions used in the other systems. In particular, we note that the expected MCERA retirement age is fractionally younger than most systems. The following graph shows MCERA’s expected retirement age (green bar) for Safety members along with several other California retirement systems.



The retirement assumptions appear reasonable. Consideration should be given to lowering the retirement assumptions for PEPRA members to reflect the expectation of later retirements. At a minimum, the PEPRA retirement rates should be monitored going forward as members from these tiers start to retire.

Rates of Disability Retirement

We reviewed the rates of disability retirement. The current assumptions vary by membership class (Miscellaneous and Safety) and generally increase with age. Service-connected and non-service-connected disability assumptions are studied separately. We believe this methodology is sound.

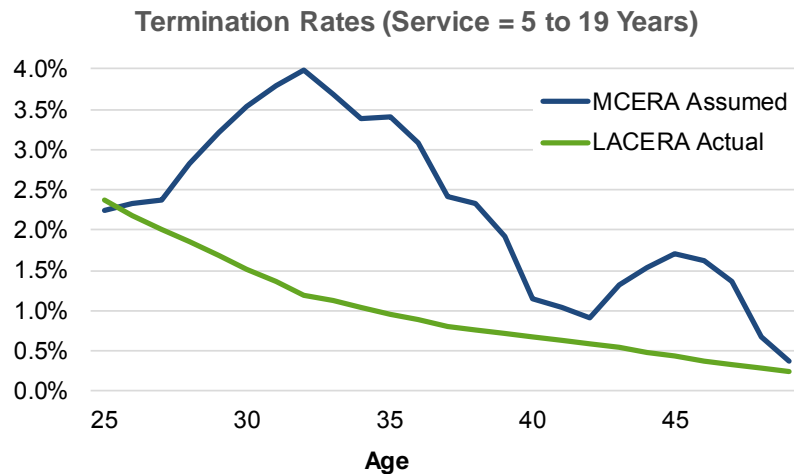
The sample size is small for this assumption, but based on Cheiron's analysis, the disability assumptions appear reasonable.

Rates of Termination (Withdrawal, Vested Termination and Reciprocal Transfer)

We reviewed the rates of termination. The current assumption varies by membership class, age, gender and length of service. We agree that these factors are generally the most significant in projecting termination rates.

Cheiron uses an assumption that no terminations take place after 30 years of service (20 years for Safety) or after eligibility for service retirement. We agree that such terminations are rare and that this is a reasonable assumption.

Based on Cheiron's analysis, the termination rates are aligned with actual experience, and the assumptions appear reasonable. The one change that we think should be considered with the next experience study is the pattern of Safety termination rates with 5 to 19 years of service. The current assumption assumes rates increase then decrease then increase then decrease from younger to older ages. The pattern for the MCERA termination rates are different than what we would expect. Our observation is that termination rates generally decrease as a member ages. This is illustrated in the following graph.

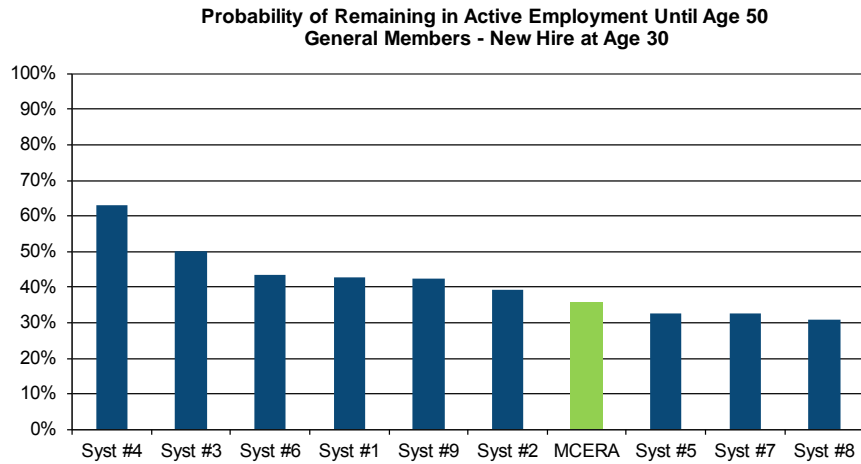


For comparison, we have shown the actual termination rates from Milliman's experience study for the Los Angeles County Employees Retirement Association (LACERA) for the period 2013-16, which shows what we believe is a more typical pattern. We selected LACERA since it is large enough to have credible experience for this group. Note that LACERA's actual experience was based on five-year age groupings and then smoothed to individual years.

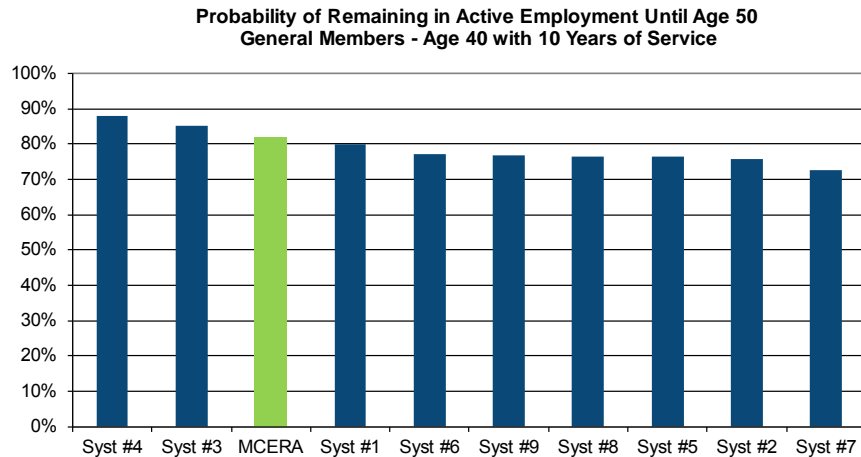
**Rates of Termination
(Withdrawal, Vested
Termination and
Reciprocal Transfer)
(continued)**

Additionally, we compared MCERA’s termination rates for Miscellaneous (we’ll refer to as General for consistency with most other systems) members with those from other California retirement systems and found them to be relatively consistent. Because some systems base this assumption on service only and some by a combination of age and service, comparing among systems can pose some issues. To best compare, we used two sample members, both hired at age 30. For one of the sample members, we assumed no current service, and for the other we assumed 10 years of current service. For both, we compared the probability of remaining employed to age 50 (first eligibility for service retirement).

The results for General member new hires are as follows:

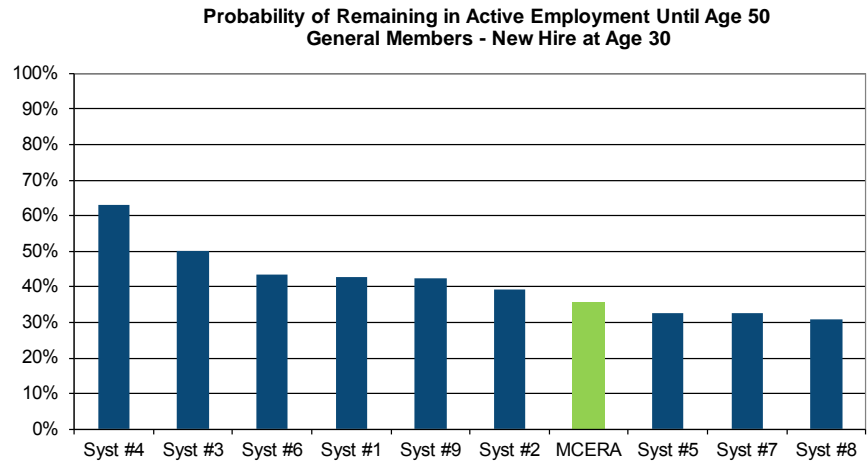


The results for General members with 10 years of service are as follows:

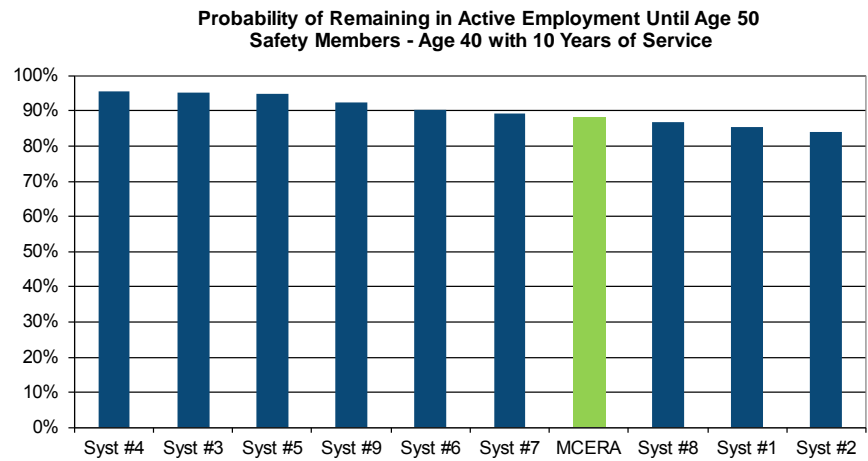


**Rates of Termination
(Withdrawal, Vested
Termination and
Reciprocal Transfer)
(continued)**

The results for Safety member new hires are as follows:



The results for Safety members with 10 years of service are as follows:



Other Assumptions

We reviewed the remaining assumptions and have the following comments:

- ✓ **Sick Leave Credit Service (and Other Terminal Earnings) upon Retirement:** Members of some employers have the opportunity to convert unused sick leave into service credit at retirement. Additionally, non-PEPRA members may be able to increase their final compensation due to certain terminal earnings. The valuation includes an assumption to account for the potential impact of increased service or increased final compensation on pension benefits at retirement. Separate assumptions are made for different employer groups.

This assumption changed from the June 30, 2016 valuation to the June 30, 2017 valuation. There was no documentation of this change in the experience study report, but it was noted that there was a change in the assumption in the valuation report.

PEPRA members should be analyzed separately for this assumption. Although they may be eligible for sick leave conversion, they are not eligible for the terminal earnings that would increase final compensation. The relative impact of only the sick leave conversion on benefits for PEPRA members is expected to be less than the combined impact for both sick leave conversion and terminal earnings for non-PEPRA members. The 2017 valuation assumes no sick leave conversion for PEPRA members. We recommend that this assumption be reviewed with the next experience study (or earlier) and consideration be given to adding a non-zero assumption for sick leave conversion for PEPRA members. Cheiron has indicated that they have already completed a preliminary analysis of this.

- ✓ **Family Composition:** The valuation uses an assumption for the members who have a beneficiary eligible for the unmodified benefit option with 60% continuance at the time of retirement. This is a significant assumption due to the increased value of the unmodified benefit for those with eligible survivors. Additionally, Cheiron assumes that male retirees are three years older than their eligible survivor, and females are three years younger.

These assumptions are similar to what we have found for other California retirement systems. We believe that it is a reasonable assumption.

Section 9 Cheiron Reports

Audit Conclusion



Cheiron's reports meet the applicable actuarial standards of practice. We felt that the amount of disclosure included in the report was commensurate with the complexity of MCERA. We are recommending several changes be made in the 2018 valuation that will provide better disclosure, and we are providing some other comments for consideration in future valuation reports.

Comments

As previously noted, we believe Cheiron's valuation report meets the requirements for actuarial communication. In particular, we compliment Cheiron on the inclusion of projected changes in future employer contribution rates and funded ratios.

The following discussion mentions a few items that we believe that Cheiron should consider disclosing (or changing their current disclosure) in the future. These are all changes in disclosure and would not impact the results of the valuation. We have divided our comments into changes that should be made and others that are not necessary but may provide a benefit.

Incorrect or Missing Information

- Table IV-2 shows the amortization bases for the County, San Rafael, and Novato. In practice, the UAAL amortization calculations are based on subgroups of these employers. We recommend either a sentence be added to clarify how the calculation is done or the amortization schedule for each subgroup be shown in the report.
- Appendix B, item 1 (Actuarial Cost Method). The description states that Surplus Funding is amortized. A statement should be added that Surplus Funding is only amortized if the Funded Ratio is over 120% to be consistent with the provisions of PEPRA.
- In Appendix B, the assumption for deferred retirement age should be disclosed.
- In Appendix B, the assumption for compensation increases for current and future reciprocal members should be disclosed.
- In Appendix B item 16, the service-connected and non service-connected disability rates for Safety members shown in the two tables do not reflect the 1.25% maximum assumed rate referenced in the text; however, it appears that the actual rates used in the valuation do reflect the 1.25% maximum rate.
- In Appendix B, the report says that "Active member benefits are adjusted" to account for sick leave conversion. Cheiron informed us that this is only applied to non-PEPRA active members in the valuation. This should be clarified in the report.

Comments (continued)

- In Appendix E, the description of the member contribution rate calculation refers to the wrong mortality table.

Other Comments for Consideration

- In the report, the terms “funded ratio” and “funding ratio” appear to be used interchangeably. We suggest the terminology be consistent or there is an explanation of the difference between the two terms.
- In Charts I-4 through I-6, the X-axis appears to be the valuation year. We believe this may cause confusion, as it is not equivalent to the contribution year. For example, in the report it states that a “significant reduction in contribution rates is projected in 2030.” We believe the reduction in contribution rates is actually projected to occur in Fiscal Year 2031-2032.
- In Appendix C (page 34), the description of the pre-retirement death benefit amount is not completely accurate. Specifically, the language says the death benefit payable to the survivor is “60% of the survivor benefit.” We believe that “survivor benefit” should be replaced with “non-service-connected disability benefit.”
- In Appendix E, in the first paragraph it states that some County Safety groups are paying additional employee contributions. Cheiron should consider expanding this to note that some tiers of Miscellaneous and Courts employees also make additional employee contributions. This is just a minor issue with the introductory description. The member contribution tables shown in Appendix E reflect the additional contributions for these groups.

Basic Disclosures Under CAAP Guidance Comments for Consideration

We reviewed the report for consistency with the basic model disclosure elements recommended by the California Actuary Advisory Panel (CAAP). The Cheiron report met all of these criteria with these exceptions:

- Cheiron did not disclose the normal cost as a dollar amount.
- Cheiron did not disclose the expected employer contributions as a dollar amount.

Each of these CAAP disclosure items are informational in nature. Given the amount of numbers already contained in the report, it may not be beneficial to MCERA to have additional information. We still think it is worthwhile to consider including. It is likely Cheiron has already thought about this and decided not to include the additional disclosures.

Appendix A Supporting Exhibits



Appendix A-1

Comparison of Present Value of Benefits by Agency and Tier
(Rounded to nearest \$10,000)

Tier	Cheiron	Milliman	Cheiron / Milliman
County of Marin (including Courts and Special Districts)			
County Misc Tier 1	\$ 12,930,000	\$ 13,210,000	97.9%
County Misc Tier 2	19,080,000	19,300,000	98.9%
County Misc Tier 3	457,950,000	462,790,000	99.0%
County Misc Tier 3A	38,550,000	38,090,000	101.2%
County Misc Tier 4	34,700,000	34,270,000	101.3%
County Misc Tier 5 (PEPRA)	90,940,000	94,700,000	96.0%
County Safety Tier 1A	2,950,000	2,990,000	98.7%
County Safety Tier 2A	42,680,000	43,650,000	97.8%
County Safety Tier 2B	212,020,000	213,330,000	99.4%
County Safety Tier 3 (PEPRA)	32,370,000	33,100,000	97.8%
Courts Tier 1	1,340,000	1,370,000	97.8%
Courts Tier 2	290,000	290,000	100.0%
Courts Tier 3	30,300,000	30,490,000	99.4%
Courts Tier 4	1,250,000	1,250,000	100.0%
Courts Tier 5 (PEPRA)	2,950,000	3,100,000	95.2%
South Marin Fire Misc Tier 1	570,000	570,000	100.0%
South Marin Fire Misc Tier 2 (PEPRA)	600,000	660,000	90.9%
South Marin Fire Safety Tier 1	18,670,000	18,800,000	99.3%
South Marin Fire Safety Tier 2	15,760,000	17,350,000	90.8%
South Marin Fire Safety Tier 2A	1,180,000	1,240,000	95.2%
South Marin Fire Safety Tier 3A (PEPRA)	4,320,000	4,430,000	97.5%
Mosquito District Tier 1	19,310,000	19,680,000	98.1%
Mosquito District Tier 2 (PEPRA)	360,000	360,000	100.0%
LAFCO Tier 3	770,000	780,000	98.7%
LAFCO Tier 4 (PEPRA)	120,000	120,000	100.0%
Tamalpais CSD Tier 1	5,500,000	5,590,000	98.4%
Tamalpais CSD Tier 2 (PEPRA)	440,000	460,000	95.7%
Marin City CSD Tier 1	290,000	300,000	96.7%
Marin City CSD Tier 2 (PEPRA)	610,000	640,000	95.3%
Employer Total	\$ 1,048,800,000	\$ 1,062,910,000	98.7%
Novato Fire Protection District			
Novato Misc Tier 1	\$ 4,480,000	\$ 4,490,000	99.8%
Novato Misc Tier 2A (PEPRA)	350,000	390,000	89.7%
Novato Safety Tier 1	72,600,000	73,540,000	98.7%
Novato Safety Tier 2	5,570,000	5,950,000	93.6%
Novato Safety Tier 3 (PEPRA)	2,980,000	3,070,000	97.1%
Employer Total	\$ 85,980,000	\$ 87,440,000	98.3%
City of San Rafael			
San Rafael Misc Tier 1	\$ 81,070,000	\$ 81,730,000	99.2%
San Rafael Misc Tier 2	4,880,000	4,580,000	106.6%
San Rafael Misc Tier 3 (PEPRA)	7,490,000	7,650,000	97.9%
San Rafael Fire Tier 1	48,160,000	48,580,000	99.1%
San Rafael Safety (Police) Tier 1	53,820,000	54,540,000	98.7%
San Rafael Fire Tier 2	9,610,000	9,740,000	98.7%
San Rafael Safety (Police) Tier 2	3,370,000	3,320,000	101.5%
San Rafael Safety (Police) Tier 3 (PEPRA)	12,080,000	12,430,000	97.2%
Employer Total	\$ 220,480,000	\$ 222,570,000	99.1%

Appendix A-2

Comparison of Employer Contribution Rates by Agency and Tier (as a Percentage of Payroll)

Tier	Cheiron	Milliman	Cheiron / Milliman
County of Marin (including Courts and Special Districts)			
County Misc Tier 1	30.96%	31.19%	99.3%
County Misc Tier 2	22.86%	23.03%	99.3%
County Misc Tier 3	21.93%	22.10%	99.3%
County Misc Tier 3A	22.92%	22.72%	100.9%
County Misc Tier 4	22.97%	22.83%	100.6%
County Misc Tier 5 (PEPRA)	20.06%	19.86%	101.0%
County Safety Tier 2A	39.73%	39.84%	99.7%
County Safety Tier 2B	37.06%	36.60%	101.3%
County Safety Tier 3 (PEPRA)	33.09%	33.41%	99.0%
Courts Tier 1	33.65%	33.81%	99.5%
Courts Tier 2	24.65%	24.66%	100.0%
Courts Tier 3	26.66%	26.66%	100.0%
Courts Tier 4	28.48%	28.35%	100.4%
Courts Tier 5 (PEPRA)	25.46%	25.35%	100.4%
South Marin Fire Misc Tier 1	22.98%	23.13%	99.4%
South Marin Fire Misc Tier 2 (PEPRA)	18.12%	18.71%	96.8%
South Marin Fire Safety Tier 1	40.03%	39.24%	102.0%
South Marin Fire Safety Tier 2	43.43%	42.96%	101.1%
South Marin Fire Safety Tier 2A	39.51%	41.06%	96.2%
South Marin Fire Safety Tier 3A (PEPRA)	28.82%	29.19%	98.7%
Mosquito District Tier 1	33.22%	33.45%	99.3%
Mosquito District Tier 2 (PEPRA)	25.71%	25.79%	99.7%
LAFCO Tier 3	18.32%	18.48%	99.1%
LAFCO Tier 4 (PEPRA)	7.59%	7.84%	96.8%
Tamalpais CSD Tier 1	35.21%	35.27%	99.8%
Tamalpais CSD Tier 2 (PEPRA)	30.14%	29.01%	103.9%
Marin City CSD Tier 1	19.57%	17.85%	109.6%
Marin City CSD Tier 2 (PEPRA)	18.00%	17.92%	100.5%
Employer Total	25.44%	25.26%	100.7%
Novato Fire Protection District			
Novato Misc Tier 1	20.11%	20.39%	98.6%
Novato Misc Tier 2A (PEPRA)	18.07%	19.60%	92.2%
Novato Safety Tier 1	53.25%	52.88%	100.7%
Novato Safety Tier 2	54.99%	54.87%	100.2%
Novato Safety Tier 3 (PEPRA)	41.42%	41.84%	99.0%
Employer Total	49.05%	48.83%	100.4%
City of San Rafael			
San Rafael Misc Tier 1	53.34%	53.01%	100.6%
San Rafael Misc Tier 2	52.40%	50.08%	104.6%
San Rafael Misc Tier 3 (PEPRA)	45.39%	44.93%	101.0%
San Rafael Fire Tier 1	74.94%	75.00%	99.9%
San Rafael Safety (Police) Tier 1	74.30%	74.43%	99.8%
San Rafael Fire Tier 2	72.55%	72.60%	99.9%
San Rafael Safety (Police) Tier 2	73.49%	73.17%	100.4%
San Rafael Safety (Police) Tier 3 (PEPRA)	63.06%	63.58%	99.2%
Employer Total	61.76%	61.50%	100.4%