Water Supply Assessment for the Kaskaskia Region

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Expected timeline of the remaining water supply assessment work

- Remaining analyses of water availability under 2050 demand scenarios will be completed and presented today and at next month's meeting
- There may be the opportunity to examine selected additional scenarios beyond the March meeting
- Documentation of analyses and preparation of draft report will be completed this summer
- Report will be reviewed with publication by the end of 2012

Today's Surface Water Topics

1. Projected yield versus demand to 2050 for community surface water supply systems
2. Revised yield assessments for Carlyle Lake and Lake Shelbyville
3. Simulated Carlyle and Shelbyville lake levels for the 3 worst historical droughts

Community Surface Water Systems
projected to 2050

- Systems with Impounding Reservoirs will have future declines in yield estimates because of sedimentation
- Demand estimates by Dziegielewski do not include service to satellite systems. For some communities presented here, demands have been increased to add back in these satellite uses.

Uncertainties in Yield Estimates – Use of a Lower Confidence Limit

- Our biggest concern is that reservoir storage and inflow data may overestimate the amount of available water (producing a false positive)
- The traditional "best" estimate that did not address uncertainties provided roughly a 50% confidence value (equal chance that it could be over- or under-estimated)
- In this study we now also calculate a 90% confidence yield value (lowest 10^{th} percentile) ...
- ...we are 90% confident that the "true" yield is equal to or greater than the 90% yield value
- ...we are 90% confident that a community's system will have sufficient water during a severe drought

Categories of Drought Vulnerability

- Inadequate System = Greater than 50% chance that the system will not meet expected demands during the drought of record
- At Risk System = 10% to 50% chance that the system will not meet expected demands (confidence < 90%)
- Adequate System = 90% confidence that the system will meet expected demands without threat of shortage
- Marginal System = Meets expected demands of the drought of record with 90% confidence; however, the threat of shortages in the later stages of drought may lead the community to adopt extraordinary measures.

Systems with Allocations

	Allocation (mgd)	Demand 2010/2050CT* (mgd)
Centralia	7.56	4.0 / 5.0
Salem	6.0	1.2 / 1.5
Gateway	4.0	
Holland	5.0	

* CT = current trend growth scenario

Kaskaskia River Withdrawals

No expected supply limitations for moderate growth

- Carlyle
- Evansville
- Kaskaskia Water District
- Nashville*
- SLM Water Commission
- Sparta*
- Vandalia*

* these systems also have reservoir supplies

Inadequate Systems

values in mgd

	90% yield	Demand 2010/2050CT
Altamont	0.12	0.26 / 0.32
Coulterville	0.01	0.14 / 0.17
Farina	0.05	0.14 / 0.16
Wayne City	0.26	0.33 / 0.35

At Risk Systems

values in mgd

	50% Yield 2010/2050	Demand 2010/2050CT
Fairfield	0.98 / 0.98	0.9 / 1.0

planning to build additional off-channel storage, which would then effectively reclassify as an adequate system

Mt. Olive	0.26 / 0.17	0.21 / 0.27

expected to become inadequate by 2025

Staunton	0.52 / 0.50	0.5 / 0.6

expected to become inadequate by 2015

Adequate through 2050

	90%Yield 2010/2050	Demand 2010/2050CT
Breese	1.0 / 1.0	0.7 / 0.83
Effingham	6.2	2.1 / 2.8
Greenville	3.0	1.3 / 1.6
Highland	2.0 / 1.8	1.3 / 1.6*
Kinmundy	0.26/0.21	0.08 / 0.10
Mattoon	4.4	2.5 / 2.9
Olney	2.1 / 2.0	1.4 / 1.7*
Pana	0.82 / 0.76	0.6 / 0.7*
Taylorville**	3.0 / 2.6	2.2 / 2.5

* we consider these would be marginal systems by 2050

** Taylorville has additional yield through GW supplies

Hillsboro

	2010	2030	2050
Yield			
50%	4.5	3.9	3.2
90%	2.9	2.4	1.7
Demand			
LRI	1.28	1.37	1.50
CT	1.30	1.43	1.60
MRI	1.32	1.49	1.71*

* At risk – 2050 MRI scenario

Litchfield

	2010	2030	2050
Yield			
50%	4.7	3.6	2.7
90%	3.1	2.2	1.6
Demand*			
LRI	0.94/1.3	1.01/1.4	1.10/1.5
CT	0.95/1.3	1.05/1.4	1.18/1.6**
MRI	0.97/1.3	1.10/1.5	1.26/1.7**

* First value is based on reported deliveries of finished water.

Second value is based on reported withdrawals from their lake.

** At risk – 2050 CT and MRI scenarios

At risk and marginal systems by 2050

- The projected demand scenarios for several larger community systems approaches their 90%-confidence yield by 2050 or in subsequent decades.
- The 90%-confidence yield analyses used to determine at-risk systems incorporate uncertainties in available data. The 90% yield could potentially be increased by obtaining more precise data – without any changes to the available supply.
- Of the various data inputs, uncertainties in reservoir storage can most easily be addressed. Thus it could be potentially very beneficial for these communities to conduct periodic detailed bathymetric surveys of their lakes to better determine existing/future storage and sedimentation rates.

2012 Reassessment of the yields of Carlyle and Shelbyville Lakes

Primary differences from the previous (2001) ISWS yield estimates:

1. Computations performed using daily time intervals (instead of monthly)
2. Surcharge storage effects are considered – this primarily effects the estimated yield of the 1953-54 drought of record
3. Increased effluent inflows to the lakes are considered (adding 1.6 mgd to Shelbyville yield)

Comparison of 2001 & 2012 Yield Estimates – State Storage

2001

- 50-year yield*
  - Shelbyville = 21 mgd
  - Carlyle = 31 mgd
- 100-year yield
  - Shelbyville = 15 mgd
  - Carlyle = 21 mgd

2012

- 50-year yield*
  - Shelbyville = 23 mgd
  - Carlyle = 31.5 mgd
- 100-year yield
  - Shelbyville = 20 mgd
  - Carlyle = 27 mgd

With both the 50- and 100-year estimates, there is a collective 5 mgd loss in yield by 2050 associated with projected sedimentation effects to the total storage in the joint-use pools

What does this mean in terms of available State allocations?

To determine potential yield for allocations, the new (2012) computed 50-year yield estimates are reduced:

1) To account for projected loss by 2040 from sedimentation
2) To account for the State's share of the minimum flow releases from the lakes

The collective 2040 yield available for allocation is estimated to be 44 mgd (an increase of 2.5 mgd over the 2001 value). However, the current State allocation from the two lakes is 44.7 mgd. Thus, it appears unlikely that new allocations would be available based on the more recent yield estimate.

Has yield uncertainty played a role in determination of the State allocation?

No. Incorporation of data uncertainties in the analysis would produce 90% yield values that are roughly 8 mgd lower than the 50% estimates that are used for establishing the allocations.

But, because the State uses only a small % of the joint-use pool, it is assumed that additional water could be made available during emergency conditions such as for a near-record drought. Thus there is not the same burden to be 90% confident in the supply availability.

Collective yields (Carlyle + Shelbyville) for the worst seven historical drought periods – current (2010) conditions

Drought	Yield (mgd)
1953-54	46 mgd
1894-95	53 mgd
1930-31	56 mgd
1976-77	80 mgd
1940-41	88 mgd
1963-65	90 mgd
1988-89	99 mgd

Simulated Lake Levels for the Worst Historical Droughts

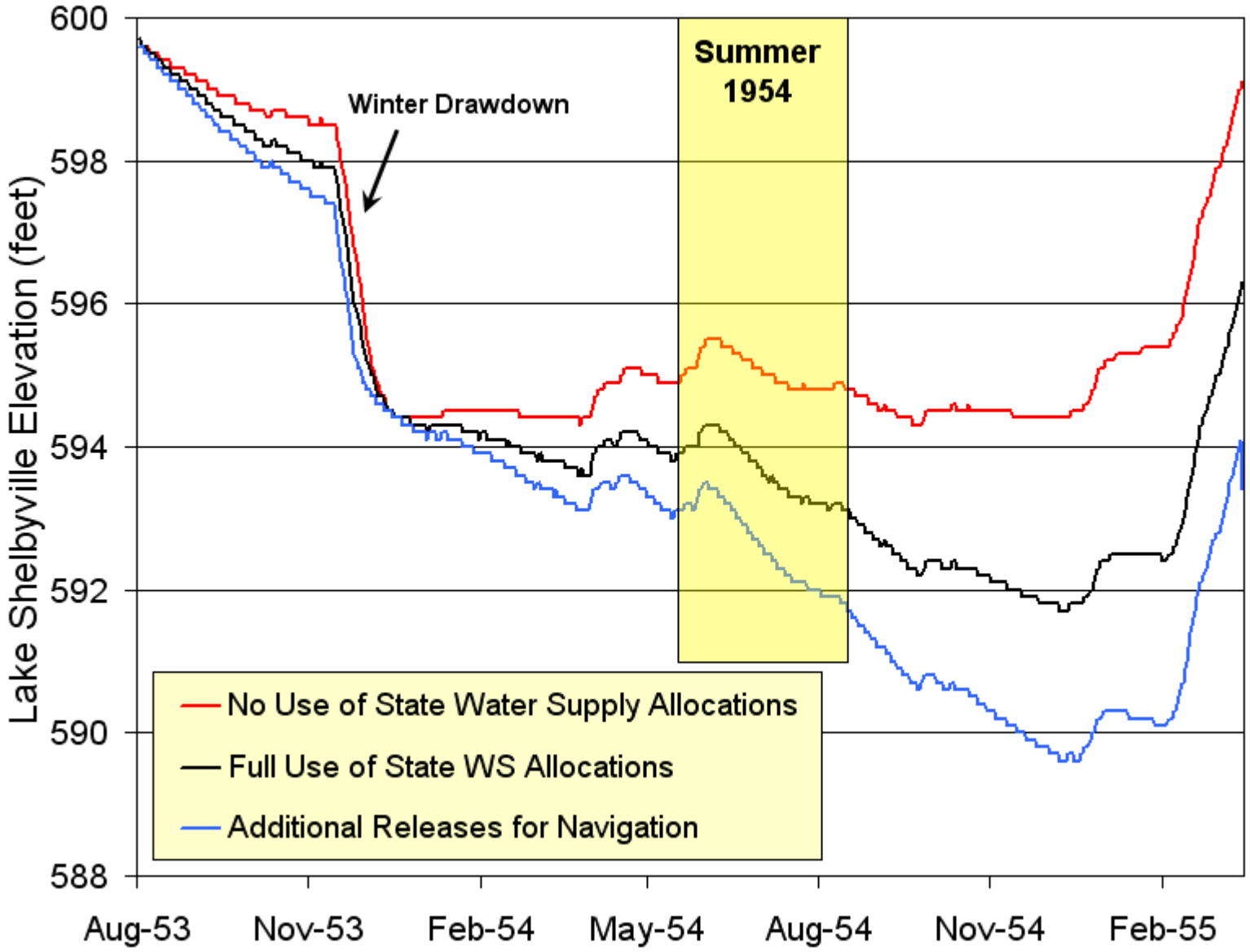
- 1953-1954, 1930-1931, and 1894-1895 droughts
- Three scenarios per drought:
  - No use of the state water supply allocations
  - Full use of the water supply allocations (45 mgd)
  - Additional (50 mgd) releases by Corps for navigation
- Scenarios assume constant releases for water supply and navigation over the duration of the drought

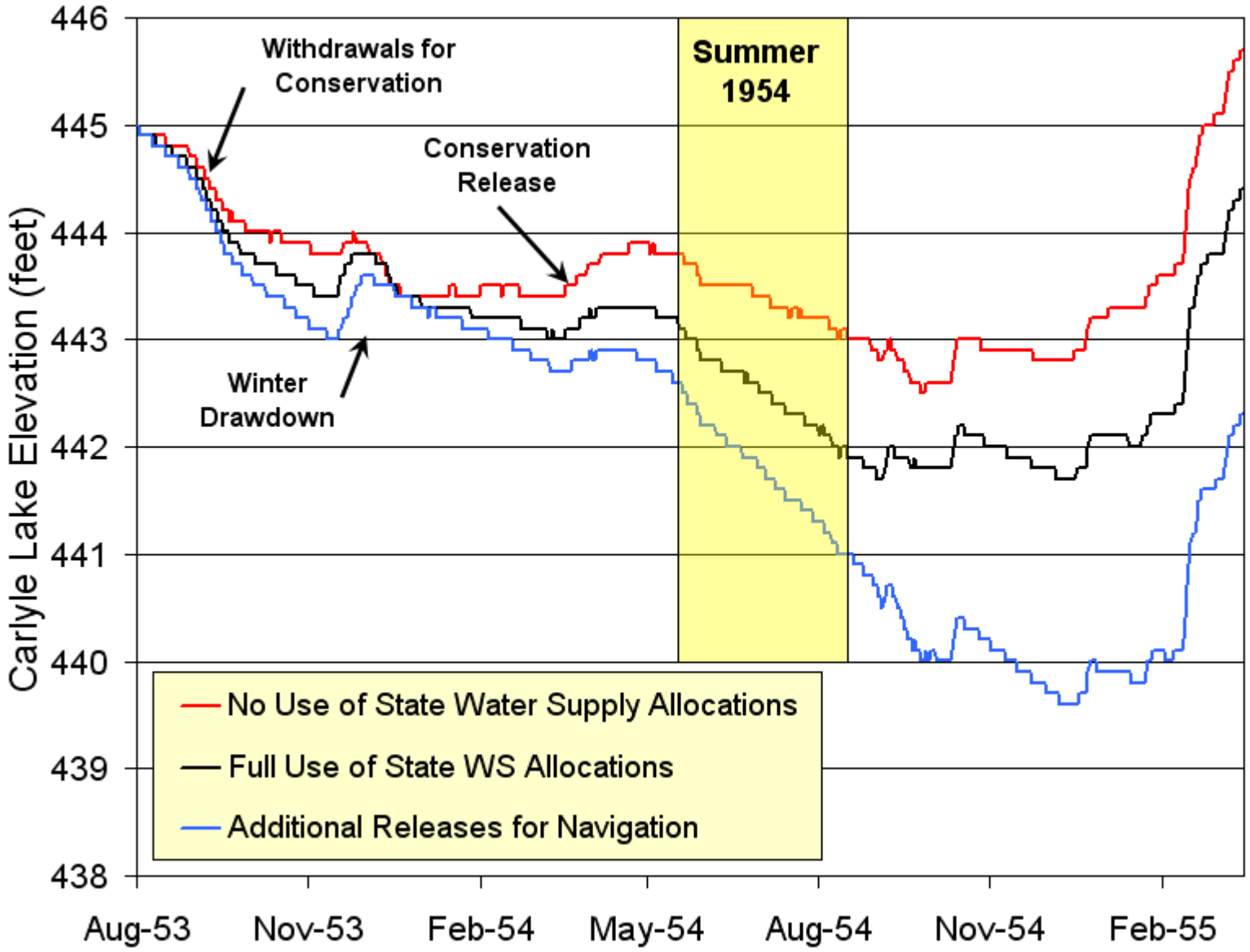
Simulated Lake Levels for the Worst Historical Droughts

The following slides have been modified from their original presentation on Feb. 7, 2012. The following changes were made in the computed lake levels:

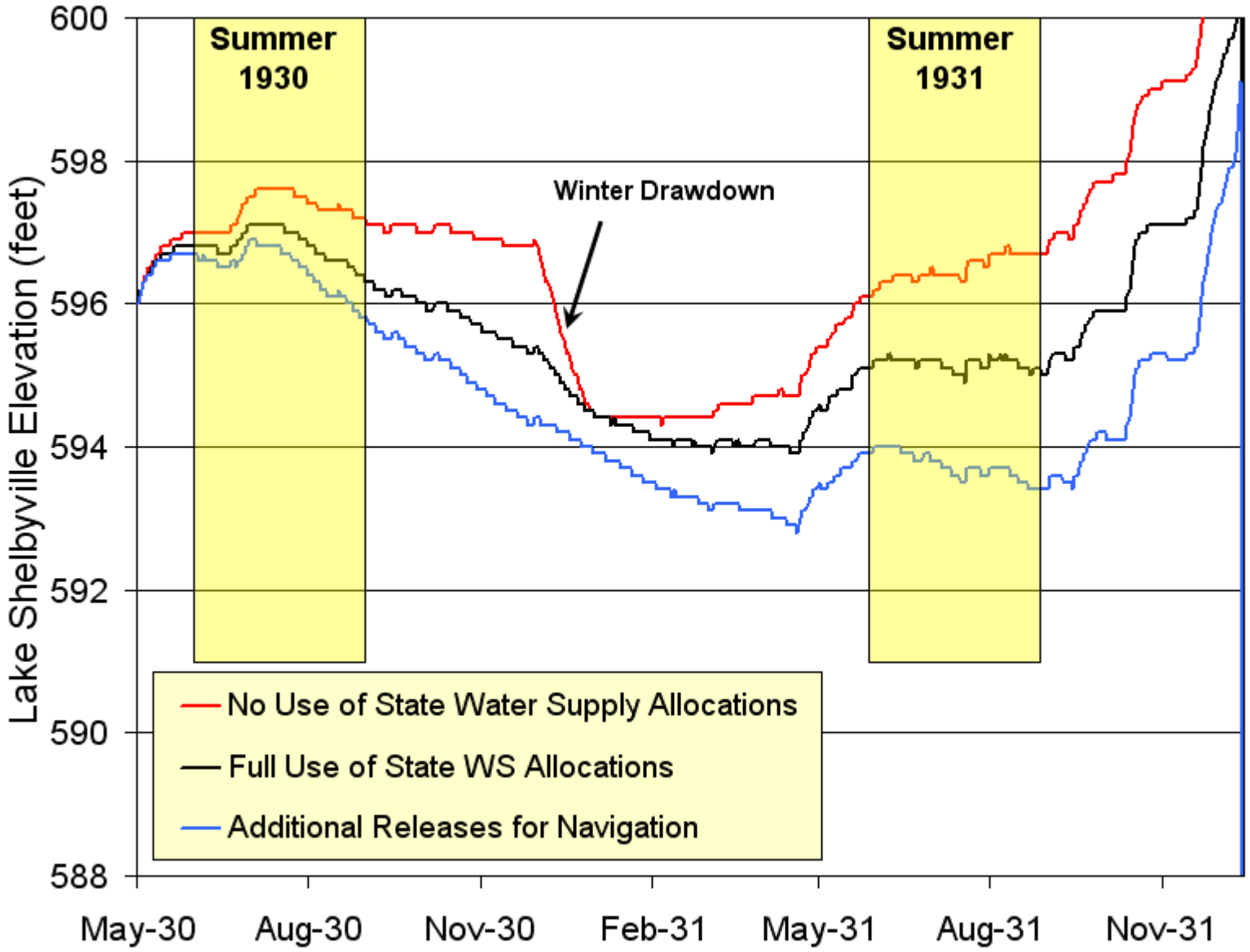
- The navigation use in the third scenario has been reduced from 50 mgd to 40 mgd.
- It has been assumed that during such abnormally dry years, the Corps would likely provide a 6" variance (increase) in the winter pools of both lakes.
- Carlyle Lake conservation withdrawals are assumed not to occur if the lake level falls below 442 feet (due to the limitation of the pumps to draw water at such low levels).

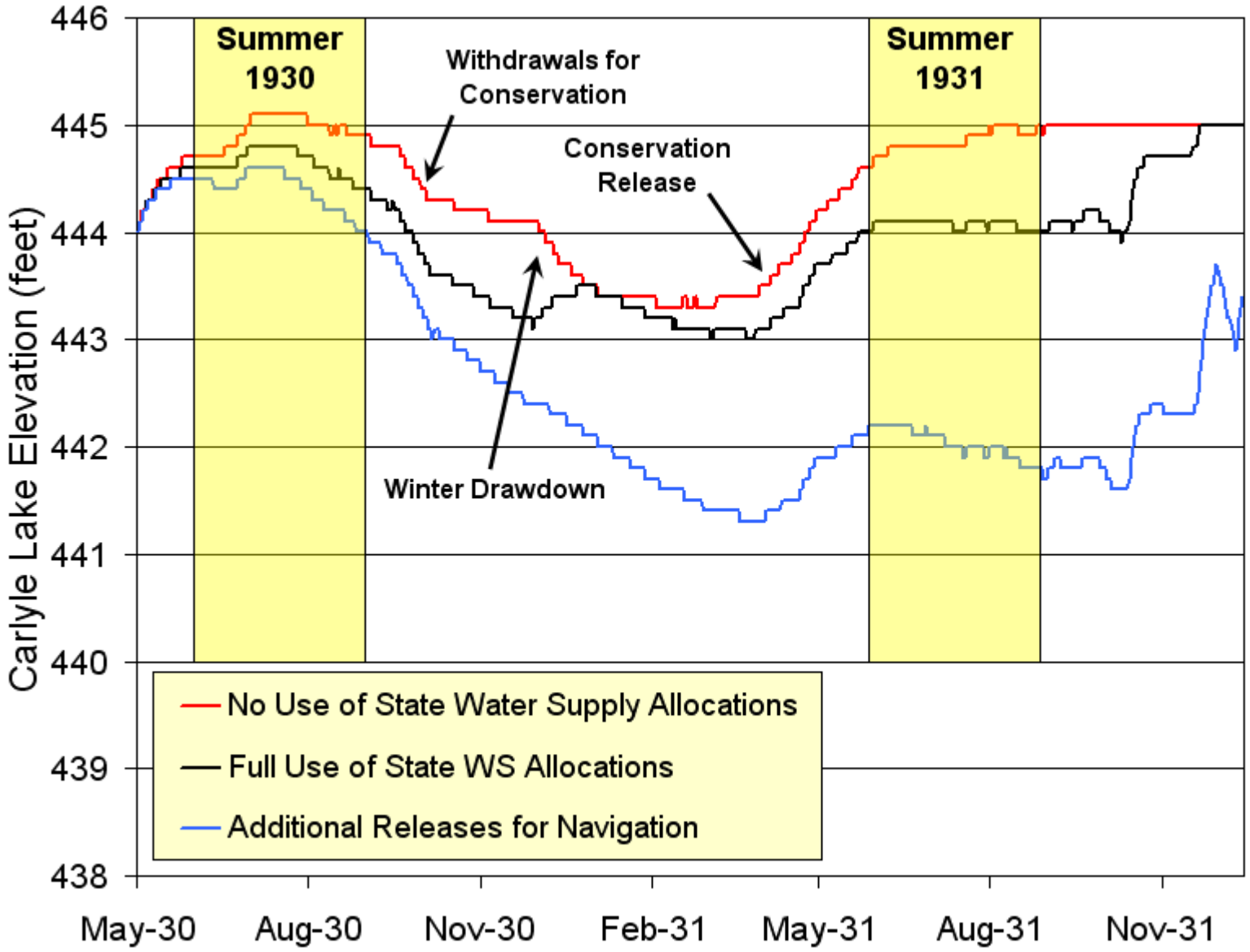
1953-54 = Drought of Record


Lake Shelbyville Elevation (feet)
600
598
596
594
592
590
588
Aug-53
Nov-53
Feb-54
May-54
Aug-54
Nov-54
Feb-55
Winter Drawdown
Summer
1954
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation

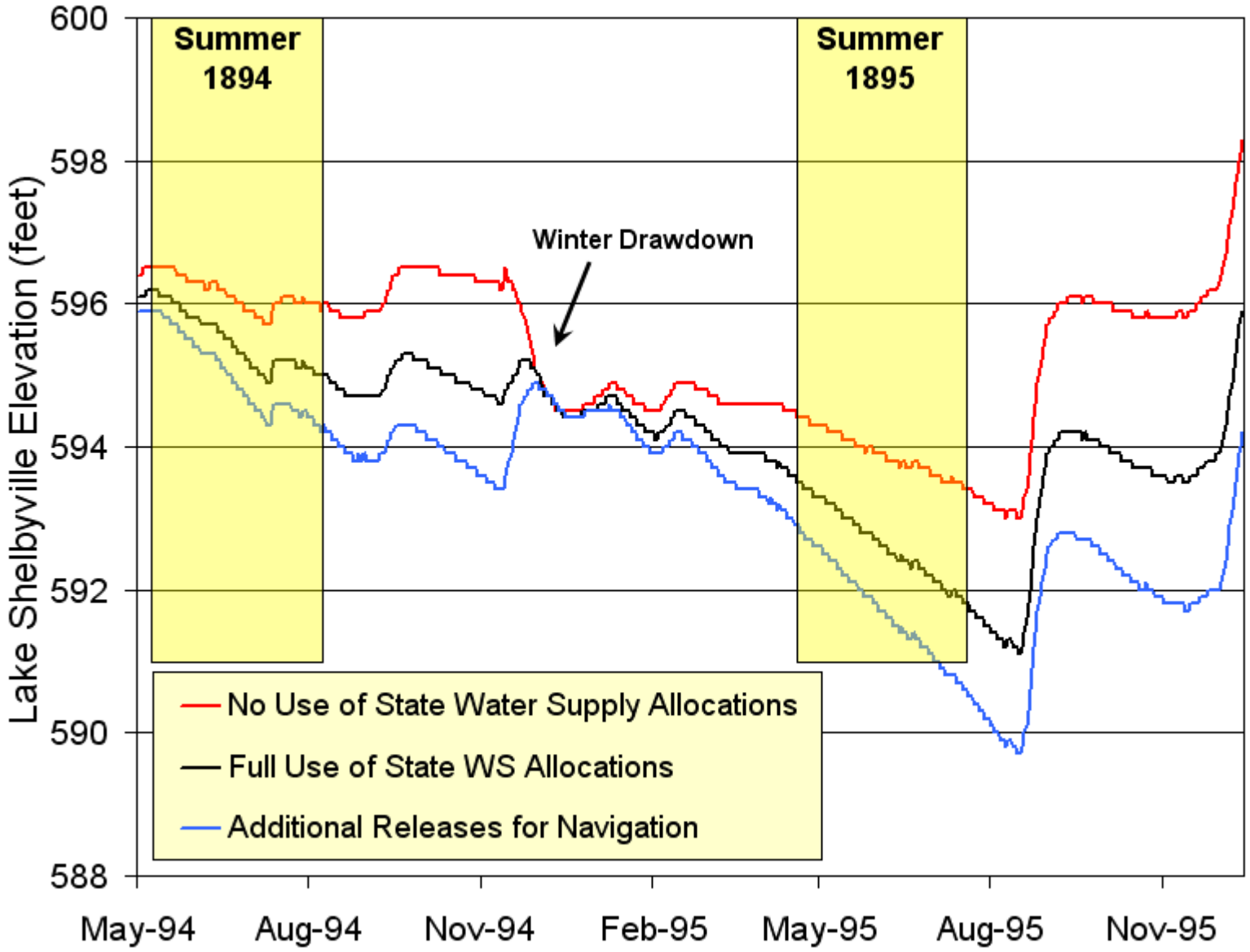

Withdrawals for Conservation
Summer 1954
Conservation Release
Winter Drawdown
Carlyle Lake Elevation (feet)
446
445
444
443
442
441
440
439
438
Aug-53
Nov-53
Feb-54
May-54
Aug-54
Nov-54
Feb-55
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation

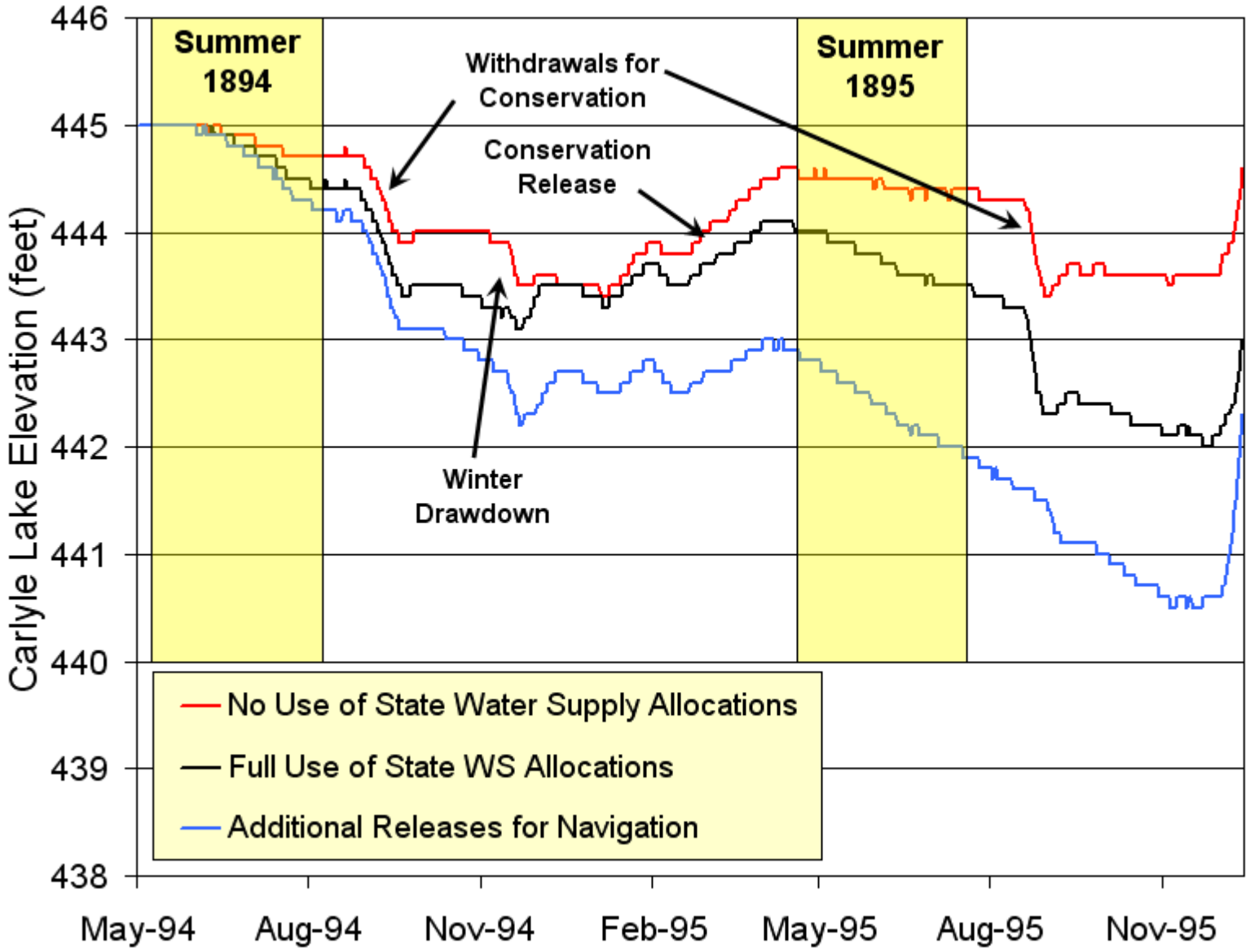
1930-31 = Roughly a 50-year drought
Onset in late spring/early summer


Summer 1930
Summer 1931
Winter Drawdown
Lake Shelbyville Elevation (feet)
600
598
596
594
592
590
588
May-30
Aug-30
Nov-30
Feb-31
May-31
Aug-31
Nov-31
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation


Summer 1930
Summer 1931
Withdrawals for Conservation
Conservation Release
Winter Drawdown
Carlyle Lake Elevation (feet)
446
445
444
443
442
441
440
439
438
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation
May-30
Aug-30
Nov-30
Feb-31
May-31
Aug-31
Nov-31

1894-95 = Using simulated flows from watershed model, estimated to be the second worst drought


Summer 1894
Summer 1895
Winter Drawdown
Lake Shelbyville Elevation (feet)
600
598
596
594
592
590
588
May-94
Aug-94
Nov-94
Feb-95
May-95
Aug-95
Nov-95
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation


Summer 1894
Summer 1895
Withdrawals for Conservation
Conservation Release
Winter Drawdown
Carlyle Lake Elevation (feet)
446
445
444
443
442
441
440
439
438
May-94
Aug-94
Nov-94
Feb-95
May-95
Aug-95
Nov-95
No Use of State Water Supply Allocations
Full Use of State WS Allocations
Additional Releases for Navigation

Next month:

- Beyond yield analyses: Simulated flow releases and the water budget of the Kaskaskia Navigation Channel during severe drought