

Water Conservation & Demand Hardening

Veva McCaig

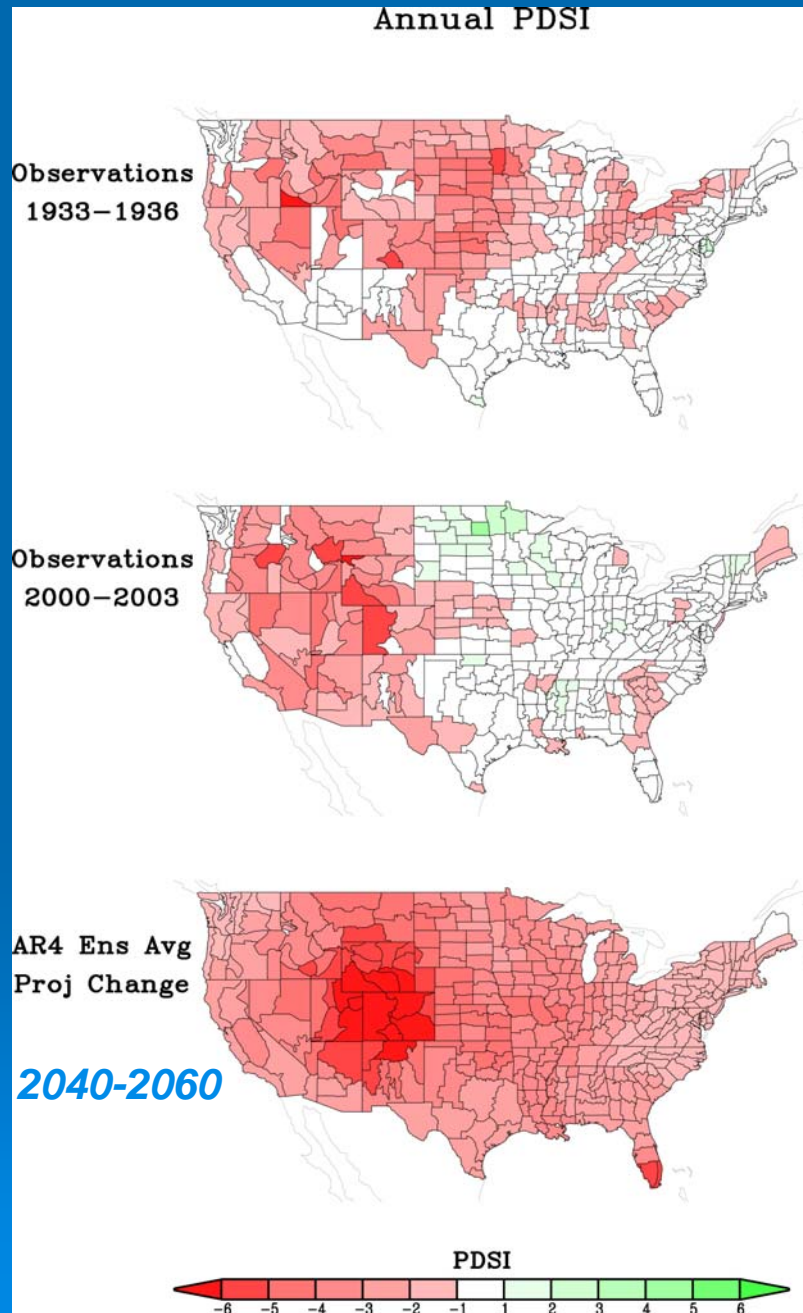
Office of Water Conservation & Drought Planning

Colorado Water Conservation Board



Drought @2050 vs Notorious Recent Historical Droughts

PDSI = Palmer
Drought Severity
Index




Source: Dr. Martin
Hoerling, NOAA
Earth System Research
Laboratory

System Reliability and Conservation

Idea for work emerged from:

- *SWSI Phase 2 Conservation & Efficiency Technical Roundtable*
- *Discussions between Peter Mayer, Aquacraft and David Little, Denver Water*
- *Concept of “demand hardening” is often raised as a red flag*

Questions

- *How does water conservation impact system reliability?*
 - *Does conservation impact drought response?*
 - *Can conserved water be used to serve new customers?*
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Reliability

A water supply system's ability to meet the needs of its customers during times of stress.



Demand Hardening

“By saving water, long term conservation can also reduce the water savings potential for short term demand management strategies during water shortages” (Flory, J. E. , and T. Panella. 1994).

Is this true?

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Demand Hardening Revisited

- *Demand hardening is only a consideration during a water shortage and if conserved water is used to serve new customers.*
- *Even during a water shortage and if new customers are served, demand hardening may not be a significant problem*

Key Reliability Considerations 1

- *Customers who have reduced their demand through technological changes or who join a system as efficient users (such as new customers) can still achieve **behavioral reductions** during a shortage.*



Key Reliability Considerations 2

By modeling the impacts of conservation programs on current customers and the potential for drought curtailment in new and existing customers it is possible for water providers to determine what portion of achieved conservation savings should be held to maintain (or improve) system reliability and what portion can be used to serve new customers.

Key Reliability Considerations 3

Since conservation savings are achieved by existing customers it is important that the supply reliability for these customers not be negatively impacted as new customers are added to a system.



Simple Drought Response Model

							Standard Daily Per Capita Use		Drought Daily Per Capita Use	
END USE	NON-CONS.	CONS./NEW	UNIT	Normal Use	Drought Use	UNIT	NON-CONS.	CONS./NEW	NON-CONS.	CONS./NEW
Toilets	3.5	1.6	gal/flush	6	4	flush/cd	21	9.6	14	6.4
Showers	3	2	gpm	0.7	0.5	spcd	2.1	1.4	1.5	1
Clotheswasher	40	25	gal/load	0.4	0.3	lpcd	16	10	12	7.5
Baths	2	2	gpcd	0.1	0.1	bpcd	0.2	0.2	0.2	0.2
Faucets	2.5	1.5	gpm	8.1	6	min.pcd	20.25	12.15	15	9
Dishwasher	10	7	gal/load	0.1	0.1	lpcd	1	0.7	1	0.7
Leaks	9.5	9.5	gpcd	1	0.8		9.5	9.5	7.6	7.6
Other	1.6	1.2	gpcd	1	0.8		1.6	1.2	1.28	0.96
Total							71.65	44.75	52.58	33.36

	NON-CONS.	CONS./NEW	
<i>Irrigation standard</i>	16	12	<i>gal/sf/yr</i>
<i>Irrigation drought</i>	12	9	<i>gal/sf/yr</i>

Simple Drought Response Model Results

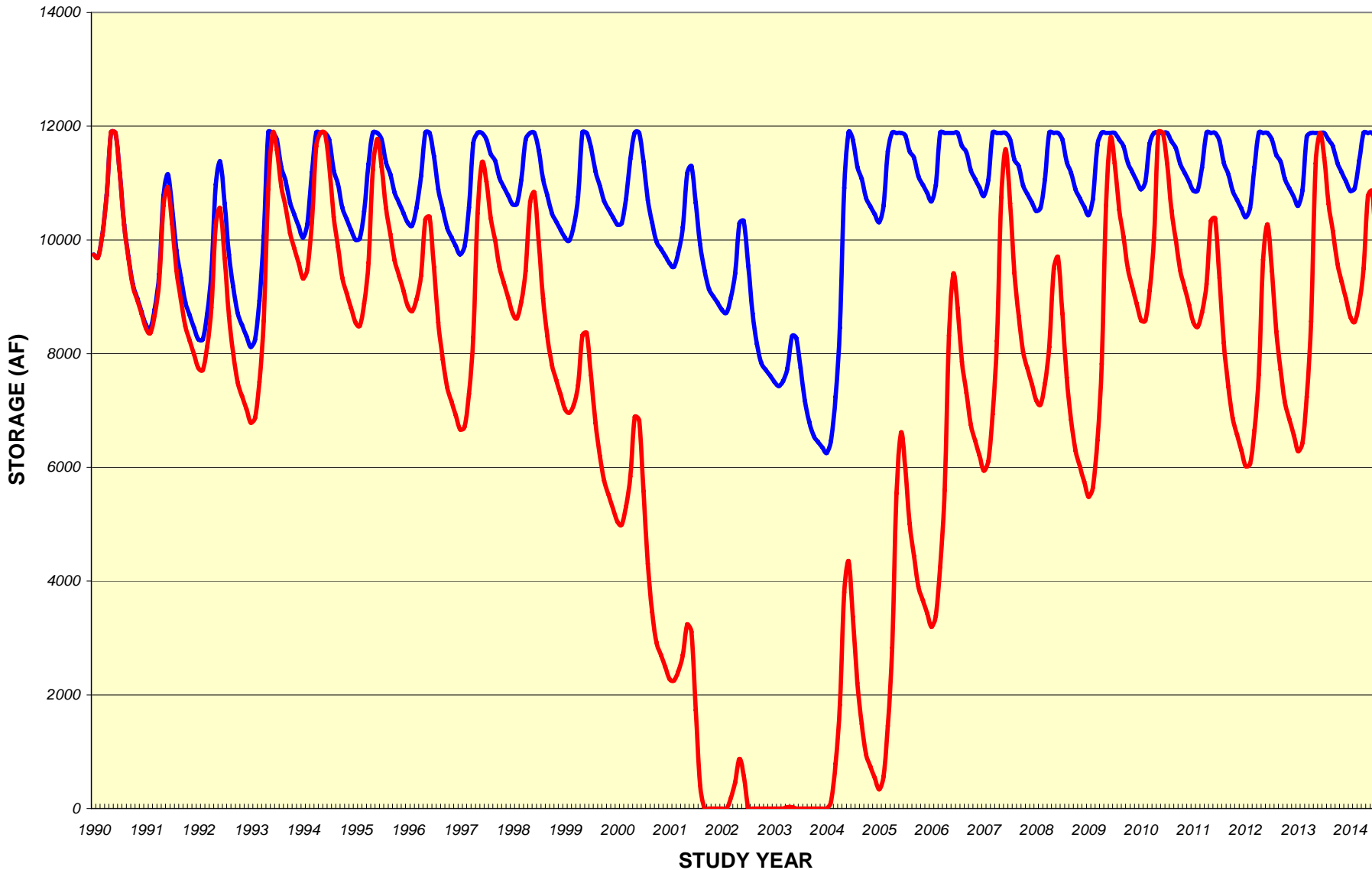
*Water System – Avg. year yield = 5,000 af
Safe yield = 3,300 af*

10,000 non-conserving households can be served during drought of record.

14,300 conserving households can be served during drought of record.

% reductions achieved through behavioral response are similar between conserving and non-conserving customers.

System Storage During Drought – with and without Conservation




Source – Journal AWWA, Feb. 2006

— Conservation — No Conservation

Answers

- *Conservation either does not impact or improves system reliability.*
- *Conservation improves a system's ability to manage drought.*
- *Some portion of conserved water can be used to serve new customers without negatively impacting reliability as long as the constrained drought demand does not increase.*

Wrap Up

- *Time to get serious about water conservation*
 - *Conservation does not negatively impact system reliability.*
 - *Savings from conservation programs must be monitored and verified if they are to be relied on.*
 - *New programs and technologies are emerging*
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*For more information on the SWSI
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