The Role of Water Conservation in a Long Range Drought Plan

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Problems With Droughts:

- **They can come on quickly**
  - Over a few months
- **They are difficult to predict**
  - Practically impossible over short term
- **Difficult to recognize early**
  - By the time you know you are in a drought it may be too late to respond effectively.

The hypothesis:

"Policies and plans that are pro-active rather than reactive and that aim at reducing risk rather than responding to crisis are more cost-effective, can lead to more sustainable resource management and reduced interventions by government"

Donald Wilhite 2005

Concerns:

- Water conservation can lead to demand hardening
- The waste provides a cushion in times of shortage
- Conservation is project of last resort.

Which is Better?

- **Conserve before the drought?**
  - Building codes, retrofits, Xeriscape, leak management, non-potable irrigation supply.
- **Rely on restrictions during drought to capture waste and inefficiency?**
  - Mandatory indoor and outdoor reductions.

Test Case

- **A 25 year simulation of a hypothetical community**
  - Moderate growth
  - Mainly SF Residential
  - No new water supply projects available
  - Fairly standard, non-conserving demand patterns.

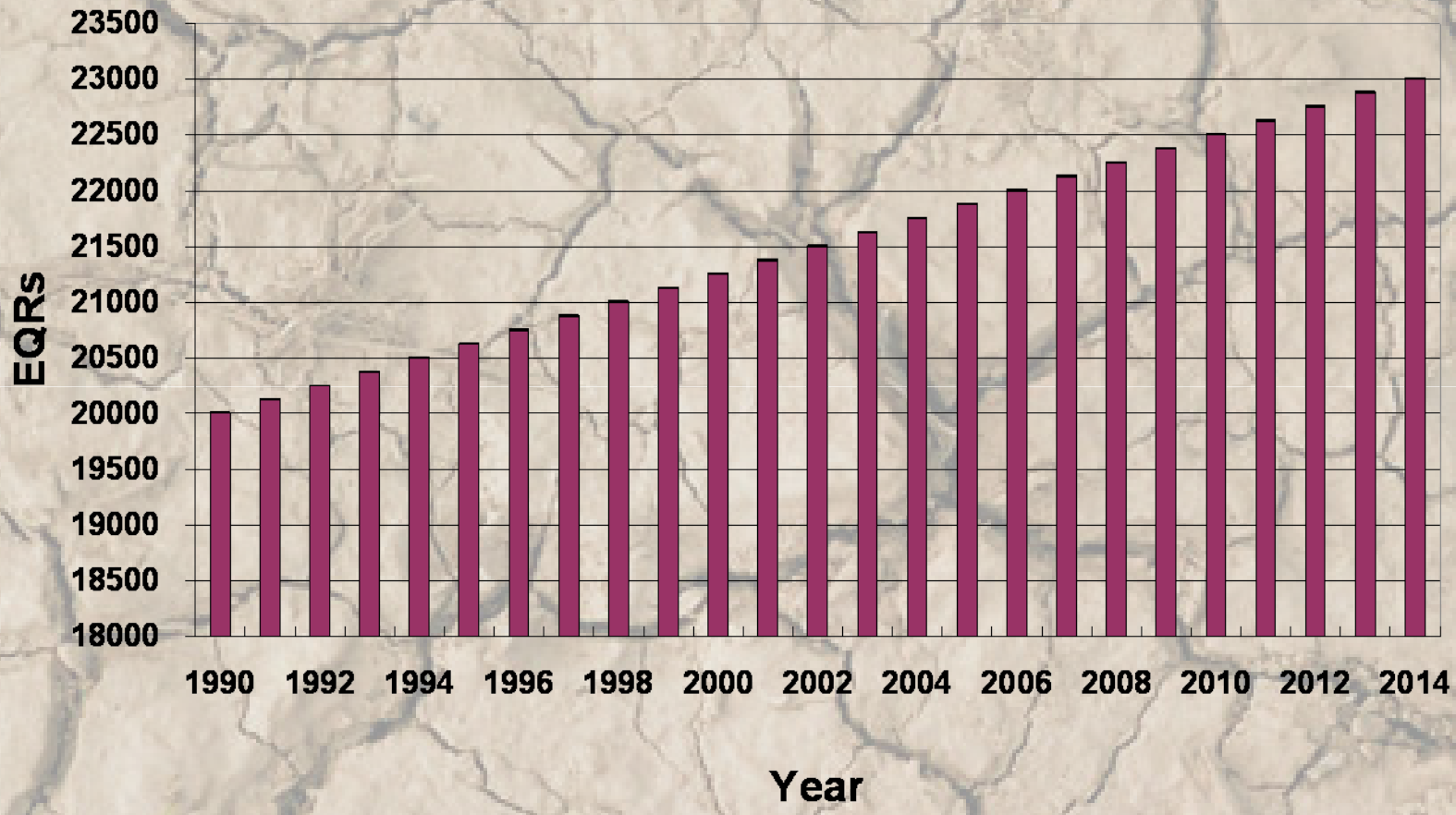
Use Model to Test Alts.

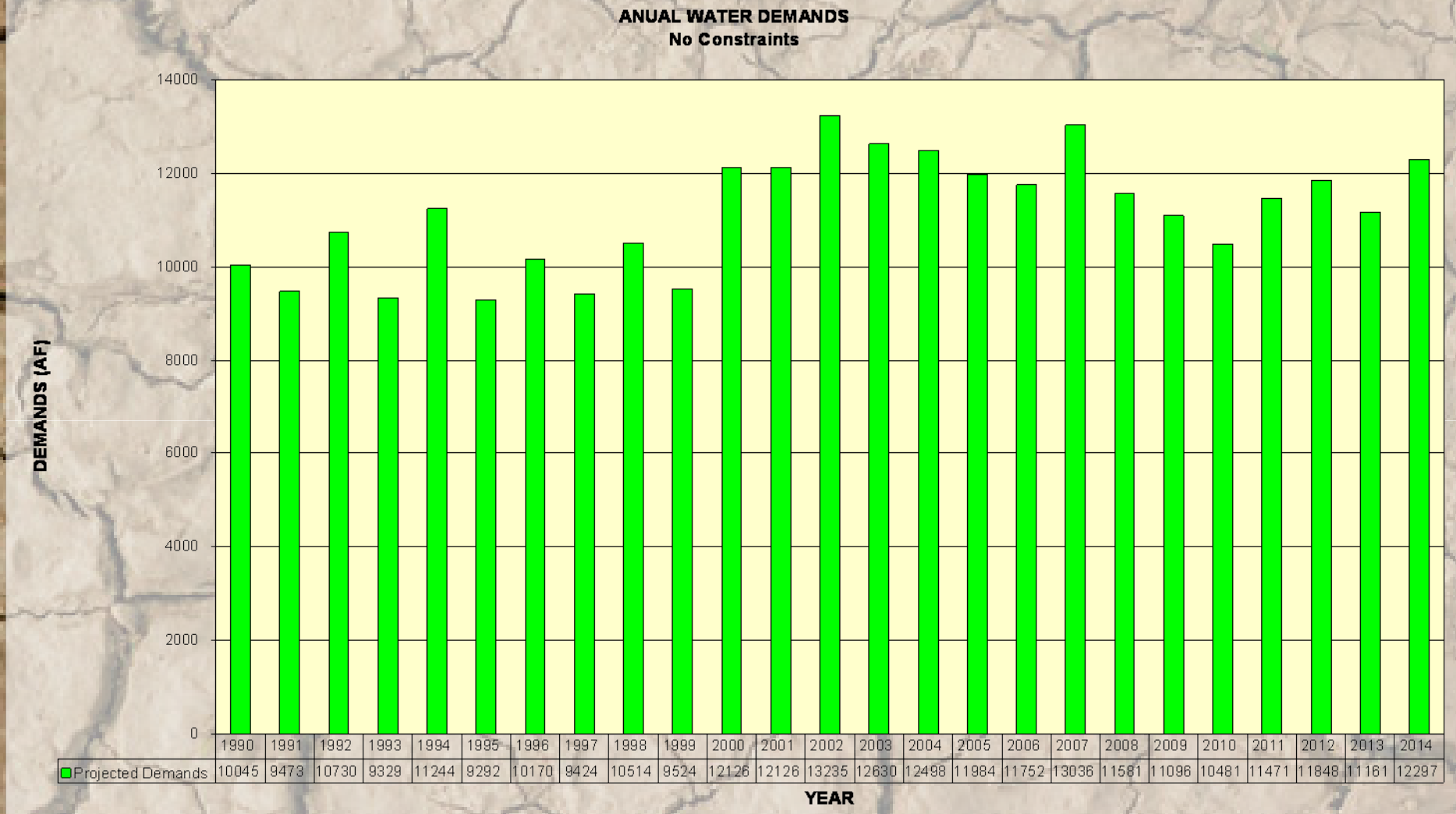
- **Model applied to a hypothetical system**
- **25 year, monthly model**
- **Demands disaggregated**
  - New/existing; by end uses
  - Baseline, Rationing and Conservation
- **Water supply including drought**
- **Reservoir operations**
- **Reliability Criteria (rules).**

Drought Recognition

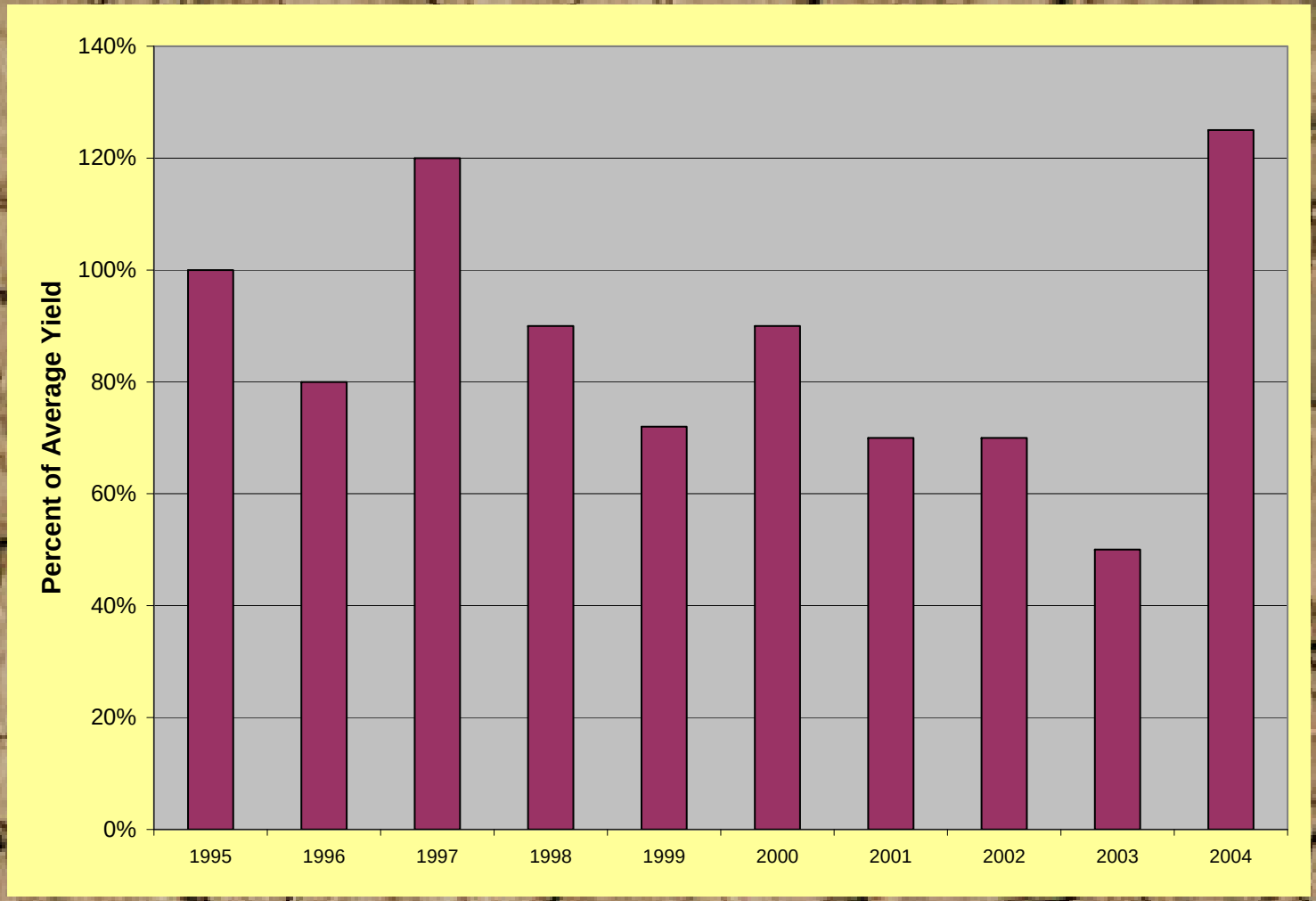
- Available Storage = 12 kaf = 1 yr dems
- Reliance on spring snowmelt
- Failure to fill to at least 67% of capacity

Projected EQR Growth

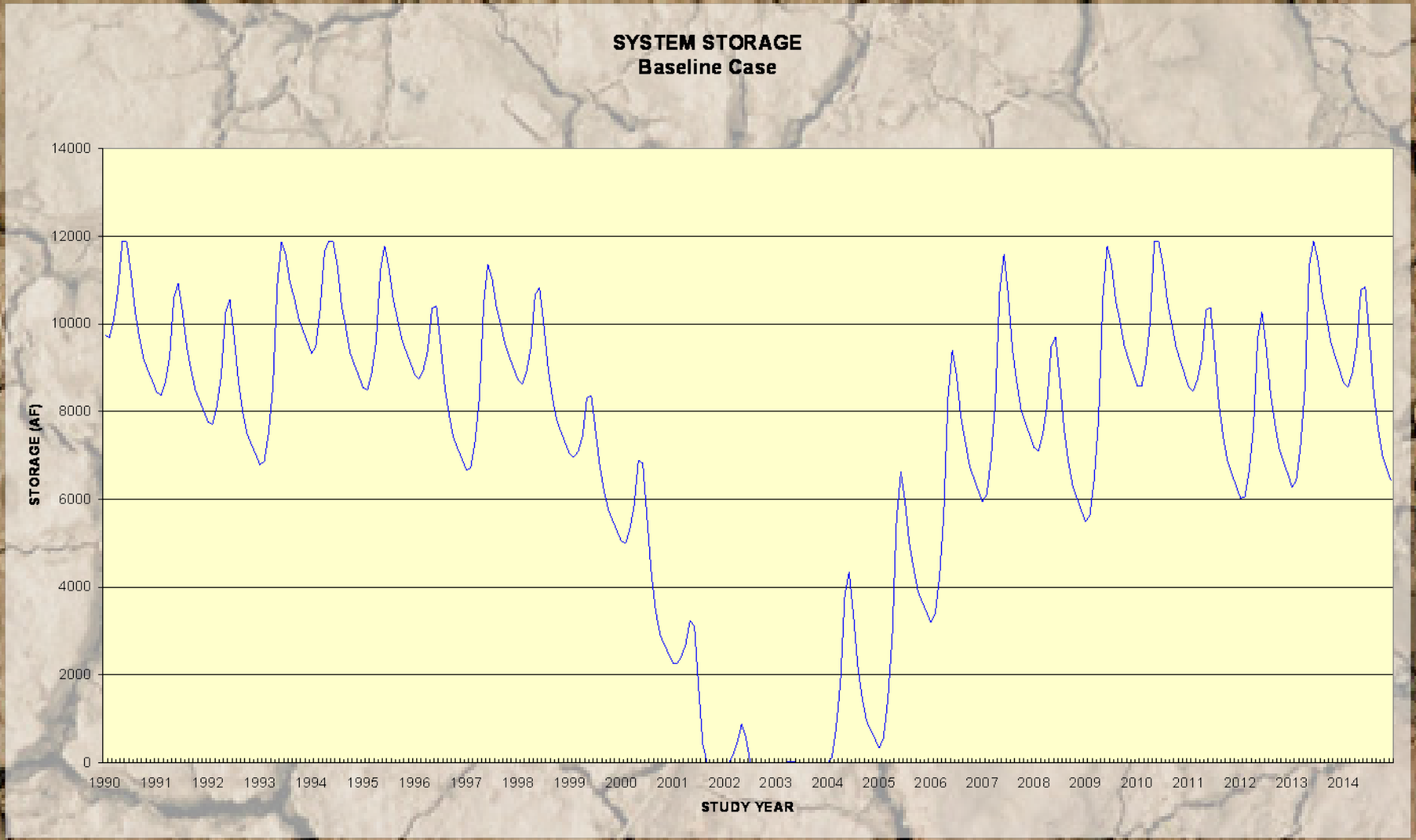



ANUAL WATER DEMANDS
No Constraints
DEMANDS (AF)
14000
12000
10000
8000
6000
4000
2000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Projected Demands 10045 9473 10730 9329 11244 9292 10170 9424 10514 9524 12126 12126 13235 12630 12498 11984 11752 13036 11581 11096 10481 11471 11848 11161 12297
YEAR

Drought Pattern

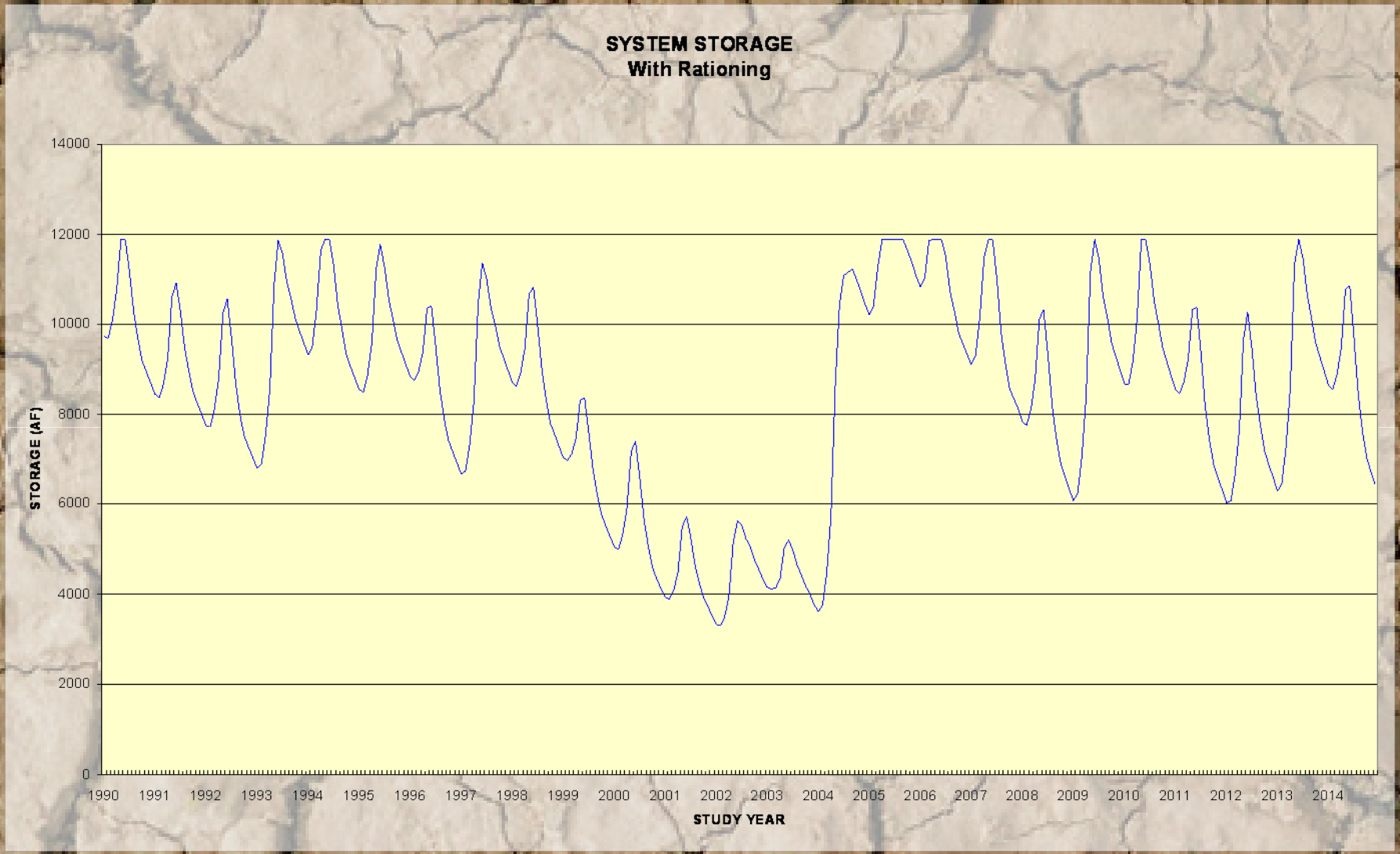


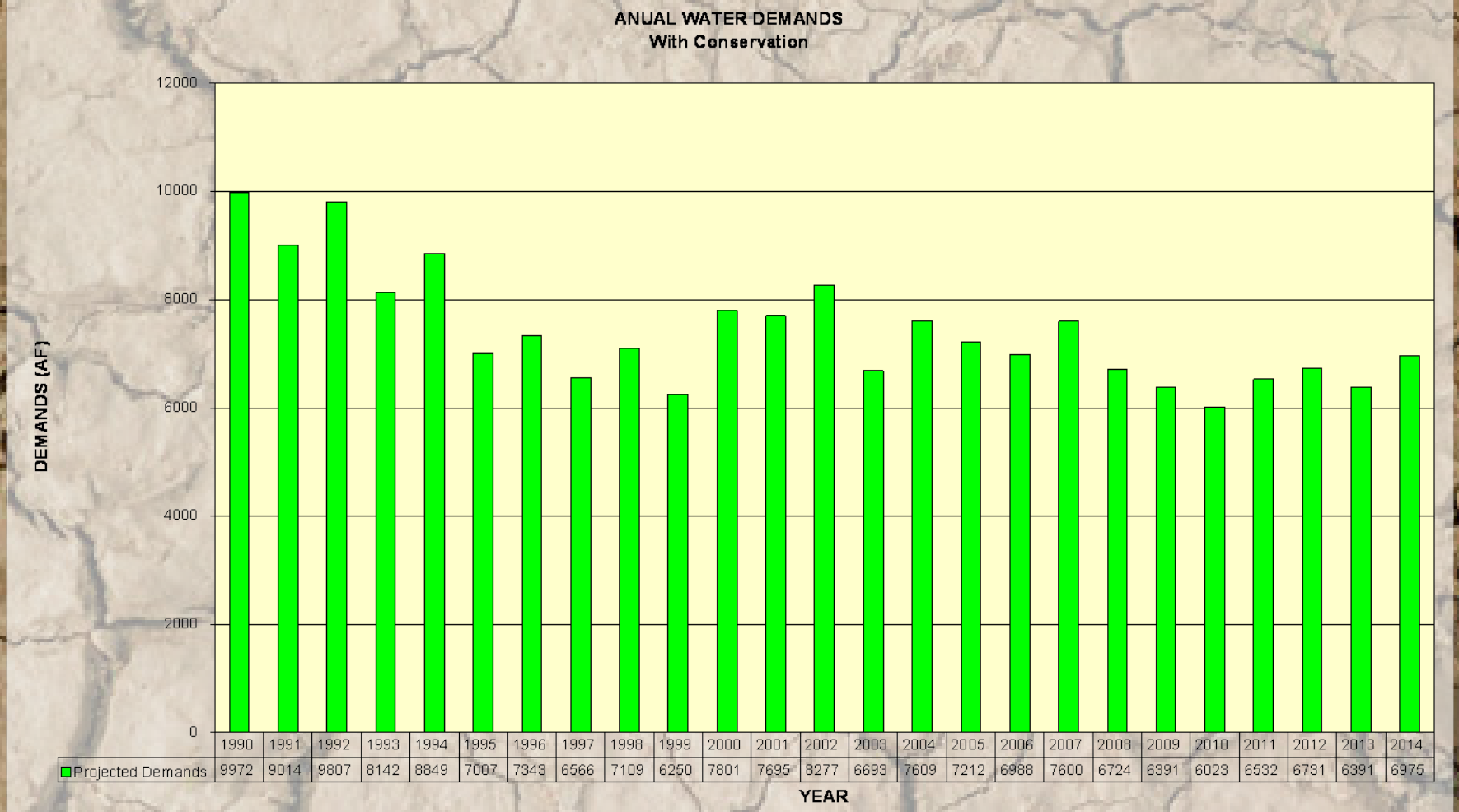
Baseline Results

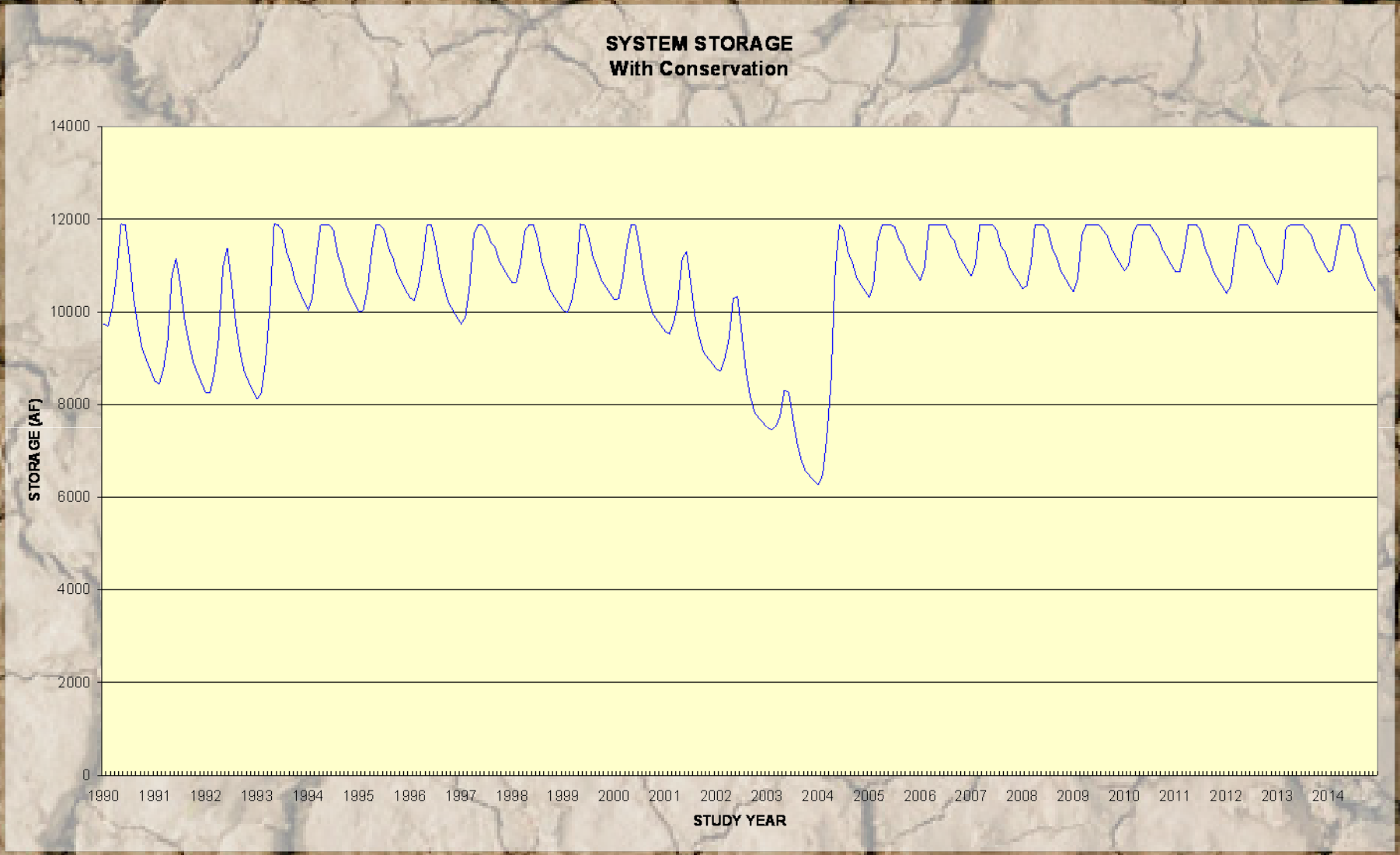


Required Rationing Factors

Year	Indoor	Outdoor
2000	1.00	0.75
2001	0.90	0.50
2002	0.90	0.25
2003	0.85	0.25
2004	0.85	0.00
2005	0.85	0.00
2006	0.85	0.90
2007	0.85	1.00


SYSTEM STORAGE
With Rationing
STORAGE (AF)
14000
12000
10000
8000
6000
4000
2000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
STUDY YEAR


ANUAL WATER DEMANDS
With Conservation
DEMANDS (AF)
12000
10000
8000
6000
4000
2000
0
YEAR
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Projected Demands 9972 9014 9807 8142 8849 7007 7343 6566 7109 6250 7801 7695 8277 6693 7609 7212 6988 7600 6724 6391 6023 6532 6731 6391 6975


SYSTEM STORAGE
With Conservation
STORAGE (AF)
14000
12000
10000
8000
6000
4000
2000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
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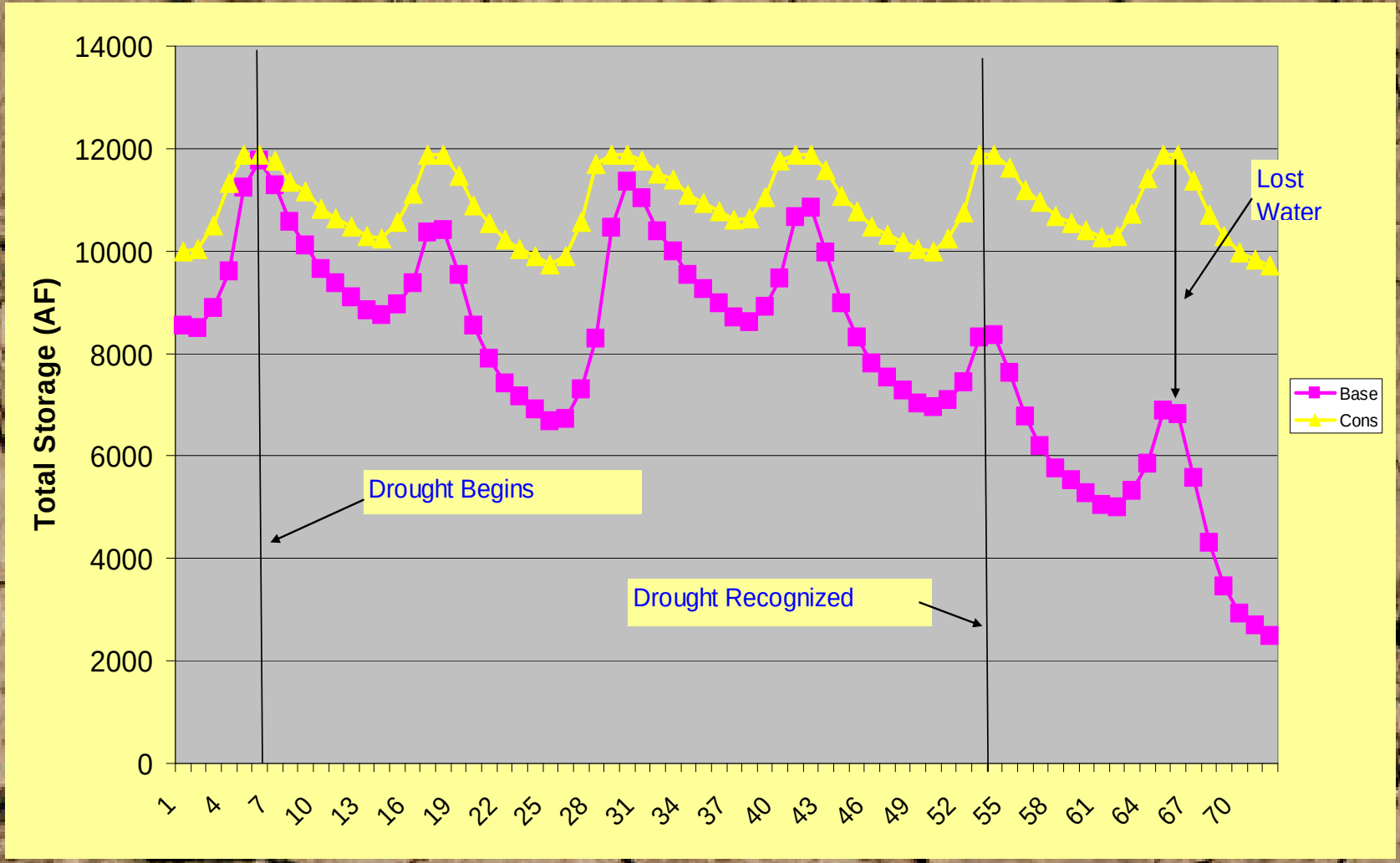
2007
2008
2009
2010
2011
2012
2013
2014
STUDY YEAR

Lost Water


14000
12000
10000
8000
6000
4000
2000
0
Total Storage (AF)
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
52
55
58
61
64
67
70
Drought Begins
Drought Recognized
Lost Water
Base
Cons

Conclusions:

- Planning can reduce risks of drought damage.
- Important to understand the severity and extent of the design drought
- Conservation provides years of savings to system before it can be recognized.
- It can take 1 to 2 years for restrictions to make significant changes to demands.
- Best course is to start conservation efforts early, and provide a drought reserve.

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Abstract

To advocates of water conservation, it seems intuitively clear that reducing water demands in normal times through increased efficiency and elimination of waste should prove useful in making water systems more able to ride out periods of shortages in water supply caused by droughts. Nonetheless, there are legitimate questions about how water conservation programs should tie into drought response plans, and whether there are situations in which conserving water during normal times may either fail to reduce the impacts of droughts, or even make matters worse. This paper discusses the role of water conservation in drought planning, and examines the performance of a hypothetical community over a 25 year study period in order to identify the factors that affect how water conservation improves or degrades its drought response.

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Mr. DeOreo has been actively practicing water engineering in Colorado since 1978 after receiving his Master Degree in Civil and Environmental Engineering from the University of Colorado at Boulder. He has worked both in the public sector and as a private consultant. His main interests are in development of innovative supplies of water for municipal uses, improving the yield of urban water systems through better water planning and management, integration of urban water uses into watershed analyses, and development of computer based applications to assist with water planning. Mr. DeOreo is a member of the Planning and Evaluation sub-committee of the AWWA Water Conservation national committee, and has served as principal investigator on the recent AWWARF studies of Residential and Commercial End Uses of Water. He has prepared several water conservation plans and has conducted detailed investigations of the impacts of various water conservation programs on urban water demands.