

DAVID Y. IGE  
GOVERNOR



**DEPT. COMM. NO. 238**

CRAIG K. HIRAI  
DIRECTOR  
GLORIA CHANG  
DEPUTY DIRECTOR

EMPLOYEES' RETIREMENT SYSTEM  
HAWAII EMPLOYER UNION HEALTH BENEFITS TRUST FUND  
OFFICE OF THE PUBLIC DEFENDER

**STATE OF HAWAII**  
**DEPARTMENT OF BUDGET AND FINANCE**  
P.O. BOX 150  
HONOLULU, HAWAII 96810-0150

ADMINISTRATIVE AND RESEARCH OFFICE  
BUDGET, PROGRAM PLANNING AND  
MANAGEMENT DIVISION  
FINANCIAL ADMINISTRATION DIVISION  
OFFICE OF FEDERAL AWARDS MANAGEMENT (OFAM)

December 28, 2021

The Honorable Ronald D. Kouchi  
President and Members  
of the Senate  
Thirtieth State Legislature  
State Capitol, Room 409  
Honolulu, Hawaii 96813

The Honorable Scott K. Saiki  
Speaker and Members of the  
House of Representatives  
Thirtieth State Legislature  
State Capitol, Room 431  
Honolulu, Hawaii 96813

Dear President Kouchi, Speaker Saiki and Members of the Legislature:

For your information and consideration, I am transmitting a copy of the Actuarial Asset and Liability Stress Test 2021 report, as required by Act 85, Session Laws of Hawaii 2017. In accordance with Section 93-16, Hawaii Revised Statutes, a copy of this report has been transmitted to the Legislative Reference Bureau and the report may be viewed electronically at <http://ers.ehawaii.gov/resources/reports-to-legislature>.

Sincerely,

A handwritten signature in black ink, appearing to read "Craig K. Hirai", written over a horizontal line.

CRAIG K. HIRAI  
Director of Finance

Enclosure

c: Legislative Reference Bureau

ec: Governor's Office: [Gov.ReportsDistribution@hawaii.gov](mailto:Gov.ReportsDistribution@hawaii.gov)  
Lieutenant Governor's Office: [LtGov.ReportsDistribution@hawaii.gov](mailto:LtGov.ReportsDistribution@hawaii.gov)  
Legislative Auditor: [auditors2@auditor.state.hi.us](mailto:auditors2@auditor.state.hi.us)  
Department of Budget and Finance: [DBFLeg.DIR@hawaii.gov](mailto:DBFLeg.DIR@hawaii.gov)



December 17, 2021

Board of Trustees  
Employees' Retirement System of  
The State of Hawaii  
City Financial Tower  
201 Merchant St., Ste. 1400  
Honolulu, HI 96813-2980

**Re: Stress Test Annual Report**

Dear Members of the Board:

The purpose of this report is to provide the Employees' Retirement System of the State of Hawaii (ERS) with the information it must submit to the legislature as required by ACT – 85 (2017). Act – 85 (2017) requires that the actuary of the ERS perform an annual stress test as defined by the legislation and described below. This stress test is based on the preliminary valuation results of ERS as of July 1, 2021.

**Requirements of Annual Stress Test Report**

The annual stress test must address the following scenarios:

1. A 30-year projection of the ERS's assets, liabilities, pension debt, service costs, employee contributions, employer contributions, net amortization, benefit payments, payroll, and funded ratio assuming the current actuarial assumptions are met, including a 7% return projected from the actuarial, or smoothed, value of assets. See Stress Test Exhibit 1.
2. Two 30-year projections of the same items above assuming the actual investment performance in future years is 2% less than the assumed rate of return, starting from the market value of assets as of the valuation date, but with two different contribution policies.
  - a. The first scenario shows the projected items assuming that the employer contribution rate in future years would increase if necessary to meet the current funding policy. In other words, if the funding period in a future year exceeds 30 years, the contribution rates would be adjusted to bring the funding period down to 30 years. See Stress Test Exhibit 2A.
  - b. The second scenario shows the projected items assuming no change in the current statutory contribution rates. See Stress Test Exhibit 2B.

3. Two 30-year projections of the same items above assuming the actual investment performance in the first year is a negative 20% followed by a 20-year period where investment performance is 2% less than the assumed rate of return, but with two different contribution policies.
  - a. The first scenario shows the projected items assuming that the employer contribution rate in future years would increase if necessary to meet the current funding policy. In other words, if the funding period in a future year exceeds 30 years, the contribution rates would be adjusted to bring the funding period down to 30 years. See Stress Test Exhibit 3A.
  - b. The second scenario shows the projected items assuming no change in the current statutory contribution rates. See Stress Test Exhibit 3B.
4. The estimated actuarial accrued liability, the total normal cost for each benefit tier, and the employer normal cost for each benefit tier under the current investment return assumption and using the 10-year average of the 30-year treasuries notes as of the valuation date. See Stress Test Exhibit 4.

#### Stress Test Summary Results

The information required by the legislation is contained in the tables that follow this letter. The following is some brief commentary concerning the results themselves.

1. As shown in Stress Test Exhibit 1, the ERS is expected to be fully funded (100% funded ratio) in fiscal year ending 2045. **Important Note:** the Statutes governing the ERS contemplate that the employer contribution rates would be changed when the ERS is fully funded. However, because the statutes governing the stress test require the use of the same contribution pattern for Scenario's 1, 2B and 3B, we felt it would be inappropriate to change the contribution rates for Scenario #1 since the contribution rates would not change under the ERS statute in Scenarios 2B and 3B.
2. Stress Test Exhibits 2A and 2B are identical. This is because the funding period at future valuation dates under both scenarios is never expected to exceed 30 years. The impact of the underperformance is a lengthening of the period of time until the plan is fully funded, but it is never expected to be more than 30 years from a future valuation date. Note this is true in aggregate as well as for the All Other Employee group and the Police and Fire Employee group when determined separately.
3. Under the first part of the 3<sup>rd</sup> Stress Test (see Stress Test Exhibit 3A) the employer contribution rates would ultimately increase to 24.04% of pay for All Other Employees and 46.07% of pay for Police and Firefighters and remain at those levels for the foreseeable future. As shown in Stress Test Exhibit 3B (Employer Contributions remain at statutory rates) the funded ratio would decline to approximately 41% but the trust is never exhausted. The funded ratio would begin to slowly climb once the 20-year period of 5% returns ends.





4. The 10-year average of the 30-year treasury notes is 2.81% as of July 1, 2021.

Based on the information reviewed for this report, the stress test shows that the System is sustainable in the protracted low return environment of Scenario #2, but would require maintaining the current contribution patterns for a much longer period of time than is currently expected. While we believe the likelihood of Scenario #3 occurring is remote, if it did occur it would require an increase in the employer contribution rates under the current statutes and the higher rates would be required for many years.

#### **Disclosures**

The information contained in this report is based on the preliminary valuation results of the ERS as of June 30, 2021. While the actual valuation results may be slightly different, it is not expected that those changes will have any material impact on the information contained herein.

Except as noted, the data, financial information, and actuarial methods and assumptions are those used in the June 30, 2021 actuarial valuation. These assumptions are detailed in the actuarial valuation report dated January 2021. The results of the actuarial valuation and this "Stress Test" are dependent on the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods. Based on the scope of this engagement, we have not performed analysis on the potential range of future measurements based on other factors. The actuarial calculations are intended to provide information for rational decision making.

This report was prepared using our proprietary valuation model and related software which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

Joe Newton is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.



Board of Trustees  
December 17, 2021  
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We look forward to discussing the results of this analysis with the Board.

Sincerely,

A handwritten signature in black ink that reads "Lewis Ward". The script is fluid and cursive.

Lewis Ward  
Consultant

A handwritten signature in black ink that reads "Joe Newton". The script is fluid and cursive.

Joseph P. Newton  
Pension Market Leader and Actuary

Enclosures



# Hawaii Employees Retirement System

Stress Test Projections  
(Dollar Amounts in \$ Millions)

Valuation Date	Market Value of Assets	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded		Normal Cost	Projected Employee Contributions	Projected Employer Contributions	Net Amortization	Benefit Payments	Covered Payroll	Funded Ratio
				Actuarial Accrued Liability								
				(1)	(2)							
30-Jun-21	\$ 21,350	\$ 19,765	\$ 34,139	\$ 14,375	\$ 673	\$ 310	\$ 1,241	\$ 97	\$ 1,744	\$ 4,784	57.9%	
30-Jun-22	\$ 20,931	\$ 20,931	\$ 35,403	\$ 14,472	\$ 686	\$ 326	\$ 1,271	\$ 71	\$ 1,843	\$ 4,898	59.1%	
30-Jun-23	\$ 22,124	\$ 22,124	\$ 36,667	\$ 14,543	\$ 702	\$ 342	\$ 1,304	\$ 41	\$ 1,943	\$ 5,028	60.3%	
30-Jun-24	\$ 23,349	\$ 23,349	\$ 37,933	\$ 14,584	\$ 718	\$ 359	\$ 1,339	\$ 8	\$ 2,046	\$ 5,162	61.6%	
30-Jun-25	\$ 24,604	\$ 24,604	\$ 39,196	\$ 14,592	\$ 735	\$ 376	\$ 1,375	\$ (29)	\$ 2,150	\$ 5,303	62.8%	
30-Jun-26	\$ 25,893	\$ 25,893	\$ 40,457	\$ 14,563	\$ 753	\$ 394	\$ 1,412	\$ (70)	\$ 2,255	\$ 5,450	64.0%	
30-Jun-27	\$ 27,221	\$ 27,221	\$ 41,714	\$ 14,494	\$ 771	\$ 412	\$ 1,451	\$ (115)	\$ 2,363	\$ 5,604	65.3%	
30-Jun-28	\$ 28,589	\$ 28,589	\$ 42,967	\$ 14,379	\$ 790	\$ 431	\$ 1,492	\$ (165)	\$ 2,470	\$ 5,765	66.5%	
30-Jun-29	\$ 30,002	\$ 30,002	\$ 44,217	\$ 14,214	\$ 810	\$ 450	\$ 1,535	\$ (220)	\$ 2,577	\$ 5,933	67.9%	
30-Jun-30	\$ 31,468	\$ 31,468	\$ 45,463	\$ 13,995	\$ 831	\$ 470	\$ 1,581	\$ (282)	\$ 2,684	\$ 6,109	69.2%	
30-Jun-31	\$ 32,993	\$ 32,993	\$ 46,706	\$ 13,713	\$ 853	\$ 490	\$ 1,628	\$ (349)	\$ 2,792	\$ 6,293	70.6%	
30-Jun-32	\$ 34,582	\$ 34,582	\$ 47,947	\$ 13,365	\$ 876	\$ 512	\$ 1,678	\$ (423)	\$ 2,901	\$ 6,485	72.1%	
30-Jun-33	\$ 36,243	\$ 36,243	\$ 49,186	\$ 12,942	\$ 900	\$ 534	\$ 1,729	\$ (504)	\$ 3,008	\$ 6,684	73.7%	
30-Jun-34	\$ 37,985	\$ 37,985	\$ 50,423	\$ 12,438	\$ 925	\$ 557	\$ 1,783	\$ (593)	\$ 3,115	\$ 6,893	75.3%	
30-Jun-35	\$ 39,818	\$ 39,818	\$ 51,663	\$ 11,846	\$ 951	\$ 580	\$ 1,840	\$ (690)	\$ 3,221	\$ 7,111	77.1%	
30-Jun-36	\$ 41,750	\$ 41,750	\$ 52,906	\$ 11,156	\$ 979	\$ 605	\$ 1,898	\$ (796)	\$ 3,326	\$ 7,337	78.9%	
30-Jun-37	\$ 43,794	\$ 43,794	\$ 54,155	\$ 10,361	\$ 1,007	\$ 629	\$ 1,959	\$ (911)	\$ 3,429	\$ 7,573	80.9%	
30-Jun-38	\$ 45,963	\$ 45,963	\$ 55,414	\$ 9,451	\$ 1,038	\$ 655	\$ 2,023	\$ (1,036)	\$ 3,529	\$ 7,820	82.9%	
30-Jun-39	\$ 48,272	\$ 48,272	\$ 56,687	\$ 8,415	\$ 1,069	\$ 682	\$ 2,090	\$ (1,172)	\$ 3,626	\$ 8,079	85.2%	
30-Jun-40	\$ 50,738	\$ 50,738	\$ 57,981	\$ 7,244	\$ 1,103	\$ 709	\$ 2,160	\$ (1,320)	\$ 3,721	\$ 8,349	87.5%	
30-Jun-41	\$ 53,377	\$ 53,377	\$ 59,301	\$ 5,924	\$ 1,138	\$ 737	\$ 2,233	\$ (1,481)	\$ 3,814	\$ 8,631	90.0%	
30-Jun-42	\$ 56,209	\$ 56,209	\$ 60,653	\$ 4,444	\$ 1,174	\$ 766	\$ 2,309	\$ (1,655)	\$ 3,904	\$ 8,924	92.7%	
30-Jun-43	\$ 59,253	\$ 59,253	\$ 62,043	\$ 2,790	\$ 1,212	\$ 795	\$ 2,388	\$ (1,843)	\$ 3,992	\$ 9,229	95.5%	
30-Jun-44	\$ 62,530	\$ 62,530	\$ 63,478	\$ 948	\$ 1,252	\$ 825	\$ 2,470	\$ (2,047)	\$ 4,078	\$ 9,547	98.5%	
30-Jun-45	\$ 66,062	\$ 66,062	\$ 64,963	\$ (1,098)	\$ 1,294	\$ 856	\$ 2,555	\$ (2,268)	\$ 4,163	\$ 9,876	101.7%	
30-Jun-46	\$ 69,872	\$ 69,872	\$ 66,507	\$ (3,366)	\$ 1,337	\$ 888	\$ 2,644	\$ (2,506)	\$ 4,248	\$ 10,219	105.1%	
30-Jun-47	\$ 73,986	\$ 73,986	\$ 68,115	\$ (5,871)	\$ 1,382	\$ 920	\$ 2,736	\$ (2,763)	\$ 4,331	\$ 10,575	108.6%	
30-Jun-48	\$ 78,428	\$ 78,428	\$ 69,794	\$ (8,634)	\$ 1,430	\$ 954	\$ 2,832	\$ (3,042)	\$ 4,415	\$ 10,944	112.4%	
30-Jun-49	\$ 83,227	\$ 83,227	\$ 71,552	\$ (11,675)	\$ 1,479	\$ 989	\$ 2,931	\$ (3,342)	\$ 4,500	\$ 11,327	116.3%	
30-Jun-50	\$ 88,411	\$ 88,411	\$ 73,394	\$ (15,017)	\$ 1,529	\$ 1,025	\$ 3,033	\$ (3,667)	\$ 4,589	\$ 11,724	120.5%	
30-Jun-51	\$ 94,008	\$ 94,008	\$ 75,325	\$ (18,683)	\$ 1,582	\$ 1,061	\$ 3,140	\$ (4,016)	\$ 4,681	\$ 12,134	124.8%	



## Hawaii Employees' Retirement System

Stress Test Exhibit 2A - Actual Returns are 5% (2% Less than Assumed)

Scenario A - Contribution Rates Adjusted if Necessary to Keep Future Valuations' Funding Periods at 30 Years or Less  
(Dollar Amounts in \$ Millions)

			Unfunded									
Valuation	Market	Actuarial	Actuarial	Actuarial		Projected	Projected					
Date	Value of	Value of	Accrued	Accrued	Normal	Employee	Employer	Net	Benefit	Covered	Funded	
(1)	Assets	Assets	Liability	Liability	Cost	Contributions	Contributions	Amortization	Payments	Payroll	Ratio	(12)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
30-Jun-21	\$ 21,350	\$ 19,765	\$ 34,139	\$ 14,375	\$ 673	\$ 310	\$ 1,241	\$ 97	\$ 1,744	\$ 4,784	57.9%	
30-Jun-22	22,203	21,355	35,403	14,048	686	326	1,271	41	1,843	4,898	60.3%	
30-Jun-23	23,043	22,811	36,667	13,857	702	342	1,304	(7)	1,943	5,028	62.2%	
30-Jun-24	23,874	24,031	37,933	13,902	718	359	1,339	(40)	2,046	5,162	63.4%	
30-Jun-25	24,692	25,160	39,196	14,036	735	376	1,375	(68)	2,150	5,303	64.2%	
30-Jun-26	25,498	26,185	40,457	14,272	753	394	1,412	(90)	2,255	5,450	64.7%	
30-Jun-27	26,293	27,090	41,714	14,624	771	412	1,451	(106)	2,363	5,604	64.9%	
30-Jun-28	27,075	27,915	42,967	15,053	790	431	1,492	(117)	2,470	5,765	65.0%	
30-Jun-29	27,847	28,719	44,217	15,497	810	450	1,535	(130)	2,577	5,933	65.0%	
30-Jun-30	28,611	29,512	45,463	15,951	831	470	1,581	(145)	2,684	6,109	64.9%	
30-Jun-31	29,370	30,296	46,706	16,410	853	490	1,628	(160)	2,792	6,293	64.9%	
30-Jun-32	30,125	31,077	47,947	16,870	876	512	1,678	(178)	2,901	6,485	64.8%	
30-Jun-33	30,880	31,856	49,186	17,330	900	534	1,729	(197)	3,008	6,684	64.8%	
30-Jun-34	31,636	32,637	50,423	17,787	925	557	1,783	(219)	3,115	6,893	64.7%	
30-Jun-35	32,400	33,425	51,663	18,238	951	580	1,840	(242)	3,221	7,111	64.7%	
30-Jun-36	33,173	34,223	52,906	18,683	979	605	1,898	(269)	3,326	7,337	64.7%	
30-Jun-37	33,961	35,037	54,155	19,118	1,007	629	1,959	(298)	3,429	7,573	64.7%	
30-Jun-38	34,771	35,873	55,414	19,541	1,038	655	2,023	(330)	3,529	7,820	64.7%	
30-Jun-39	35,611	36,739	56,687	19,949	1,069	682	2,090	(365)	3,626	8,079	64.8%	
30-Jun-40	36,486	37,642	57,981	20,340	1,103	709	2,160	(403)	3,721	8,349	64.9%	
30-Jun-41	37,407	38,591	59,301	20,710	1,138	737	2,233	(446)	3,814	8,631	65.1%	
30-Jun-42	38,382	39,595	60,653	21,058	1,174	766	2,309	(492)	3,904	8,924	65.3%	
30-Jun-43	39,419	40,664	62,043	21,379	1,212	795	2,388	(541)	3,992	9,229	65.5%	
30-Jun-44	40,528	41,806	63,478	21,672	1,252	825	2,470	(596)	4,078	9,547	65.9%	
30-Jun-45	41,717	43,031	64,963	21,933	1,294	856	2,555	(655)	4,163	9,876	66.2%	
30-Jun-46	42,997	44,348	66,507	22,158	1,337	888	2,644	(719)	4,248	10,219	66.7%	
30-Jun-47	44,377	45,769	68,115	22,345	1,382	920	2,736	(788)	4,331	10,575	67.2%	
30-Jun-48	45,866	47,302	69,794	22,492	1,430	954	2,832	(863)	4,415	10,944	67.8%	
30-Jun-49	47,475	48,959	71,552	22,593	1,479	989	2,931	(943)	4,500	11,327	68.4%	
30-Jun-50	49,213	50,749	73,394	22,646	1,529	1,025	3,033	(1,030)	4,589	11,724	69.1%	
30-Jun-51	51,088	52,679	75,325	22,646	1,582	1,061	3,140	(1,123)	4,681	12,134	69.9%	





**Hawaii Employees' Retirement System**  
**Stress Test Exhibit 2B - Actual Returns are 5% (2% Less than Assumed)**  
**Scenario B - Contribution Rates Kept at Current Statutory Rates**  
(Dollar Amounts in \$ Millions)

Valuation Date	Market Value of Assets	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded		Normal Cost	Projected Employee Contributions	Projected Employer Contributions	Net Amortization	Benefit Payments	Covered Payroll	Funded Ratio
				Actuarial Accrued Liability	Actuarial							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
30-Jun-21	\$ 21,350	\$ 19,765	\$ 34,139	\$ 14,375	\$ 673	\$ 310	\$ 1,241	\$ 97	\$ 1,744	\$ 4,784		57.9%
30-Jun-22	22,203	21,355	35,403	14,048	686	326	1,271	41	1,843	4,898		60.3%
30-Jun-23	23,043	22,811	36,667	13,857	702	342	1,304	(7)	1,943	5,028		62.2%
30-Jun-24	23,874	24,031	37,933	13,902	718	359	1,339	(40)	2,046	5,162		63.4%
30-Jun-25	24,692	25,160	39,196	14,036	735	376	1,375	(68)	2,150	5,303		64.2%
30-Jun-26	25,498	26,185	40,457	14,272	753	394	1,412	(90)	2,255	5,450		64.7%
30-Jun-27	26,293	27,090	41,714	14,624	771	412	1,451	(106)	2,363	5,604		64.9%
30-Jun-28	27,075	27,915	42,967	15,053	790	431	1,492	(117)	2,470	5,765		65.0%
30-Jun-29	27,847	28,719	44,217	15,497	810	450	1,535	(130)	2,577	5,933		65.0%
30-Jun-30	28,611	29,512	45,463	15,951	831	470	1,581	(145)	2,684	6,109		64.9%
30-Jun-31	29,370	30,296	46,706	16,410	853	490	1,628	(160)	2,792	6,293		64.9%
30-Jun-32	30,125	31,077	47,947	16,870	876	512	1,678	(178)	2,901	6,485		64.8%
30-Jun-33	30,880	31,856	49,186	17,330	900	534	1,729	(197)	3,008	6,684		64.8%
30-Jun-34	31,636	32,637	50,423	17,787	925	557	1,783	(219)	3,115	6,893		64.7%
30-Jun-35	32,400	33,425	51,663	18,238	951	580	1,840	(242)	3,221	7,111		64.7%
30-Jun-36	33,173	34,223	52,906	18,683	979	605	1,898	(269)	3,326	7,337		64.7%
30-Jun-37	33,961	35,037	54,155	19,118	1,007	629	1,959	(298)	3,429	7,573		64.7%
30-Jun-38	34,771	35,873	55,414	19,541	1,038	655	2,023	(330)	3,529	7,820		64.7%
30-Jun-39	35,611	36,739	56,687	19,949	1,069	682	2,090	(365)	3,626	8,079		64.8%
30-Jun-40	36,486	37,642	57,981	20,340	1,103	709	2,160	(403)	3,721	8,349		64.9%
30-Jun-41	37,407	38,591	59,301	20,710	1,138	737	2,233	(446)	3,814	8,631		65.1%
30-Jun-42	38,382	39,595	60,653	21,058	1,174	766	2,309	(492)	3,904	8,924		65.3%
30-Jun-43	39,419	40,664	62,043	21,379	1,212	795	2,388	(541)	3,992	9,229		65.5%
30-Jun-44	40,528	41,806	63,478	21,672	1,252	825	2,470	(596)	4,078	9,547		65.9%
30-Jun-45	41,717	43,031	64,963	21,933	1,294	856	2,555	(655)	4,163	9,876		66.2%
30-Jun-46	42,997	44,348	66,507	22,158	1,337	888	2,644	(719)	4,248	10,219		66.7%
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30-Jun-48	45,866	47,302	69,794	22,492	1,430	954	2,832	(863)	4,415	10,944		67.8%
30-Jun-49	47,475	48,959	71,552	22,593	1,479	989	2,931	(943)	4,500	11,327		68.4%
30-Jun-50	49,213	50,749	73,394	22,646	1,529	1,025	3,033	(1,030)	4,589	11,724		69.1%
30-Jun-51	51,088	52,679	75,325	22,646	1,582	1,061	3,140	(1,123)	4,681	12,134		69.9%





## Hawaii Employees' Retirement System

Stress Test Exhibit 3A - Negative 20% Return Followed by 20-Year Period with 5% Returns

Scenario A - Contribution Rates Adjusted if Necessary to Keep Future Valuations' Funding Periods at 30 Years or Less

(Dollar Amounts in \$ Millions)

Valuation Date	Market Value of Assets	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded		Normal Cost	Projected Employee Contributions	Projected Employer Contributions	Net Amortization	Benefit Payments	Covered Payroll	Funded Ratio
				Actuarial Accrued Liability								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
30-Jun-21	\$ 21,350	\$ 19,765	\$ 34,139	\$ 14,375	\$ 673	\$ 310	\$ 1,241	\$ 97	\$ 1,744	\$ 4,784	57.9%	
30-Jun-22	16,892	19,922	35,403	15,482	686	326	1,271	142	1,843	4,898	56.3%	
30-Jun-23	17,466	19,897	36,667	16,770	702	342	1,304	197	1,943	5,028	54.3%	
30-Jun-24	18,018	19,689	37,933	18,243	718	359	1,350	253	2,046	5,162	51.9%	
30-Jun-25	18,555	19,305	39,196	19,891	735	376	1,399	316	2,150	5,303	49.3%	
30-Jun-26	19,079	19,760	40,457	20,697	753	394	1,440	330	2,255	5,450	48.8%	
30-Jun-27	19,582	20,229	41,714	21,486	771	412	1,481	343	2,363	5,604	48.5%	
30-Jun-28	20,059	20,701	42,967	22,267	790	431	1,524	354	2,470	5,765	48.2%	
30-Jun-29	20,513	21,166	44,217	23,050	810	450	1,568	364	2,577	5,933	47.9%	
30-Jun-30	20,945	21,611	45,463	23,852	831	470	1,614	374	2,684	6,109	47.5%	
30-Jun-31	21,354	22,034	46,706	24,672	853	490	1,662	383	2,792	6,293	47.2%	
30-Jun-32	21,744	22,437	47,947	25,510	876	512	1,712	391	2,901	6,485	46.8%	
30-Jun-33	22,114	22,821	49,186	26,365	900	534	1,765	399	3,008	6,684	46.4%	
30-Jun-34	22,469	23,187	50,423	27,236	925	557	1,819	405	3,115	6,893	46.0%	
30-Jun-35	22,811	23,541	51,663	28,122	951	580	1,876	412	3,221	7,111	45.6%	
30-Jun-36	23,142	23,884	52,906	29,022	979	605	1,936	416	3,326	7,337	45.1%	
30-Jun-37	23,467	24,220	54,155	29,935	1,007	629	1,998	420	3,429	7,573	44.7%	
30-Jun-38	23,792	24,555	55,414	30,858	1,038	655	2,063	422	3,529	7,820	44.3%	
30-Jun-39	24,123	24,897	56,687	31,790	1,069	682	2,132	421	3,626	8,079	43.9%	
30-Jun-40	24,467	25,252	57,981	32,730	1,103	709	2,203	419	3,721	8,349	43.6%	
30-Jun-41	24,831	25,627	59,301	33,674	1,138	737	2,278	415	3,814	8,631	43.2%	
30-Jun-42	25,223	26,031	60,653	34,622	1,174	766	2,357	408	3,904	8,924	42.9%	
30-Jun-43	26,148	26,596	62,043	35,447	1,212	795	2,438	391	3,992	9,229	42.9%	
30-Jun-44	27,159	27,347	63,478	36,130	1,252	825	2,523	361	4,078	9,547	43.1%	
30-Jun-45	28,270	28,310	64,963	36,653	1,294	856	2,611	318	4,163	9,876	43.6%	
30-Jun-46	29,493	29,509	66,507	36,997	1,337	888	2,702	259	4,248	10,219	44.4%	
30-Jun-47	30,840	30,845	68,115	37,269	1,382	920	2,797	194	4,331	10,575	45.3%	
30-Jun-48	32,325	32,326	69,794	37,468	1,430	954	2,895	119	4,415	10,944	46.3%	
30-Jun-49	33,963	33,964	71,552	37,589	1,479	989	2,997	38	4,500	11,327	47.5%	
30-Jun-50	35,767	35,767	73,394	37,627	1,529	1,025	3,102	(53)	4,589	11,724	48.7%	
30-Jun-51	37,750	37,750	75,325	37,574	1,582	1,061	3,211	(152)	4,681	12,134	50.1%	



**Hawaii Employees' Retirement System**  
**Stress Test Exhibit 3B - Negative 20% Return Followed by 20-Year Period with 5% Returns**  
**Scenario B - Contribution Rates Kept at Current Statutory Rates**  
(Dollar Amounts in \$ Millions)

Valuation Date	Market Value of Assets	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded		Normal Cost	Projected Employee Contributions	Projected Employer Contributions	Net Amortization	Benefit Payments	Covered Payroll	Funded Ratio
				Actuarial Accrued Liability								
				(1)	(2)							
30-Jun-21	\$ 21,350	\$ 19,765	\$ 34,139	\$ 14,375	\$ 673	\$ 310	\$ 1,241	\$ 97	\$ 1,744	\$ 4,784	57.9%	
30-Jun-22	16,892	19,922	35,403	15,482	686	326	1,271	142	1,843	4,898	56.3%	
30-Jun-23	17,466	19,897	36,667	16,770	702	342	1,304	197	1,943	5,028	54.3%	
30-Jun-24	18,018	19,689	37,933	18,243	718	359	1,339	264	2,046	5,162	51.9%	
30-Jun-25	18,544	19,294	39,196	19,902	735	376	1,375	343	2,150	5,303	49.2%	
30-Jun-26	19,042	19,723	40,457	20,734	753	394	1,412	362	2,255	5,450	48.8%	
30-Jun-27	19,514	20,160	41,714	21,554	771	412	1,451	379	2,363	5,604	48.3%	
30-Jun-28	19,957	20,597	42,967	22,370	790	431	1,492	395	2,470	5,765	47.9%	
30-Jun-29	20,373	21,023	44,217	23,194	810	450	1,535	408	2,577	5,933	47.5%	
30-Jun-30	20,764	21,426	45,463	24,037	831	470	1,581	421	2,684	6,109	47.1%	
30-Jun-31	21,130	21,805	46,706	24,901	853	490	1,628	434	2,792	6,293	46.7%	
30-Jun-32	21,474	22,160	47,947	25,787	876	512	1,678	447	2,901	6,485	46.2%	
30-Jun-33	21,795	22,493	49,186	26,692	900	534	1,729	458	3,008	6,684	45.7%	
30-Jun-34	22,098	22,806	50,423	27,617	925	557	1,783	469	3,115	6,893	45.2%	
30-Jun-35	22,384	23,103	51,663	28,560	951	580	1,840	480	3,221	7,111	44.7%	
30-Jun-36	22,657	23,385	52,906	29,521	979	605	1,898	490	3,326	7,337	44.2%	
30-Jun-37	22,919	23,657	54,155	30,498	1,007	629	1,959	499	3,429	7,573	43.7%	
30-Jun-38	23,177	23,924	55,414	31,490	1,038	655	2,023	507	3,529	7,820	43.2%	
30-Jun-39	23,437	24,192	56,687	32,496	1,069	682	2,090	513	3,626	8,079	42.7%	
30-Jun-40	23,704	24,468	57,981	33,514	1,103	709	2,160	519	3,721	8,349	42.2%	
30-Jun-41	23,986	24,758	59,301	34,543	1,138	737	2,233	523	3,814	8,631	41.7%	
30-Jun-42	24,290	25,071	60,653	35,582	1,174	766	2,309	525	3,904	8,924	41.3%	
30-Jun-43	25,099	25,533	62,043	36,510	1,212	795	2,388	518	3,992	9,229	41.2%	
30-Jun-44	25,985	26,167	63,478	37,311	1,252	825	2,470	499	4,078	9,547	41.2%	
30-Jun-45	26,959	26,997	64,963	37,966	1,294	856	2,555	467	4,163	9,876	41.6%	
30-Jun-46	28,032	28,048	66,507	38,458	1,337	888	2,644	422	4,248	10,219	42.2%	
30-Jun-47	29,217	29,222	68,115	38,892	1,382	920	2,736	371	4,331	10,575	42.9%	
30-Jun-48	30,525	30,527	69,794	39,267	1,430	954	2,832	311	4,415	10,944	43.7%	
30-Jun-49	31,972	31,972	71,552	39,580	1,479	989	2,931	246	4,500	11,327	44.7%	
30-Jun-50	33,567	33,568	73,394	39,827	1,529	1,025	3,033	172	4,589	11,724	45.7%	
30-Jun-51	35,325	35,326	75,325	39,999	1,582	1,061	3,140	92	4,681	12,134	46.9%	



## Hawaii Employees' Retirement System

### Stress Test Exhibit 4 - Comparison of Cost Items at Current Investment Return Assumption (7.0%) and 10-Year Average of 30-Year Treasuries (2.81%)

#### All Other Employees

	Valuation Assumptions		10-Year Average of 30-Year Treasuries	
	Hired Prior to July 1, 2012	Hired After June 30, 2012	Hired Prior to July 1, 2012	Hired After June 30, 2012
Membership Tier				
Actuarial Accrued Liability	\$26,345	\$1,102	\$46,578	\$2,797
Total Normal Cost %	12.20%	11.86%	39.46%	33.15%
Employer Normal Cost %	7.77%	3.80%	35.02%	25.09%

#### Police and Fire Employees

	Valuation Assumptions		10-Year Average of 30-Year Treasuries	
	Hired Prior to July 1, 2012	Hired After June 30, 2012	Hired Prior to July 1, 2012	Hired After June 30, 2012
Membership Tier				
Actuarial Accrued Liability	\$6,554	\$138	\$11,956	\$372
Total Normal Cost %	27.13%	21.65%	84.01%	65.34%
Employer Normal Cost %	14.93%	7.45%	71.81%	51.14%

Dollar Amounts are in \$ Millions

