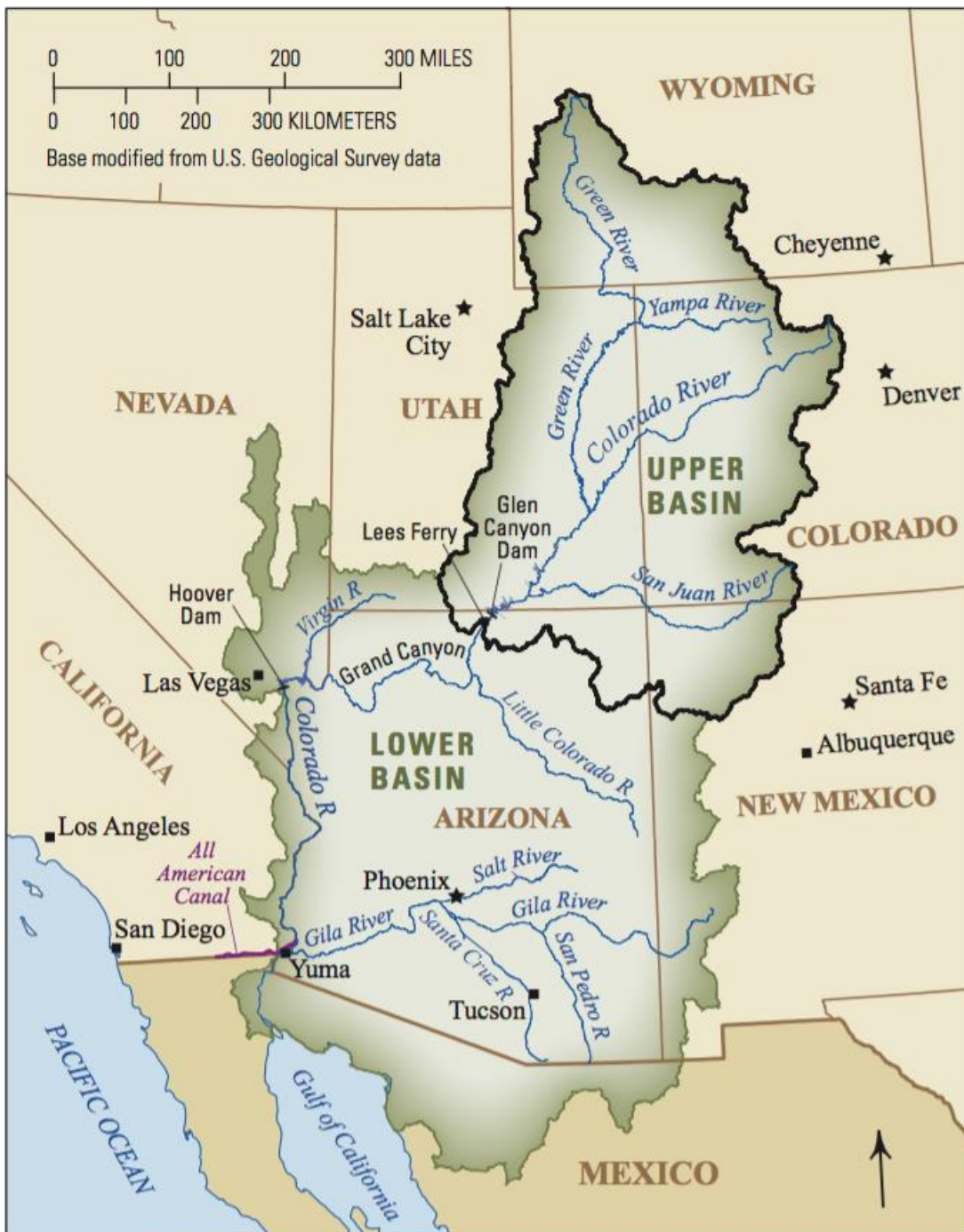




The Colorado River Basin and the need for Forecasting Improvement

Colby N. Pellegrino, Director - Water Resources
Southern Nevada Water Authority



COLORADO RIVER

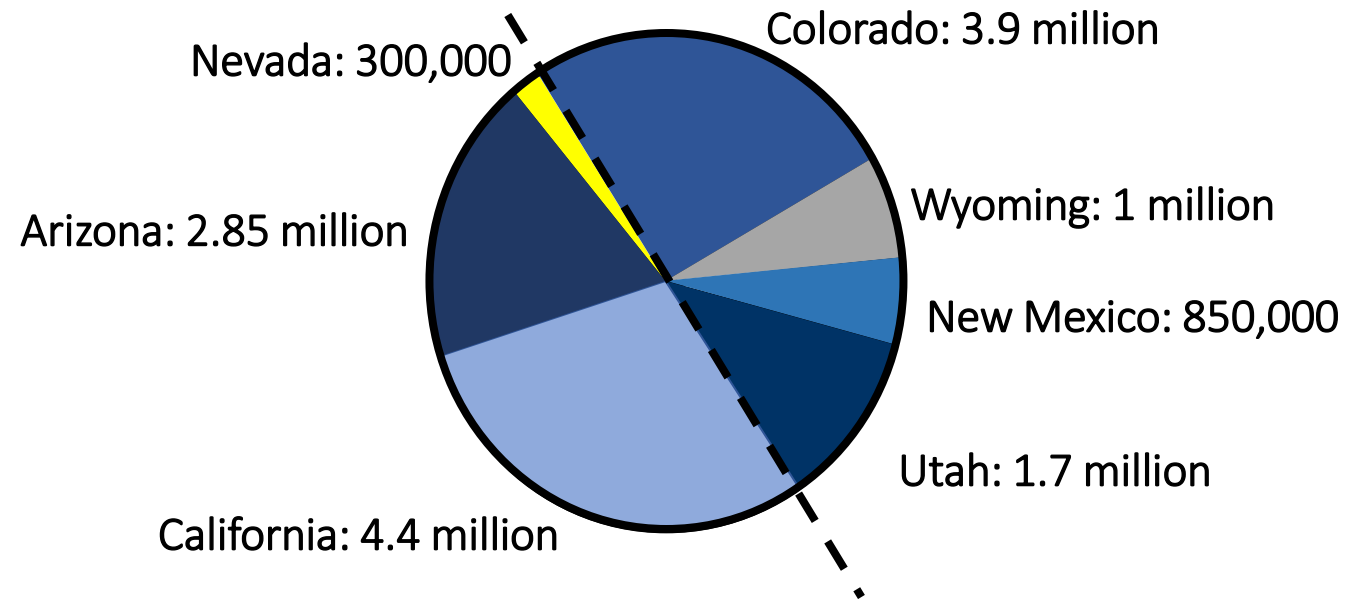
Colorado River provides water to 7 western states and the country of Mexico

- Water to 40 million people
- 5.5 million acres of agricultural land
- 22 federally recognized tribes



Colorado River Overview

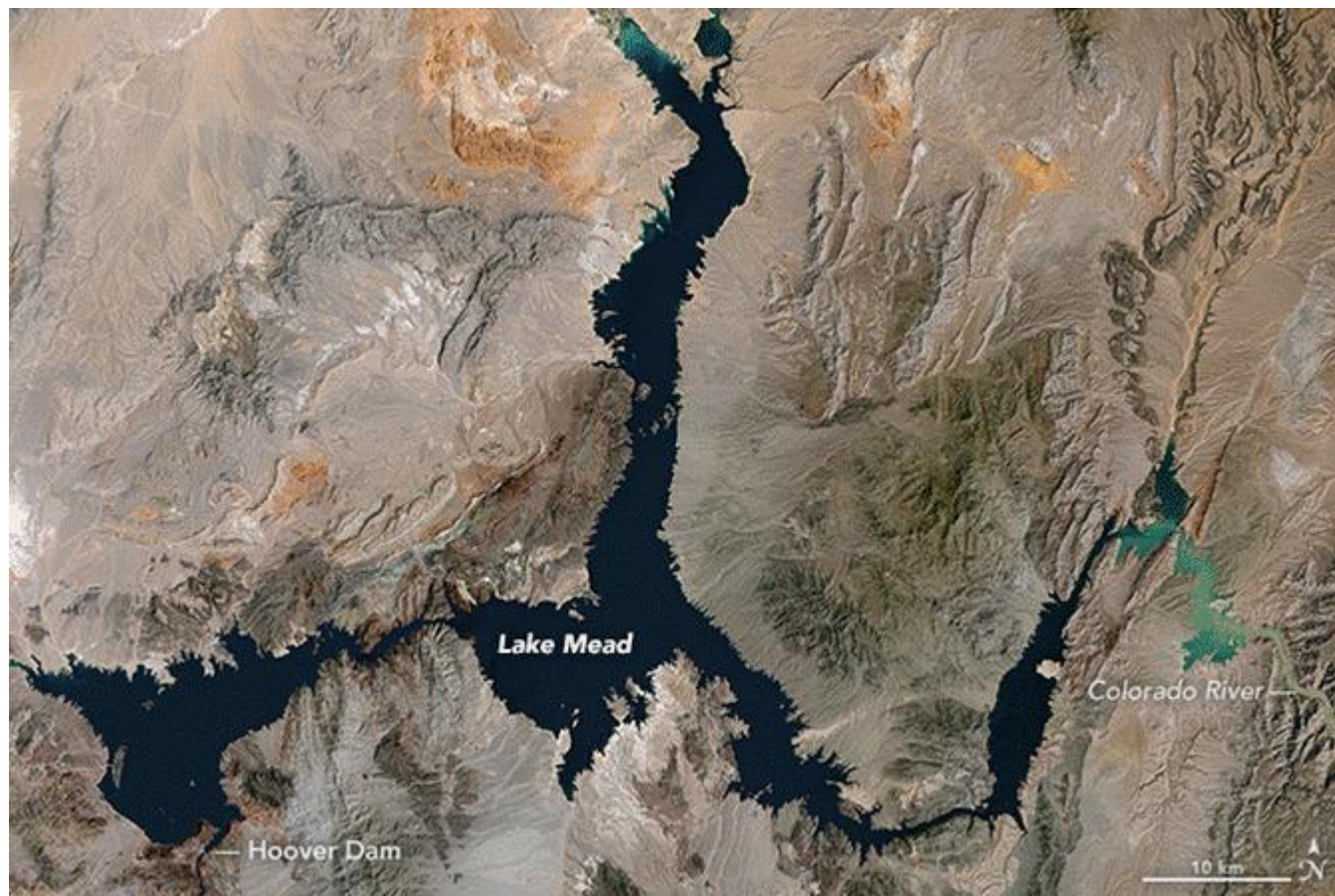
Nevada receives 300,000 acre-feet of Colorado River water annually, accessed through facilities at Lake Mead.



In addition, the country of Mexico receives 1.5 million acre-feet of Colorado River annually.



COLORADO RIVER DROUGHT



2000 vs. 2016 levels

For the past 17 years, the Colorado River has been experiencing severe drought conditions, affecting Lake Mead's water levels.



COLORADO RIVER DROUGHT

For the past 18 years, the Colorado River has been experiencing severe drought conditions, affecting Lake Mead's water levels.

Drought impacts:

- Availability of supplies
- Resource allocations
- Water quality in the lake
- Infrastructure operations

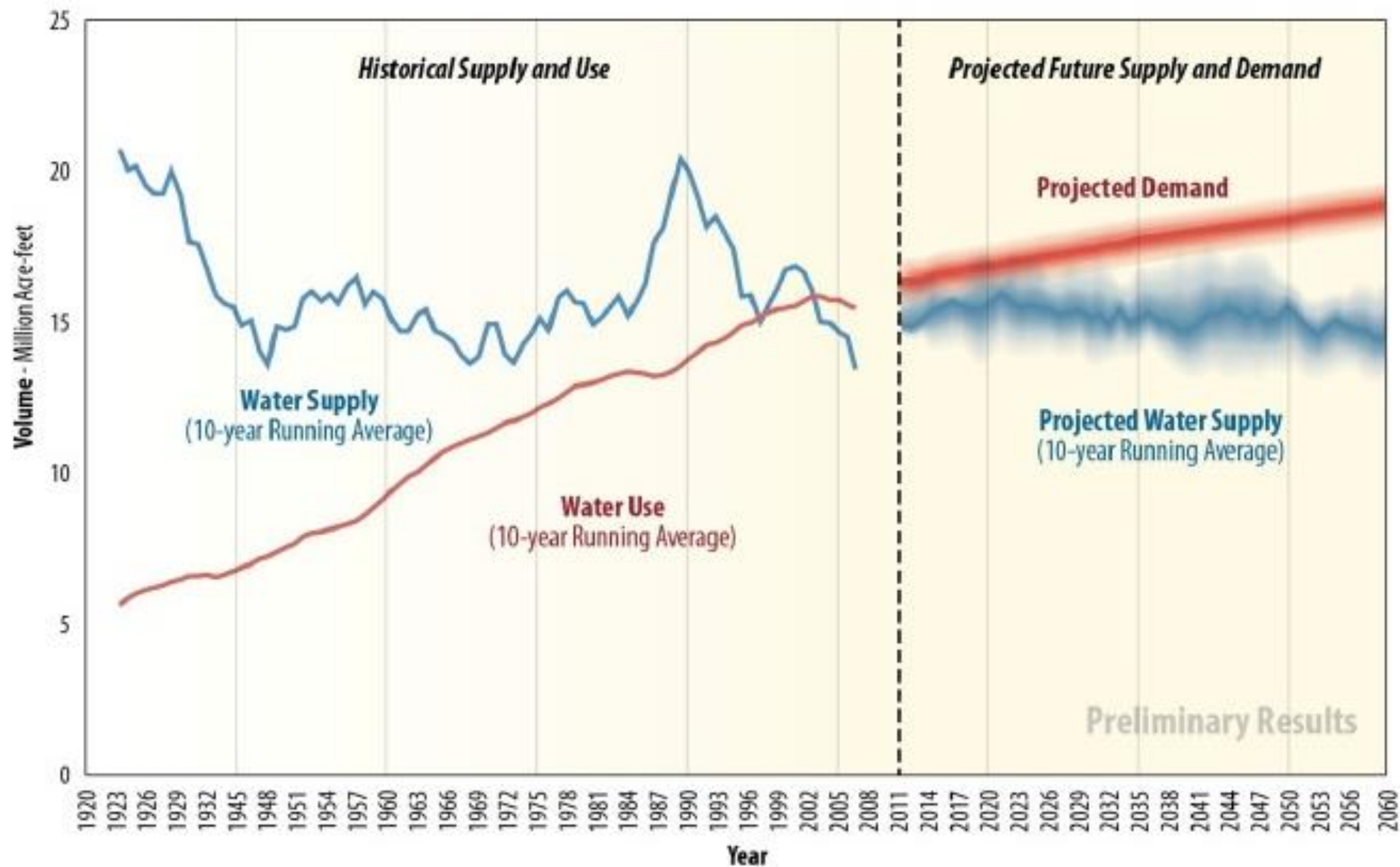


2000



Today

Historical Supply and Use and Projected Future Colorado River Basin Water Supply and Demand

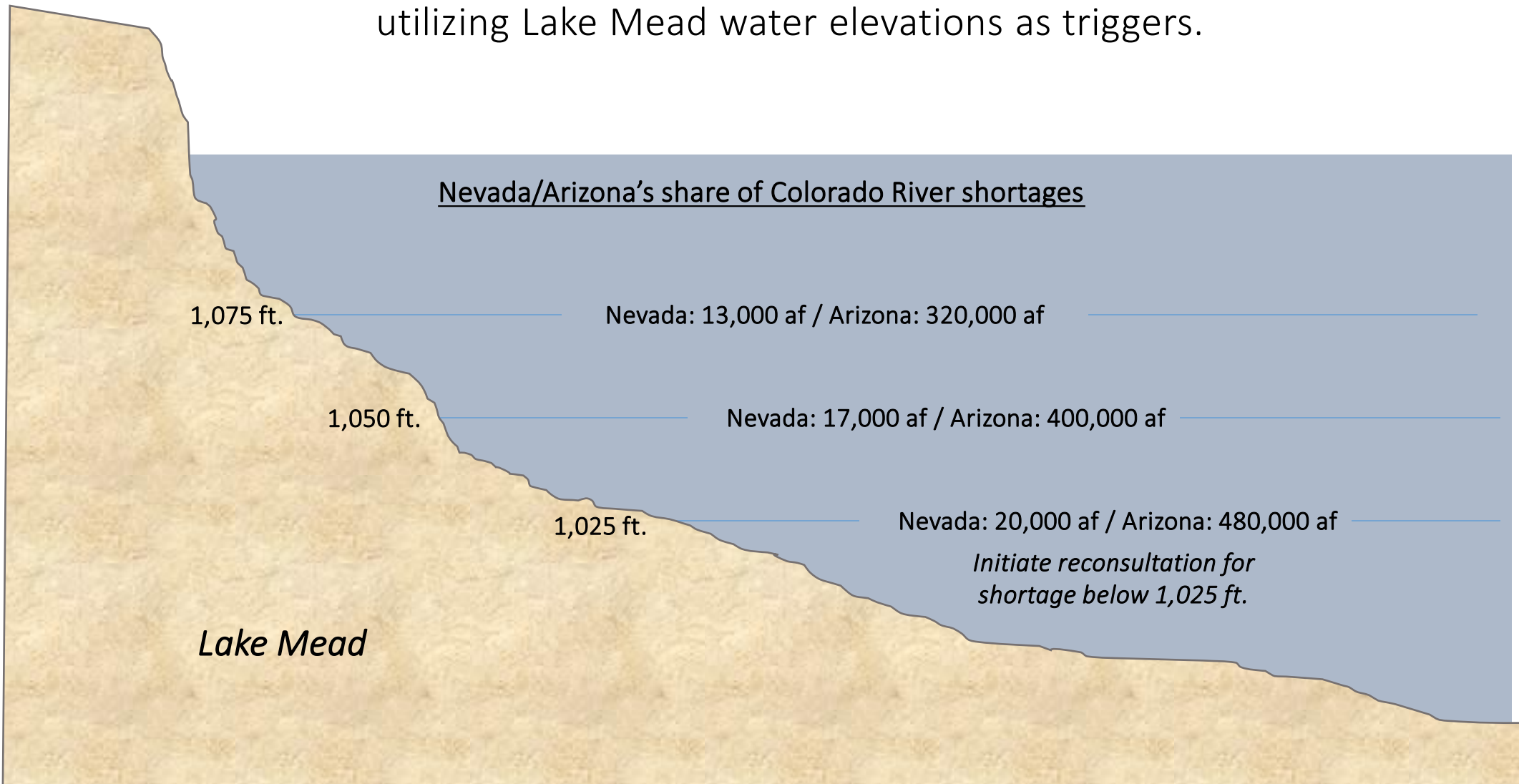


Lake Powell Operational Tiers (subject to April adjustments or mid-year review modifications)		
Lake Powell Elevation (feet)	Lake Powell Operational Tier	Lake Powell Active Storage (maf)
3,700	Equalization Tier equalize, avoid spills or release 8.23 maf	24.32
3,636 – 3,666 (see table below)	----- Upper Elevation Balancing Tier release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	15.54 – 19.29 (2008 – 2026)
3,575	----- Mid-Elevation Release Tier release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.52
3,525	----- Lower Elevation Balancing Tier balance contents with a min/max release of 7.0 and 9.5 maf	5.93
3,370		0



Drought Response

The Basin States developed a framework to manage shortages, utilizing Lake Mead water elevations as triggers.





PROTECTING LAKE MEAD

Proposed voluntary reductions would be tied to Lake Mead's elevations

Lake Mead Elevation (ft)	2007 Interim Guidelines Shortages (kaf)		Voluntary Reductions (kaf)			Combined Reductions (kaf) (2007 Interim Guidelines Shortages + Voluntary Reductions)			
	AZ	NV	AZ	NV	CA	AZ	NV	CA	TOTAL
1,090	0	0	192	8	0	192	8	0	200
1,085	0	0	192	8	0	192	8	0	200
1,080	0	0	192	8	0	192	8	0	200
1,075	320	13	192	8	0	512	21	0	533
1,070	320	13	192	8	0	512	21	0	533
1,065	320	13	192	8	0	512	21	0	533
1,060	320	13	192	8	0	512	21	0	533
1,055	320	13	192	8	0	512	21	0	533
1,050	400	17	192	8	0	592	25	0	617
1,045	400	17	240	10	200	640	27	200	867
1,040	400	17	240	10	250	640	27	250	917
1,035	400	17	240	10	300	640	27	300	967
1,030	400	17	240	10	350	640	27	350	1,017
< 1,025	480	20	240	10	350	720	30	350	1,100

Important Research - CBRFC Perspective

Improve regulated forecasts for both ESP and operation mode

Export Model

Currently historical exports are used

Should be based on current conditions

Unmeasured depletions (In-basin irrigation)

Evaluate the use of historical CDSS consumptive use within CBRFC models

ET base data

Develop a set of eddy flux sensors throughout the CBRFC area over varying terrain and vegetation

Broadleaf deciduous

Conifer

Tundra - above tree line

Steppe - plains , shrubs



Important Research - CBRFC Perspective

Seasonal Forecasts evaluation

Preliminary examination of CPC seasonal forecasts 1995-2005 above Lake Powell indicate little if any skill

There is some skill below Powell in Arizona and New Mexico

Are there other seasonal forecasts that might be considered?

If skill did exist, what is significant skill?



Important Research - CBRFC Perspective

National Water Model results are poor

How can the CBRFC and partners help the National Water Center in improving simulations over the CBRFC area

RTI project example

RDHM in 800m resolution

USU - UEB project example

Energy balanced snow model at 800 meter resolution

Develop years of calibrations quality gridded data sets for energy balance models

CBRFC 800m temperature and precipitation 3 hourly sets from 1988-2015

The need for additional historical data sets for energy balance models

Solar radiation

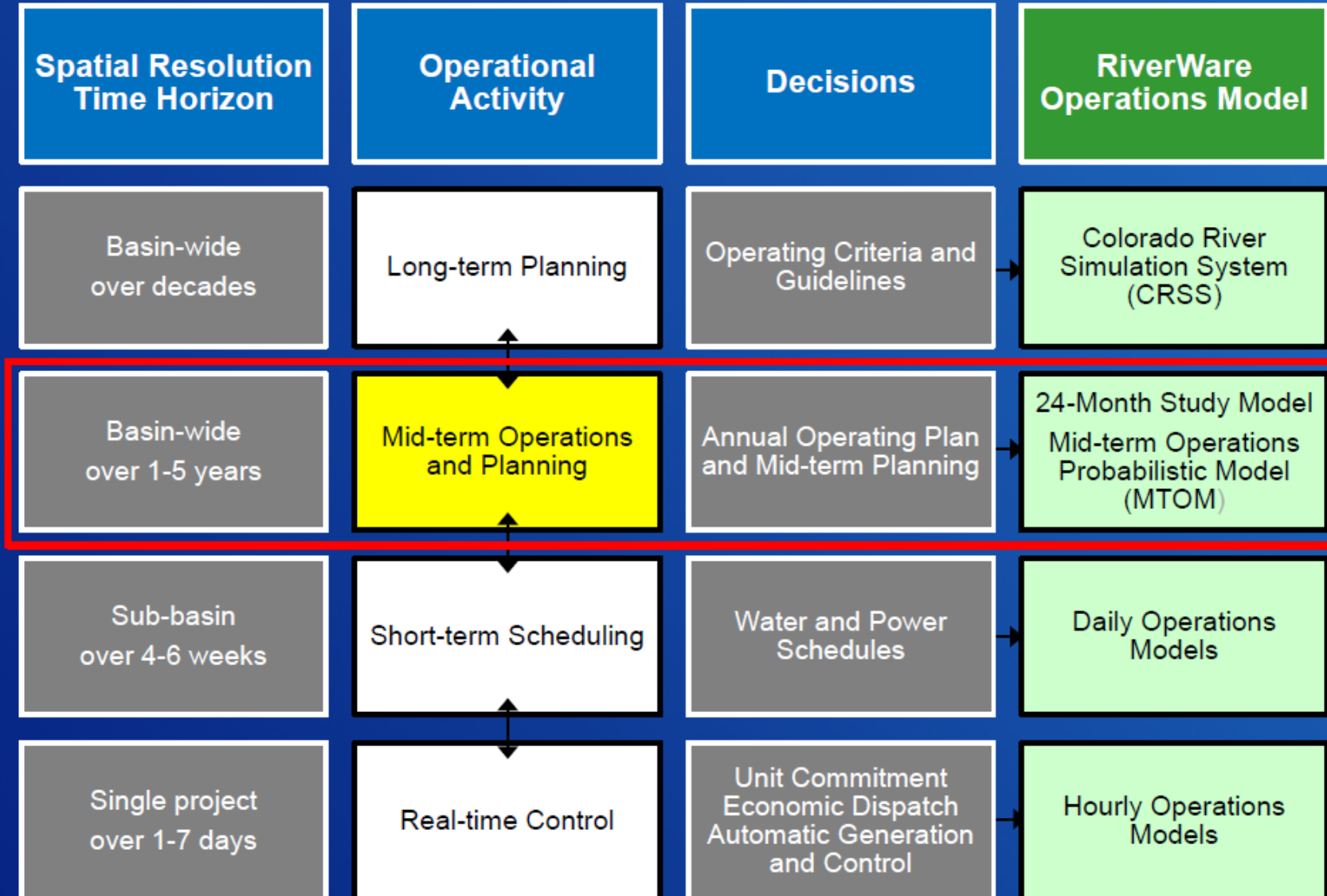
Wind

Humidity

Terrestrial radiation



Operational Decision-making Hierarchy



Opportunities

Improving Mid-Term Outlooks

	24-MS	MTOM
Simulated Reservoir Operations	• How might we better incorporate adaptive management in our probabilistic modeling? • How can we better capture daily operations on a monthly timestep?	
Upper Basin Inflow	• What product(s) might be appropriate for Upper Basin hydrology assumptions in out-years? • Any way to forecast “extreme” events (i.e., June 2015 inflow into Powell)	
Lower Basin Inflow	• Lower Basin hydrology assumption products for a monthly timestep?	
Water Demands	• Can we do a better job of modeling variability in water demands in both Upper and Lower basins?	
General	• What is driving differences in mid-term projections in MTOM and CRSS? Which is better for mid-term outlooks? Why?	



SOUTHERN NEVADA WATER AUTHORITY