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Memorandum

To: Sparb Collins, Executive Director, NDPERS
From: Paul Erlendson and Jay Kloepfer
CC: David Hunter, Executive Director and Chief Investment Officer, NDRIO
Date: November 14, 2014
Subject: NDPERS Long Term Return Assumption

Background

The North Dakota legislature has proposed legislation that would close the NDPERS pension plan ("Plan") to new participants, effective January 1, 2016. Existing participants would continue to accrue benefits over the course of their working lifetime, and then receive benefits in retirement.

The Plan actuary (Segal) was asked to calculate the amount of money needed to be added to the Plan on January 1, 2015 to enable the Plan to become fully funded by the time the last participant has been paid out. The actuary calculated a required contribution of $162.8 million and generated a cash flow projection extending out to 2098, the date of the projected last payment to plan members.

Embedded in the projection is an expected return of 8% each year out to 2094. NDPERS requested Callan Associates to evaluate the reasonableness of an 8% return assumption over an 80-year time horizon.

Observations and comments

The expected return for the Plan depends on its asset allocation and the returns for each component of the capital markets. The 8% return assumed for the NDPERS Plan assumes the current asset allocation remains constant through time, with a majority of the assets invested in growth. Over a long historical period (back to 1926), annualized returns for US stocks have averaged 10.5% while bonds averaged 6%.

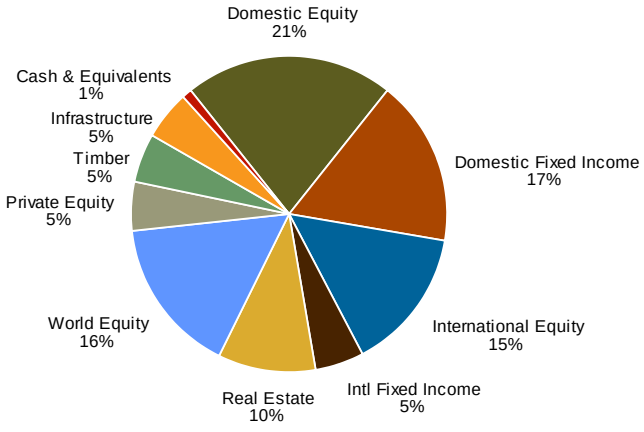
Looking forward, shorter term (5-10 year) forecasts provided by investment consultants including Callan are much lower than the historical averages. Specifically, consensus forecast approximate 7.5% for stocks and 3% for bonds. However, we do assume that long-term future returns will revert to long-term historical averages. The point is that an 8% return over the very long term is a reasonable expectation, but ***only if the Plan retains a substantial exposure to growth assets*** to achieve this goal.

Importantly, substantial return volatility comes with exposure to growth assets. The actuary's analysis assumes a constant 8% return each year with no variation around the 8% annualized return. We believe that a constant 8% return without variation is not a reasonable assumption; there will be years that produce returns both below and above that assumed rate of return. The basis of our view is that the historical standard deviation of stocks has been 16% while the standard deviation for bonds has averaged 5%. Consequently, a growth-oriented portfolio should expect to see a standard deviation of 12-14%.

An equity market drawdown of 25% (which is less than what happened in 2008-09) would pull down a diversified but growth-oriented portfolio by 15-20%. The Plan would therefore be subject to substantial volatility in the contribution required to restore funding. The conclusion of these observations is that the portfolio required to generate the 8% return embedded in the Plan closure analysis is likely to generate substantial return volatility. This return volatility, in turn, will result in the attendant potential for additional contributions to close any funding gaps that could result from adverse market experience (i.e. – losses).

The current NDPERS asset allocation is depicted in the graph and table below. The dollar amounts include both the State employees and the political subdivisions; the asset allocation for just the State employees is valid. The Plan has diversified over the years from exposure to US stocks, bonds and cash, into international stocks and bonds, high yield, real estate, timber, infrastructure and private equity.

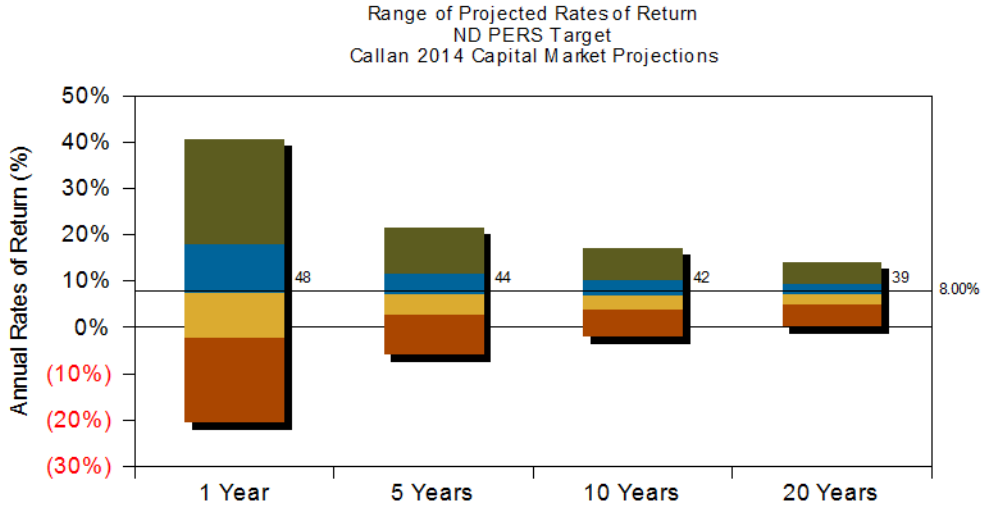
Target Asset Allocation



Asset Class	$000s Actual	Weight Actual	Target	Percent Difference	$000s Difference
Domestic Equity	525,048	22.5%	21.4%	1.1%	25,841
Domestic Fixed Income	433,382	18.6%	17.0%	1.6%	36,815
International Equity	355,002	15.2%	14.6%	0.6%	14,421
Intl Fixed Income	116,173	5.0%	5.0%	0.0%	(464)
Real Estate	219,449	9.4%	10.0%	(0.6%)	(13,825)
World Equity	361,746	15.5%	16.0%	(0.5%)	(11,494)
Private Equity	106,068	4.5%	5.0%	(0.5%)	(10,570)
Timber	99,343	4.3%	5.0%	(0.7%)	(17,294)
Infrastructure	89,834	3.9%	5.0%	(1.1%)	(26,804)
Cash & Equivalents	26,701	1.1%	1.0%	0.1%	3,374
Total	2,332,746	100.0%	100.0%		

Using Callan's 2014 capital market projections – which have a time horizon of 10 years, not the 80 years in the actuarial study – we calculate an expected arithmetic return of 7.9% and compound 10-year geometric return of 7.1%, along with an expected annual volatility for the portfolio of 14.1%.

The chart below shows the range of potential returns using these projections over 1, 5, 10 and 20 year periods. The median represents the expected case (i.e.—half of probable outcomes will be higher than the median and half will be lower). The 98th percentile represents a worse case outcome of slightly more than two standard deviations away from the expected case. The probability of an extreme occurrence in this type of scenario has a 2% probability of occurring. For reference, the 2008 drawdown in the US equity market was closer to a 99th percentile outcome. ***In any one year, the worse case can result in a 20.5% loss in the investment portfolio***. While remote, the fact is that such outcomes are possible.



	1 Year	5 Years	10 Years	20 Years
2nd Percentile	40.7%	21.7%	17.2%	14.2%
25th Percentile	17.9%	11.6%	10.3%	9.3%
Median	7.4%	7.1%	7.0%	7.1%
75th Percentile	(2.2%)	2.8%	3.9%	4.9%
98th Percentile	(20.5%)	(5.8%)	(2.1%)	0.2%
Prob > 8.00%	48.2%	44.3%	41.9%	39.0%
Prob > 7.00%	51.2%	50.8%	50.0%	51.5%
Prob > 6.00%	53.7%	56.8%	58.6%	63.2%

The chart above reveals that there is a 48.2% probability that the portfolio will achieve the assumed 8% return assumption over any given one year period. Over longer periods, the probability that the Plan will achieve a compound 8% return is lower since volatility erodes compounding returns over time. We also included the probability that the current portfolio would achieve a 7% return (51.2%) and a 6% return (53.7%) over each of the time periods. Using these 10-year projections -- which are lower than the long term historical averages -- the current portfolio is not expected to average 8% in the median case, even though it is reasonably likely to do so in any single year.

If we extend the time horizon to 80 years and assume a reversion toward long term historical mean returns for stocks and bonds, an 8% return assumption is more likely. If we assume inflation of 3% rather than the 4.5% experienced during the 1926-2013 period, a long term compound return assumption for stocks equal to 9% and for bonds equal to 5% would be consistent with long term average real returns for both broad asset classes.

The current diversified asset allocation is roughly similar in underlying risk exposure to a 75% equity/25% fixed income. A portfolio using these longer term return assumptions would generate a 9% arithmetic return and a 10-year compound return of 8.35%. The 8% return assumption is therefore not unreasonable, although we reiterate that the investment portfolio required to generate such a return requires a substantial allocation to growth assets which necessarily increases expected volatility.

Should the Plan seek to reduce return volatility to mitigate the potential for a funding shortfall in the worse case, the expected return for the investment portfolio will be lower, thereby raising the required contribution to fully fund the Plan in the expected case. In other words, the Plan can reduce the exposure to growth assets to reduce return volatility, but the return in the expected case will come down. Under this scenario, the expected return on assets must be reduced in the funding calculation.

NDPERS has received calculations from their consulting actuary suggesting that a reduction in the assumed return to 7% would require an initial funding contribution closer to $400 million rather than the $168.2 million referenced above, and that a 6% return assumption would require $800 million. Callan created a range of broad, representative portfolios across a spectrum of expected return and risk to illustrate the impact of changing the exposure to growth assets. These portfolios are included in ***Appendix A***, attached to this memo.

Pension plans that close to new participants and begin to wind down at some point engage in a process of de-risking. “De-risking” is a process whereby the portfolio’s exposure to risky assets is reduced in order to mitigate the adverse impact of a sudden asset decline and a resultant funding shortfall due to the asset decline. Such a de-risking glidepath would take risk assets out of the portfolio in a gradual fashion, thereby reducing the volatility of return, but also reducing expected return in median case. Losses due to investment volatility earlier in the time line would result in larger dollar losses, but the long time horizon remaining would likely be sufficient to enable the Plan to make up some or all of these losses.

As the Plan gets past the first 20 years, however, assets start to dwindle; after 30 years, the Plan approaches 100% funded status. At that point, a much less risky portfolio could be a prudent for mitigating the potential for a sharp drawdown in the equity market to erode the Plan's funding. The expected return would then need to be reduced, thereby increasing the contribution required to keep the Plan fully funded.

The trigger points along the way for a de-risking glidepath are usually funded status milestones. For example, the Plan could shift 10-15% of its allocation from return seeking assets to risk mitigating assets (primarily fixed income) each time it reaches funded status goals of 80%, 85%, 90%, 95% and 100%. The Plan actuary would need to calculate the required contribution as the portfolio and therefore the assumed return changes along the glidepath.

Conclusion

To summarize, history suggests that a portfolio with a tilt toward growth assets similar to that employed by NDPERS can support an 8% return expectation over the long term. However, this tilt toward growth comes with substantial return volatility and the attendant potential requirement of additional contributions to restore funding in order to pay out the Plan liabilities.

De-risking the investment program over time to reduce return volatility will require lowering the discount rate and thereby increasing the required contribution in the expected case. Once a plan reaches fully funded status, a de-risked portfolio is typically close to 100% fixed income – a portfolio structure which is meaningfully different in both composition and return/risk characteristics from the current NDPERS investment program.

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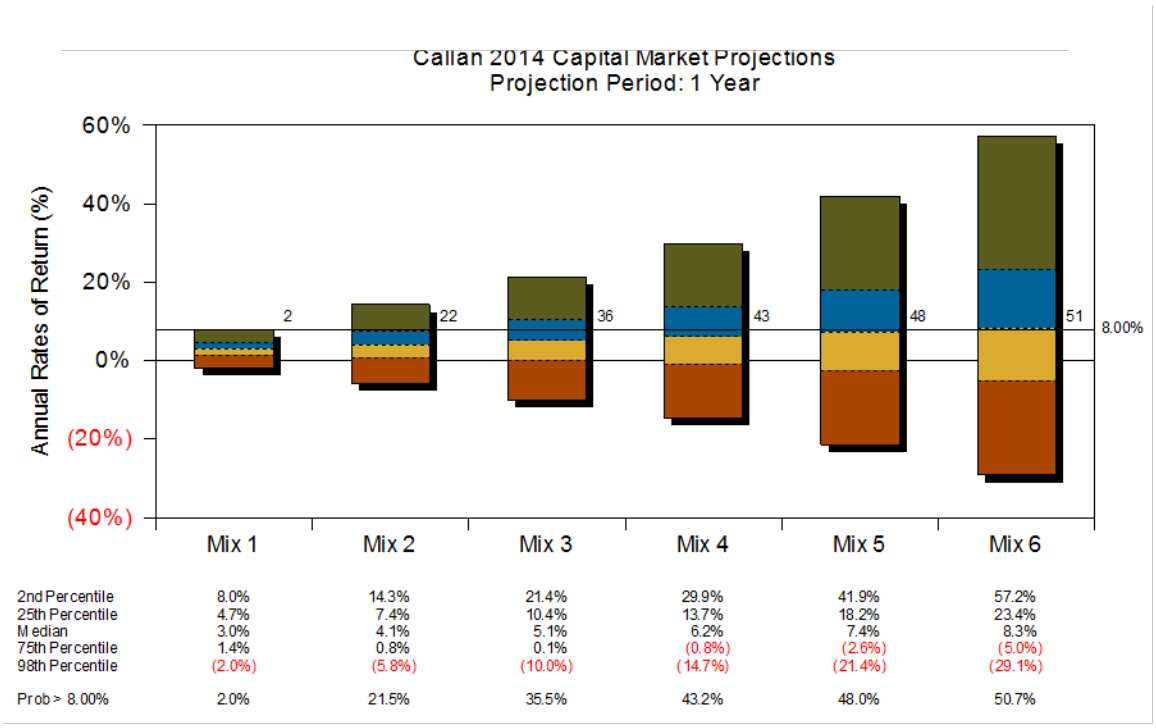
Appendix A

The table below illustrates the expected asset class composition, as well as the return and standard deviation for a series of portfolios covering an expected return range of 3% to 8%. The underlying capital market expectations are developed by Callan Associates. For simplicity, we used global equity, global bonds and cash as the broad asset classes to demonstrate exposure to investment risk. Note that using Callan's capital market expectations, which are developed with a 10-year time horizon, no asset mix is expected to reach the 8% return hurdle in the expected case. In the graphs that lie below the table, however, we show the probability that the mixes could reach 8% over 1, 10 and 20 year time horizons.

Asset Mix Alternatives - 3% to 8% Returns
Callan 10-year Capital Market Projections

Portfolio Component	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
Global Equity	11	22	34	51	74	100
Global Bonds	17	35	54	49	26	0
Cash Equivalents	72	43	12	0	0	0
Totals	100	100	100	100	100	100
10 Yr. Geometric Mean Return	3.0%	4.0%	5.0%	6.0%	7.0%	7.8%
Projected Standard Deviation	2.4%	4.8%	7.4%	10.4%	14.6%	19.6%



	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
2nd Percentile	8.0%	14.3%	21.4%	29.9%	41.9%	57.2%
25th Percentile	4.7%	7.4%	10.4%	13.7%	18.2%	23.4%
Median	3.0%	4.1%	5.1%	6.2%	7.4%	8.3%
75th Percentile	1.4%	0.8%	0.1%	(0.8%)	(2.6%)	(5.0%)
98th Percentile	(2.0%)	(5.8%)	(10.0%)	(14.7%)	(21.4%)	(29.1%)
Prob > 8.00%	2.0%	21.5%	35.5%	43.2%	48.0%	50.7%

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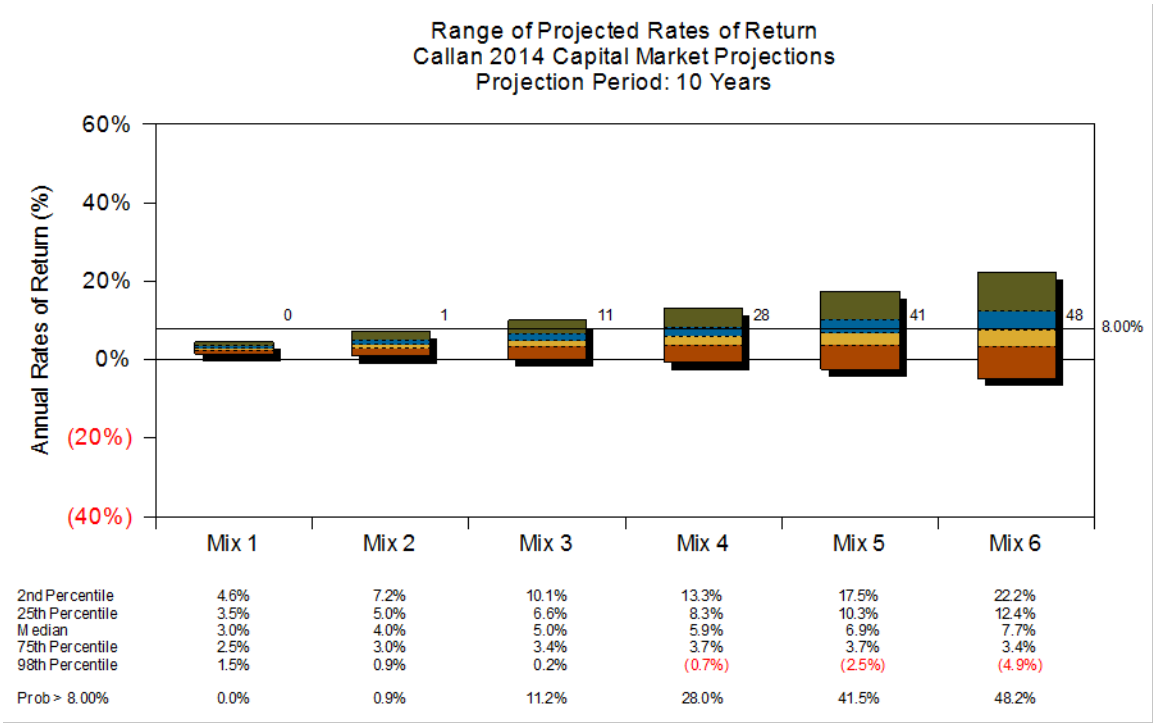
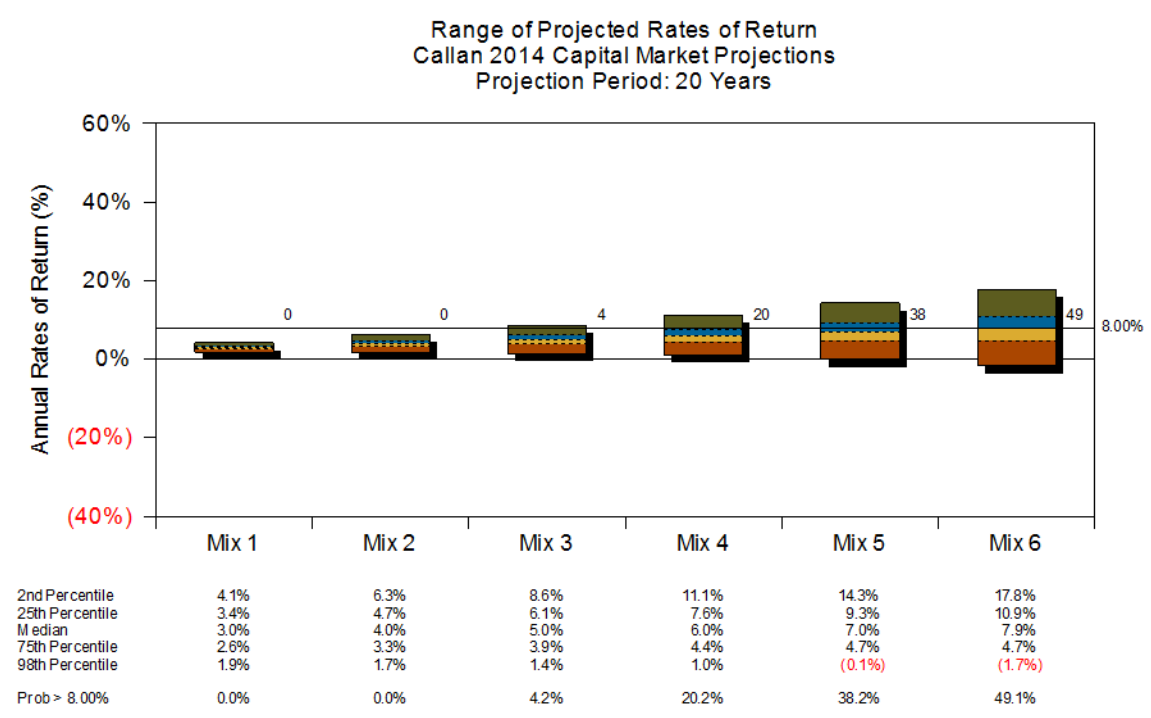


	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
2nd Percentile	4.6%	7.2%	10.1%	13.3%	17.5%	22.2%
25th Percentile	3.5%	5.0%	6.6%	8.3%	10.3%	12.4%
Median	3.0%	4.0%	5.0%	5.9%	6.9%	7.7%
75th Percentile	2.5%	3.0%	3.4%	3.7%	3.7%	3.4%
98th Percentile	1.5%	0.9%	0.2%	(0.7%)	(2.5%)	(4.9%)
Prob > 8.00%	0.0%	0.9%	11.2%	28.0%	41.5%	48.2%



	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
2nd Percentile	4.1%	6.3%	8.6%	11.1%	14.3%	17.8%
25th Percentile	3.4%	4.7%	6.1%	7.6%	9.3%	10.9%
Median	3.0%	4.0%	5.0%	6.0%	7.0%	7.9%
75th Percentile	2.6%	3.3%	3.9%	4.4%	4.7%	4.7%
98th Percentile	1.9%	1.7%	1.4%	1.0%	(0.1%)	(1.7%)
Prob > 8.00%	0.0%	0.0%	4.2%	20.2%	38.2%	49.1%

Extending the time horizon to 80 years and assuming a reversion toward long term historical mean returns for stocks and bonds, we assume inflation of 3% rather than the 4.5% experienced during the 1926-2013 period, and use a long term compound return assumption for stocks equal to 9% and for bonds equal to 5%, consistent with long term average real returns for both broad asset classes. Under these assumptions, portfolios need less risky assets to generate the same required rate of return. In the table below, a mix of 2/3 stock and 1/3 bonds generates an expected return of 8%, with a volatility of 11.2%, and a mix of 75% stock and 25% bonds (roughly the current portfolio risk posture) generates a return of 8.3% with a risk of 12.3%.

Asset Mix Alternatives - 3% to 8% Returns
Callan Long-term Projections

Portfolio Component	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6	Mix 7
Global Equity	3	11	18	27	42	67	75
Global Bonds	10	27	44	61	58	33	25
Cash Equivalents	87	62	38	12	0	0	0
Totals	100	100	100	100	100	100	100
10 Yr. Geometric Mean Return	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	8.3%
Projected Standard Deviation	1.9%	2.7%	4.1%	5.7%	7.6%	11.2%	12.3%