



NCRS Asset Liability Study Overview

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North Carolina Department of State Treasurer
Investment Management

Learn. Invest. Grow. Prosper.

NCRS Strategic Asset Allocation Background

- NCRS Strategic Asset Allocation was last set in July 2014
 - Asset allocation is the most important investment decision impacting the long-term success and risk of the NCRS
 - Strategic Asset Allocation was developed through an asset liability study with Buck Consulting conducted in late 2013 and early 2014
 - The Strategic Asset Allocation is the core of the NCRS Investment Policy Statement, reflecting the conclusions of the Asset Liability Study
- An Asset Liability Study is essential to setting investment policy
 - Set investment objectives and analyze risks and trade-offs that reflect the mission of the NCRS and other macro considerations
 - Incorporate a holistic view on the “Role in the Portfolio” of asset classes/strategies in light of an economic and financial market outlook and NCRS circumstances
 - Facilitate stress testing and scenario testing



NCRS Investment Objectives (Excerpts)

- Over the long-term, provide investment returns sufficient:
 - For the NCRS to make timely benefit payments
 - To keep long-term contribution rates at a reasonable level
- Over the intermediate-term, avoid excessive volatility in the contribution rate:
 - It is acceptable to limit the use of return-seeking strategies in order to avoid excessive contribution rate volatility
 - Diversify with respect to economic and financial risk factors that impact assets and liabilities
- Ensure sufficient liquidity to cost-effectively meet the Fund's obligations over all time periods



2016 NCRS Asset Liability Study Update

- Updated the baseline asset allocation assumptions
- Created three Scenario-Based Asset Allocation Model Portfolios
 - The purpose of these Model Portfolios is to facilitate analysis of how different asset allocation policies would perform on average and in specific economic/financial environments (i.e., Scenario Analysis)
 - Model Portfolios were developed with a blend of judgement and optimization
 - For purposes of evaluating possibilities, Model Portfolios were allowed to have flexibility in excess of current statutory limits—i.e., Model Portfolios may exceed asset class and other limits in current NC statutes
- Buck Consulting applied their asset liability modeling to TSERS to produce various cost and performance projections
 - The TSERS Employer Contribution Rate Stabilization Policy adopted earlier this year is incorporated into the modeling (Note for modeling purposes only, the Stabilization Policy does not sunset after 8 years)
 - Focus is on 10 year results, with extensive scenario analysis of different economic/financial environments
 - Selected 30 year results are also presented



“Role in the Portfolio” Perspective: Investment Categories

The four Investment Categories in the NCRS Investment Policy Statement:

- Return-Seeking/Growth
 - Global public equity (long-only and hedged equity)
 - Private equity
 - Public/Private non investment grade opportunistic credit
 - Non-core real estate
- Risk-Reducing/Rates and Liquidity
 - Treasury bonds, mortgage agency bonds, and investment grade credit
 - Cash/short duration
- Inflation Sensitive and Diversifiers
 - Short duration U.S. Treasury Inflation Protected Securities
 - Core real estate (public and private)
 - Public/Private natural resources (commodities, energy, timberland, agriculture, etc.)
- Multi-Strategy



Equity Return and Implied Risk Premium Assumptions for 30-year Horizon

	2013-14 Study IMD Adjusted	Low Equity Risk Premium Scenario	2016 ALM Study IMD Adjusted
Equity Return (Arithmetic)	9.44%	8.29%	8.72%
Equity Volatility	17.00%	16.50%	16.63%
Cash Return	3.63%	3.35%	3.50%
Equity Risk Premium (Geometric)	4.37%	3.69%	4.00%
Equity Return (Geometric)	8.00%	7.04%	7.47%

Source: North Carolina Department of State Treasurer and Buck Consulting

* These figures reflect a recalibration of GEMS to implement IMD's provided current and forward yield curve data.



2014 Asset Allocation Study: Current Policy Projected Returns

Projected Ranges of Annualized Compound Passive Investment Returns

Horizon	5 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
10 Years	0.0%	3.6%	6.1%	8.3%	11.9%
20 Years	2.6%	5.4%	7.3%	9.1%	11.7%
30 Years	3.8%	6.2%	7.8%	9.3%	11.8%

Source: North Carolina Department of State Treasurer and Buck Consulting



2016 Asset Allocation Study: Current Policy Projected Returns

Projected Ranges of Annualized Compound Passive Investment Returns

Horizon	5 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	95 th Percentile
10 Years	0.2%	4.0%	5.9%	8.0%	11.5%
20 Years	2.2%	4.8%	6.7%	8.5%	11.8%
30 Years	3.1%	5.3%	7.1%	8.7%	12.0%

Source: North Carolina Department of State Treasurer and Buck Consulting



2016 NCRS Scenario-Based Model Portfolios

- “Steady Growth & Inflation” Model Portfolio is designed to outperform the current Policy (with similar risk) under the baseline outlook
 - Initially very low interest rates moderately rising over intermediate term
 - Moderately rising inflation
 - Modest public equity market returns by long-term historical standards for intermediate term
- Two alternative scenarios:
 - “Low Growth & Inflation” Model Portfolio is designed to do better if U.S. economy has less momentum than expected; emerging market economic issues; delayed European normalization; systemic shocks
 - “High Growth & Inflation” Model Portfolio is designed to do better if inflation rises more than expected; global growth surprises on upside; supply shocks
- Blended Scenario Model weights 50% to Steady Growth & Inflation; 25% to Low Growth & Inflation; and 25% to High Growth & Inflation



Asset Allocation Policy Model Portfolios

(Certain allocations are in excess of asset class limits under current law and are for discussion purposes only)

	Current Policy	Steady Growth & Inflation	High Growth & Inflation	Low Growth & Inflation
Long Only Public Equity	39.1%	36.0%	42.0%	23.0%
Hedged Equity	2.9%	3.0%	2.0%	2.0%
Private Equity	6.0%	8.0%	10.0%	5.0%
Non-Core Real Estate	3.0%	8.5%	10.0%	5.0%
Distressed	3.5%	2.0%	1.0%	4.0%
High Yield	3.5%	5.0%	1.0%	2.0%
Total Growth	58.0%	62.5%	66.0%	41.0%
Government	7.6%	6.5%	5.1%	13.5%
Corporate	8.8%	7.6%	6.0%	15.8%
Mortgage	8.8%	7.6%	6.0%	15.8%
Cash (includes Core Portfolio and Pension Cash)	3.8%	3.4%	2.9%	6.0%
Total Rates & Liquidity	29.0%	25.0%	20.0%	51.0%
TIPS	2.0%	2.0%	4.0%	1.0%
Publicly Traded Natural Resources	1.0%	0.0%	0.0%	0.0%
Private Natural Resources/Real Assets	3.0%	2.5%	3.0%	1.0%
Private Equity Core Real Estate	4.0%	3.2%	4.0%	3.2%
Public Equity Core Real Estate	1.0%	0.8%	1.0%	0.8%
Total Inflation Sensitive	11.0%	8.5%	12.0%	6.0%
Multi-Strategy	2.0%	4.0%	2.0%	2.0%



Model Portfolios and Statutory Compliance

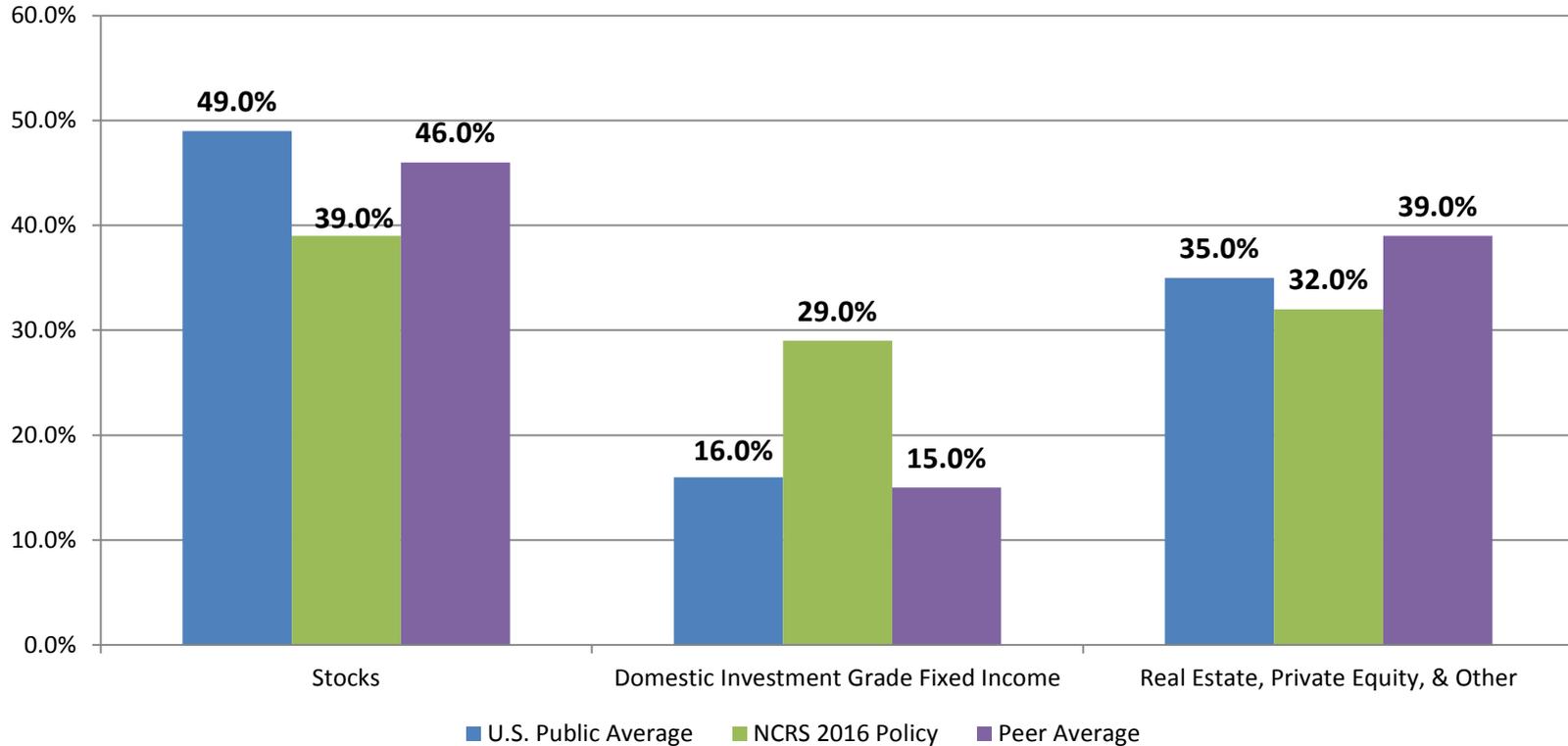
Statutory Category (Max/Min)	Model Portfolios				Scenario-Based Models		
	Current Policy	65/35	Long-Term Policy	Blended Scenario Model (50,25,25)	Steady Growth & Inflation	High Growth & Inflation	Low Growth & Inflation
Fixed Income (Min 20%)	29.00%	35.00%	33.00%	30.25%	25.00%	20.00%	51.00%
Public Equity (Max 65%)	39.06%	65.00%	57.00%	34.25%	36.00%	42.00%	23.00%
Aggregate Alternatives (Max 35%)	31.94%	0.00%	10.00%	35.50%	39.00%	38.00%	26.00%
Hedged Equity (Max 8.5%)	2.94%	0.00%	0.00%	2.50%	3.00%	2.00%	2.00%
Private Equity + MS (Max 8.75%)	8.00%	0.00%	0.00%	10.75%	12.00%	12.00%	7.00%
Real Estate (Max 10%)	8.00%	0.00%	0.00%	12.25%	12.50%	15.00%	9.00%
Other Fixed Income (Max 7.5%)	7.00%	0.00%	0.00%	5.50%	5.25%	5.25%	5.25%
Inflation Protection (Max 7.5%)	6.00%	0.00%	10.00%	4.50%	4.50%	7.00%	2.00%

Note: Certain allocations are in excess of asset class limits under current law and are for discussion purposes only. Allocation in excess of current statutes is designated in red bold text.



Public Pension Peer Policy Comparisons

Asset Allocation Policy Comparison (CEM: U.S. Public Funds) As of 12/31/2014



CEM Peer Group for NCRS:

- 15 U.S. public sponsors
- Fund sizes range from \$42 billion to \$158 billion
- Median size of \$74 billion



Large Public Pension Fund Actual Allocations

December 2015; Funds with Assets in excess of \$75 Billion

Percentage of Total Fund Value	Mean	10%	25%	Median	75%	90%
Commodities	0.5%	0%	0%	0.1%	0.5%	1.3%
Real Estate	8.9%	4.5%	6.3%	9.9%	11.1%	14.2%
Venture Capital	0.8%	0%	0%	0.9%	1.3%	1.7%
Private Equity/LBO	8.1%	3.4%	6.3%	8.1%	9.2%	11.8%
Total Fund Market Value (B)	\$105.3	\$60.3	\$79.2	\$85.9	\$142.0	\$179.3

Source: Department of State Treasurer



Key Areas for IAC Input

- With more flexibility in statutory caps it appears possible on average to improve financial outcomes for the NCRS
 - Are the potential improvements material enough to seek statutory changes?
 - Should flexibility be sought for individual asset class caps or the cap on all alternatives?
- Financial outcomes for the NCRS vary significantly when looking at low/high quartiles of equity/inflation environments
 - How much weight/consideration should be given to alternative scenarios?
 - What is the view of:
 - A new static policy portfolio designed to function well in many environments

versus

 - A dynamic asset allocation policy that changes over time with market/economic cycles?



Appendix: Additional Exhibits (on following pages)



Description of Requested Assumption Adjustments

NCRS Asset Class	NCRS Sub Asset Class	Requested Adjustments to 30-Year Arithmetic GEMS Baseline	SAA Policy Weight
Public Equity	Long Only Public Equity	Reduce return assumption to equate the 30 year geometric equity risk premium to 400bps above cash	39.06%
	Hedged Equity	Return assumption modeled as 0.4 * Public Equity + 250 basis points; risk adjusted similarly downward	2.94%
Private Equity	Private Equity	Return assumption equals US Small Cap + 300 bps	6.00%
Non-Core Real Estate	Non-Core Real Estate	Return assumption modeled as Core Real Estate + 200 basis points; risk approximates 20%	3.00%
Opportunistic Fixed Income	Distressed and Long-Short Credit	Use HFRI distressed hedge fund index to model returns and risk	3.50%
	High Yield	Return assumption should be modeled to 500 basis points over Intermediate Treasury Performance	3.50%
Investment Grade Fixed Income	Government Bonds	Use current yields and 3 year out forward curve combined with GEMS 5yr + Treasury to model returns	7.56%
	Corporate Bonds	Use current yields and 3 year out forward curve combined with GEMS 5yr + Corporate to model returns	8.82%
	Mortgage-Backed Securities	Use current yields and 3 year out forward curve combined with GEMS Agency MBS to model returns	8.82%



Description of Requested Assumption Adjustments

NCRS Asset Class	NCRS Sub Asset Class	Requested Adjustments to 30-Year Arithmetic GEMS Baseline	SAA Policy Weight
Cash	Cash	Use current yields and 3 year out forward curve combined with GEMS Cash adjusted to reflect a grade in of roughly 70bps of real yield over the horizon	3.80%
Inflation Sensitive	TIPS	Use current yields and 3 year out forward curve combined with GEMS short term TIPS (1yr-5yr) to model returns	1.98%
	Publicly Traded Natural Resources	Reduce return assumption so commodities return roughly 200 basis points over cash	1.02%
	Private Natural Resources/Real Assets	Model as infrastructure	3.00%
Core Real Estate	Private Equity Core Real Estate	Reduce return assumption so direct real estate return approximates 700 basis points; risk equaling 10%	4.00%
	Public Equity Core Real Estate	Use GEMS REIT assumptions	1.00%
Multi-Strategy	Multi-Strategy	Use GEMS diversified hedge fund assumptions	2.00%
Total			100.00%



Comparison of the Return Assumptions for the 2013 ALM Study, Lower Equity Risk Premium Scenario, and the 2016 ALM Study

Capital Market Assumptions - Expected Returns (Arithmetic)

NCRS Asset Class	NCRS Sub Asset Class	10 Year			30 Year		
		2013 ALM	Low ERP	2016 ALM	2013 ALM	Low ERP	2016 ALM
Public Equity	Long Only Public Equity	8.40%	7.20%	7.96%	9.44%	8.29%	8.72%
	Hedged Equity	5.85%	5.38%	5.68%	6.28%	5.82%	5.99%
Private Equity	Private Equity	11.35%	11.39%	12.24%	14.58%	13.77%	14.15%
Non-Core Real Estate	Non-Core Real Estate	7.99%	6.91%	7.27%	10.00%	9.22%	8.70%
Opportunistic Fixed Income	Corporate - Non IG	6.56%	8.20%	7.99%	10.20%	9.41%	9.19%
Investment Grade Fixed Income	Government Bonds	3.19%	1.55%	1.88%	5.49%	3.81%	4.52%
	Corporate Bonds	4.09%	3.01%	2.99%	6.58%	5.09%	5.49%
	Mortgage-Backed Securities	2.82%	1.81%	1.73%	5.16%	4.00%	3.86%
Cash	Cash	1.97%	1.86%	2.12%	3.63%	3.35%	3.50%
Inflation Sensitive	TIPS	1.79%	5.22%	3.64%	3.65%	7.32%	5.17%
	Publicly Traded Natural Resources	4.44%	3.51%	2.67%	4.64%	5.69%	5.51%
	Private Natural Resources/Real Assets	9.28%	7.81%	7.69%	9.43%	9.28%	9.04%
Core Real Estate	Private Equity Core Real Estate	5.15%	6.05%	6.00%	7.76%	7.22%	6.70%
	Public Equity Core Real Estate	5.78%	5.73%	5.77%	7.53%	7.30%	7.08%
Multi-Strategy	Multi-Strategy	6.48%	6.45%	6.01%	9.65%	7.02%	6.48%

