Applied climate change and sustainability: groundwater recharge and chromium VI remediation near Hinkley, California

By: John A. Izbicki

Mojave River near Lenwood, Calif., January 1993

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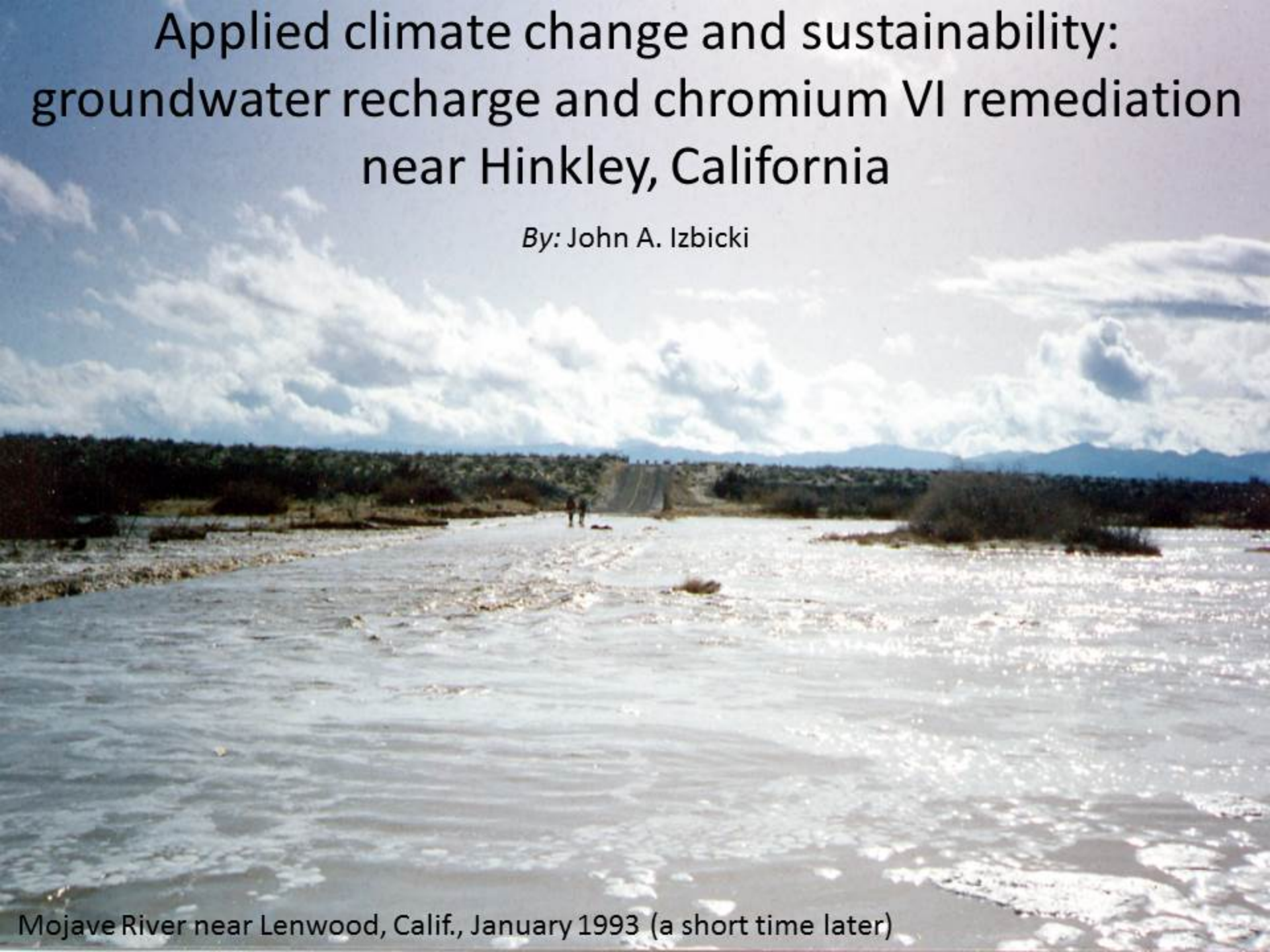
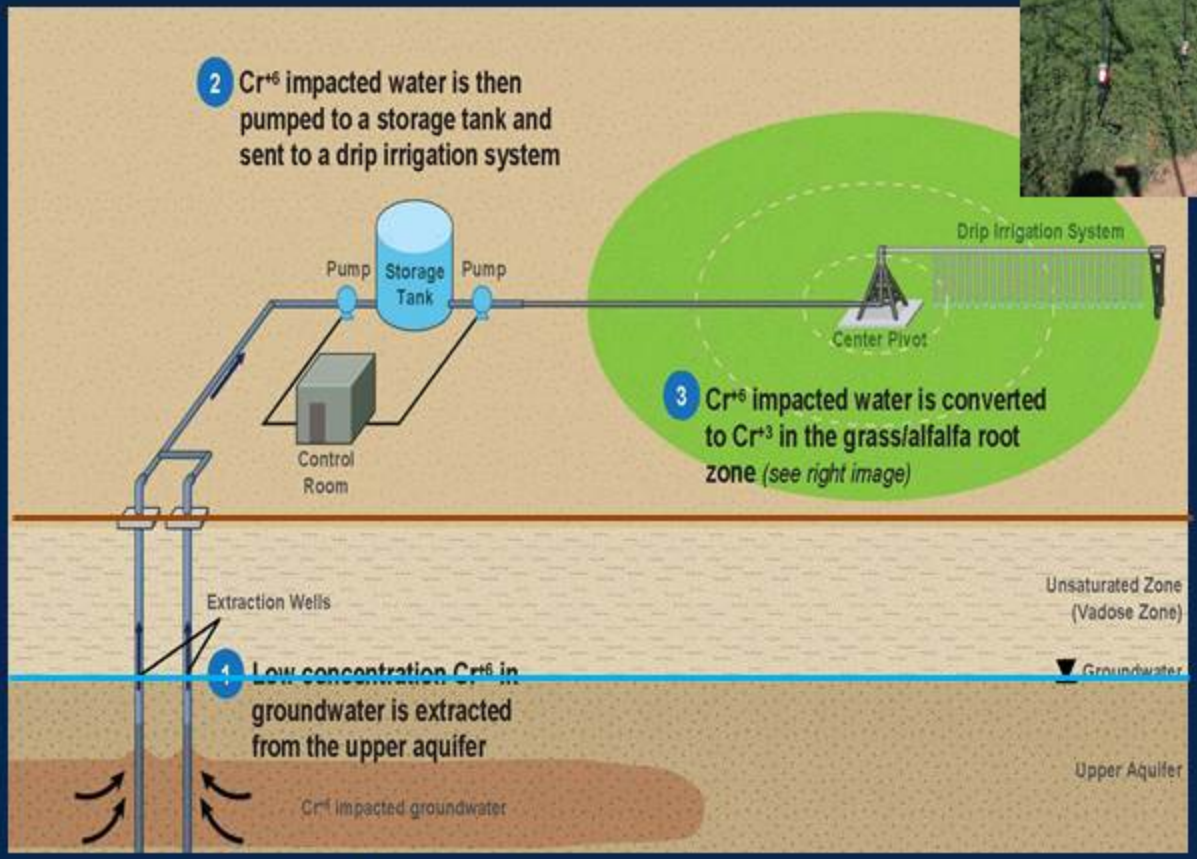


Mojave River near Lenwood, Calif., January 1993 (a short time later)

Sustainability of agricultural land treatment to remove Cr VI

Reduction of Cr VI to Cr III in agricultural treatment units



(Modified from Project Navigator, Inc.)

Proposed agricultural treatment units

(Modified from PG&E)

Groundwater pumping required for agricultural treatment units and reduction of Cr VI to Cr III

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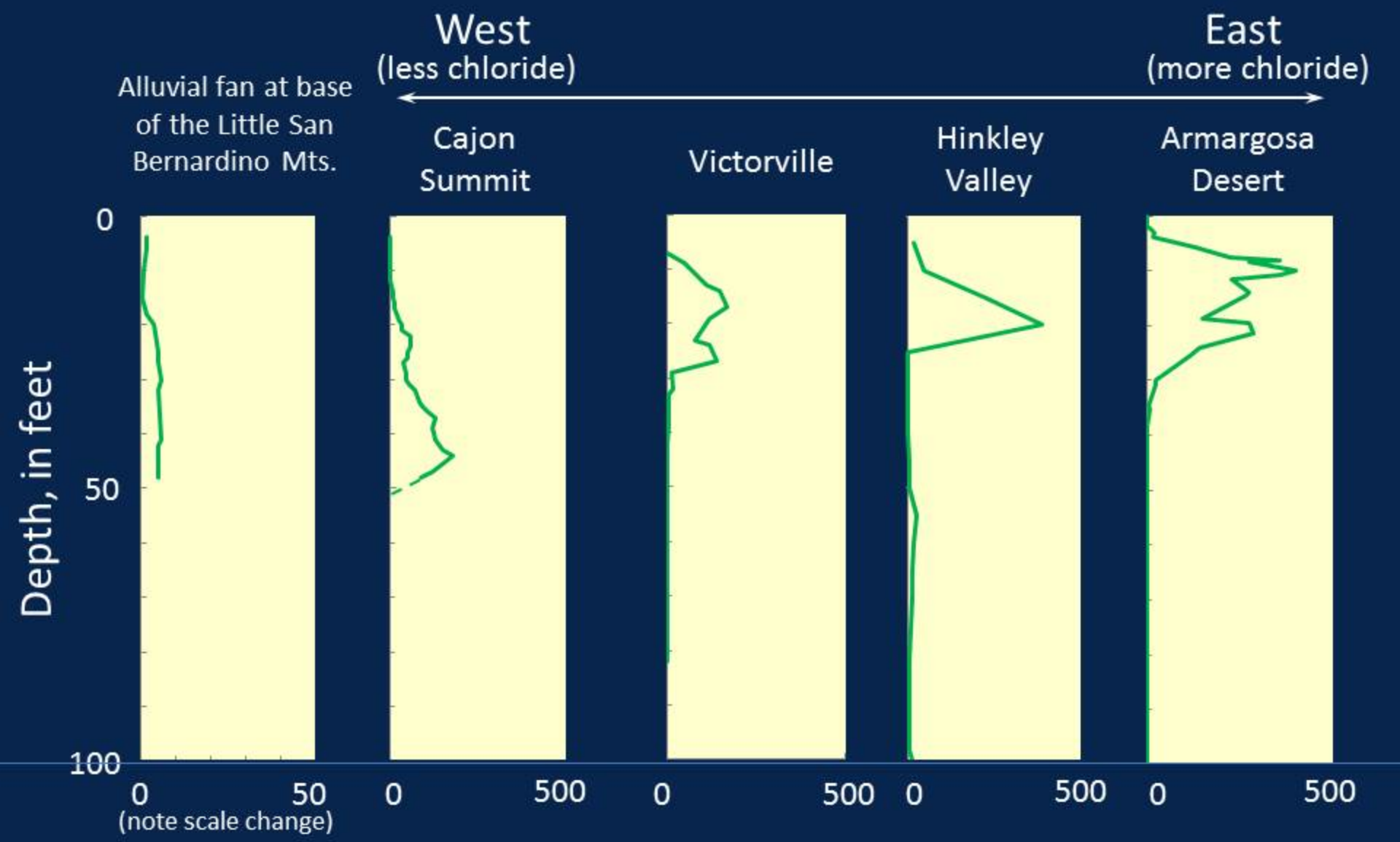
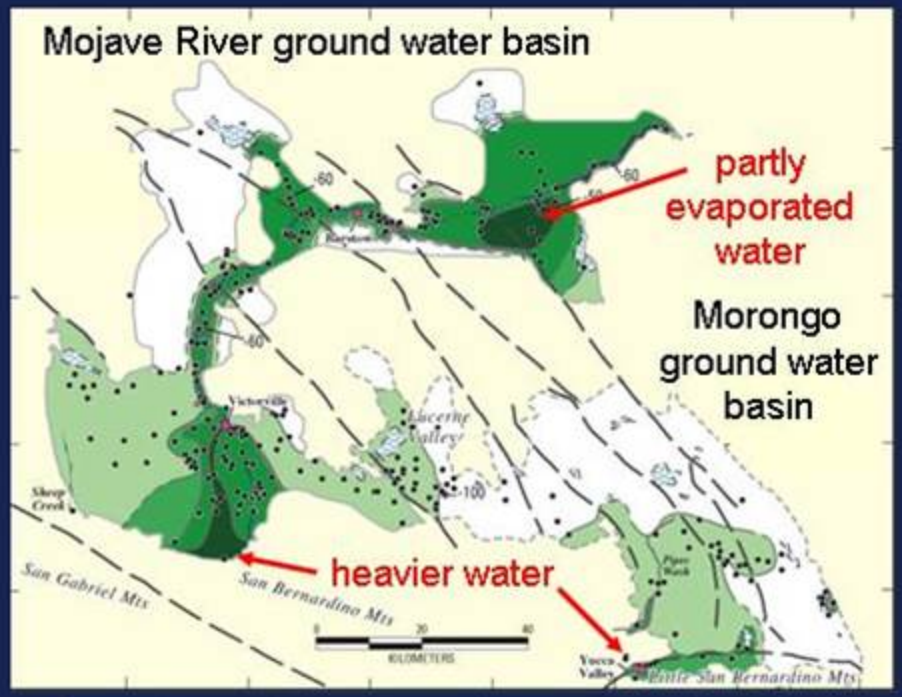
Changing climate in the Mojave Desert in recent geologic time



(Data from various sources)

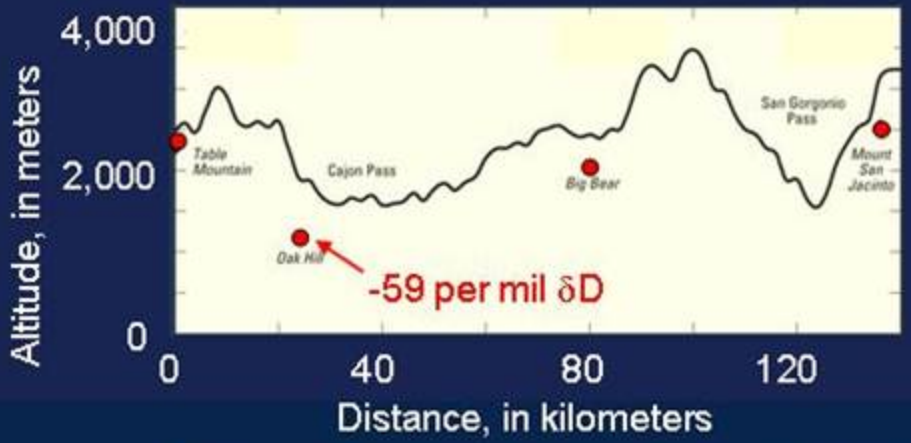
delta Deuterium composition of water from wells



delta Deuterium, in per mil

- > -60
- -60 to -70
- -70 to -80
- -80 to -90
- < -90

- Isotopically heavier precipitation, condensed at lower altitudes and warmer temperature near Cajon Pass, gives rise to surface flow in the Mojave River
- Similar processes give rise to recharge in the southern part of the study area near San Gorgornio Pass
- Isotopically heavy water west of the Mojave River recharged as infiltration from intermittent streams near Cajon Pass



Projected topography along the San Gabriel, San Bernardino, and San Gabriel Mountains

(From Izbicki and others, 2004)

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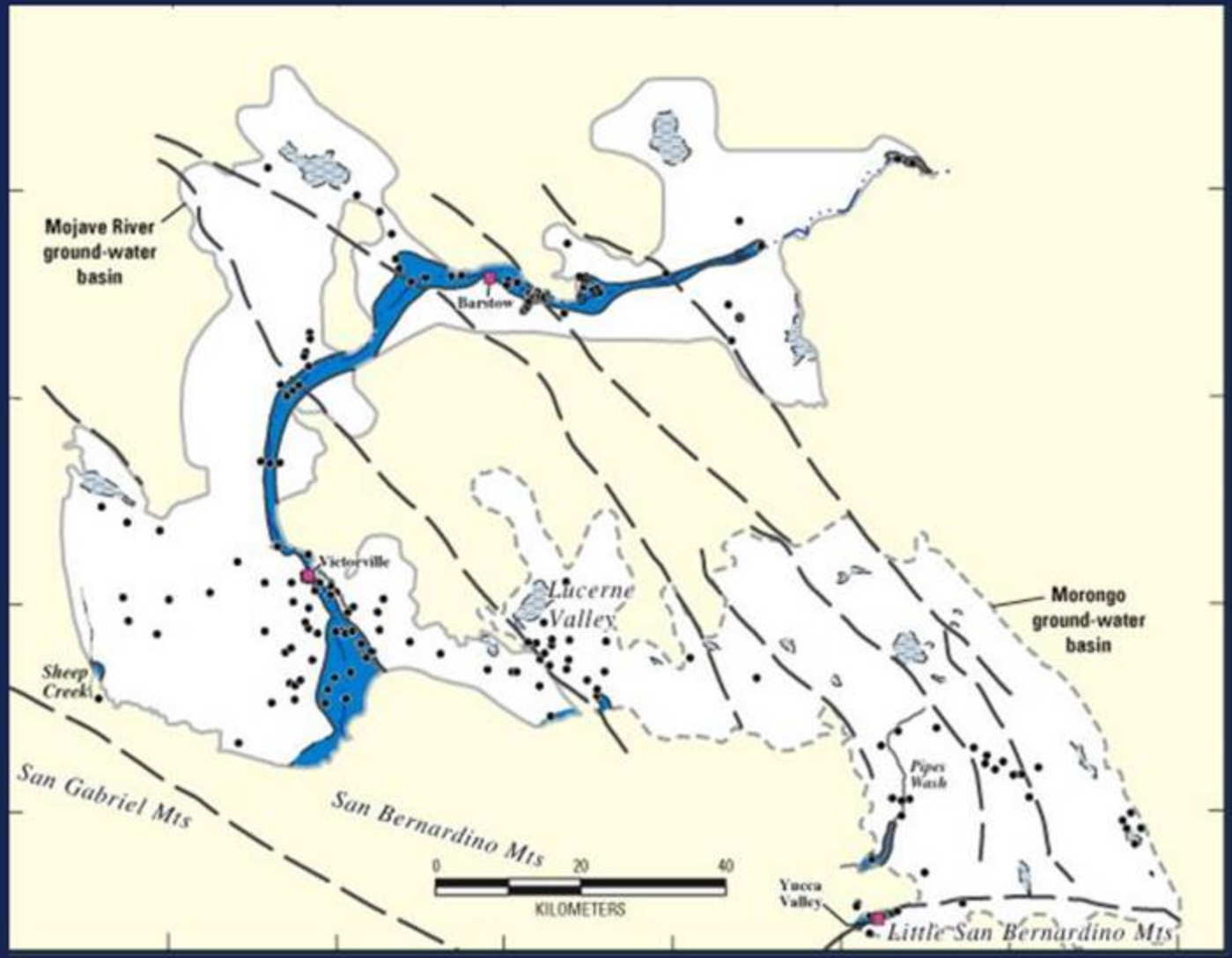
Tritium in water from wells



Tritium,
in tritium units

> 0.2

< 0.2

(From Izbicki and others, 2004)

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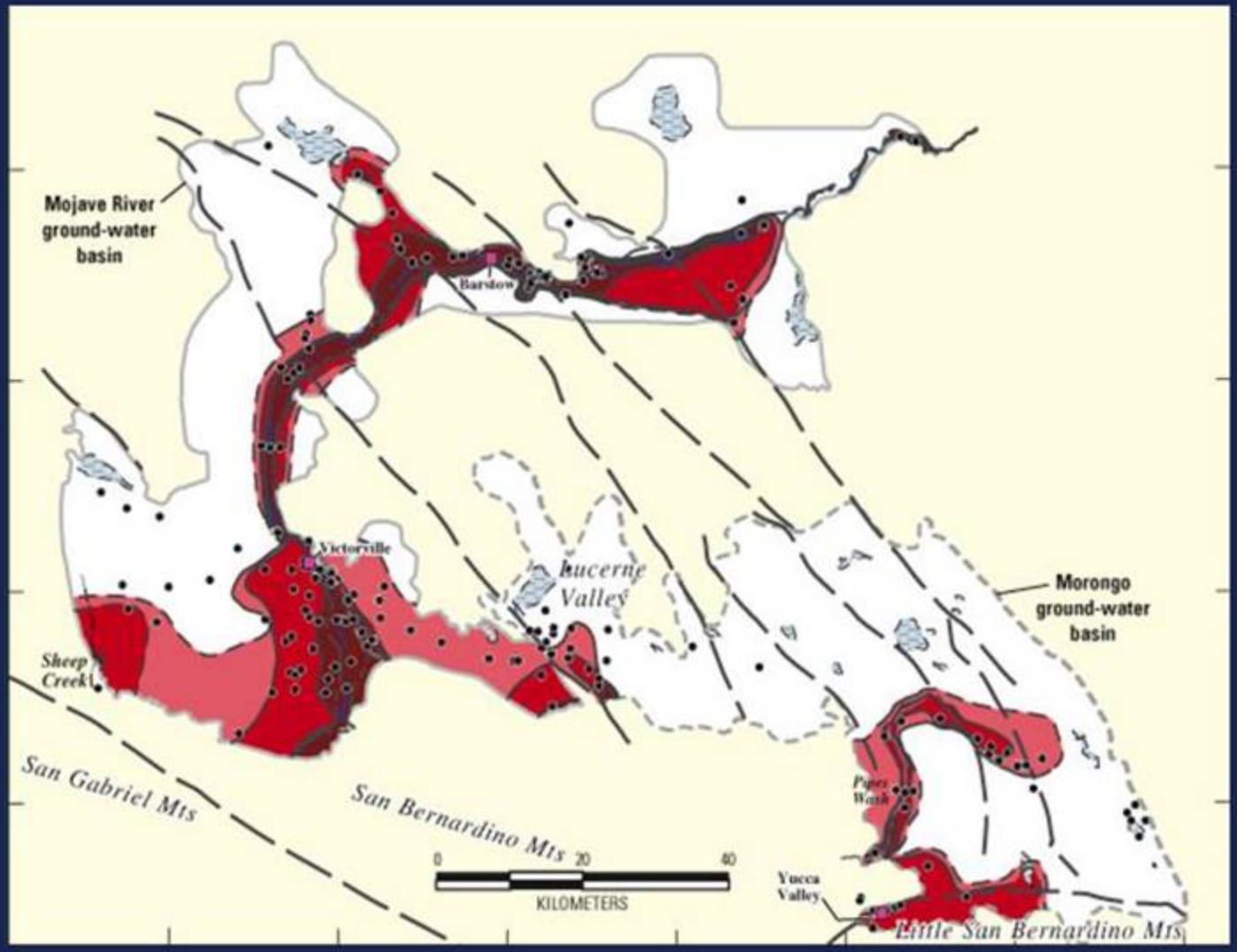
Carbon-14 in water from wells



Carbon-14, in percent modern carbon

- > 90
- 90 to 50
- 50 to 30
- < 30

(From Izbicki and others, 2004)

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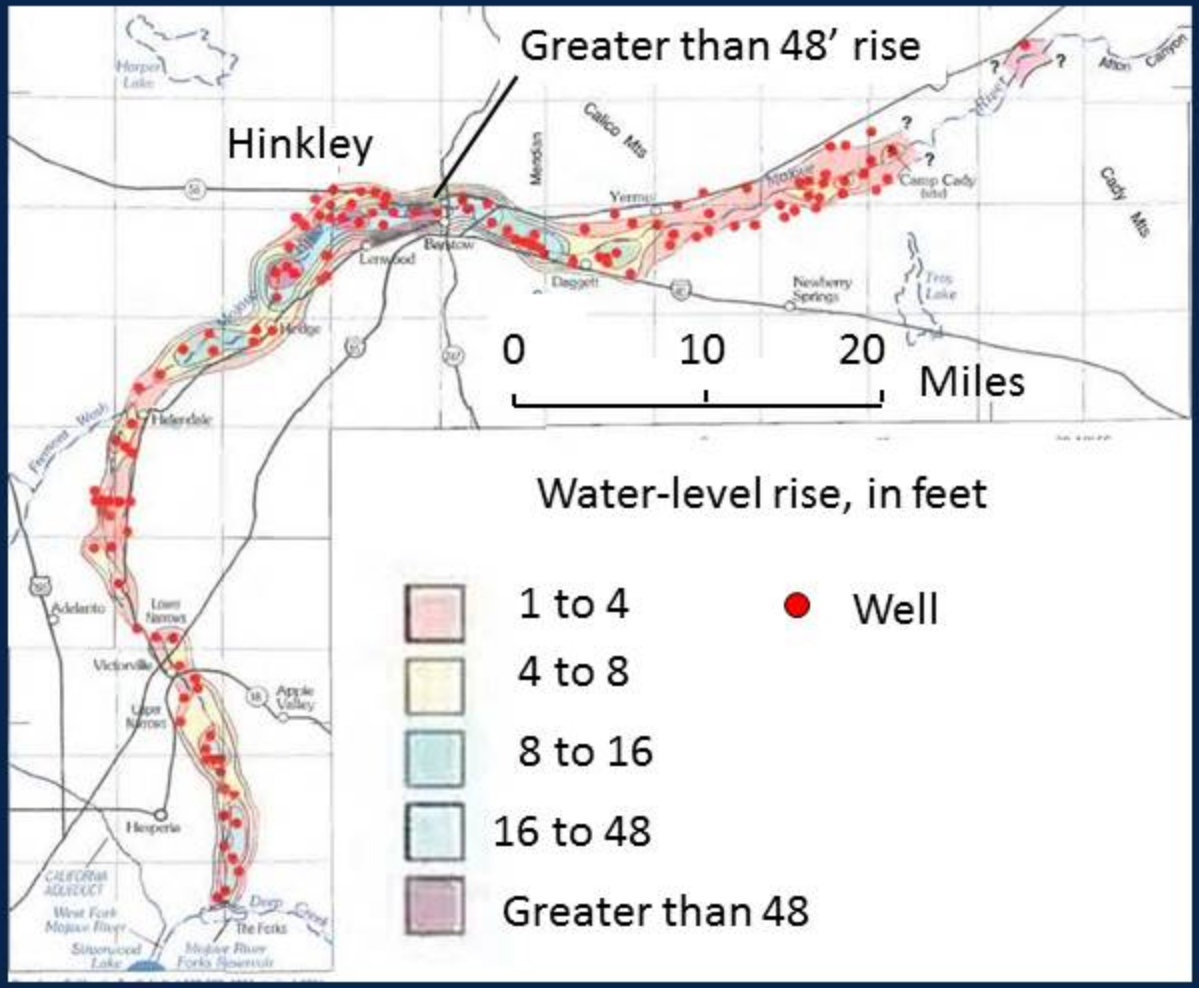
Water-level rise along the Mojave River November 1992 to March 1993



(From Lines, 1996)

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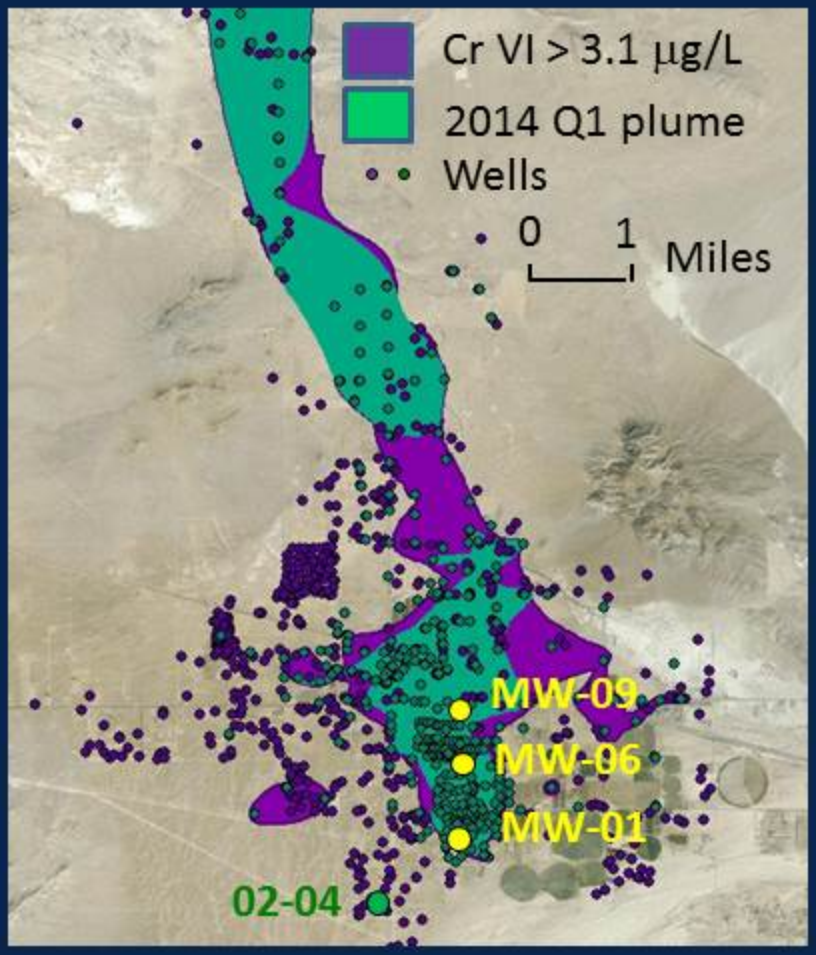
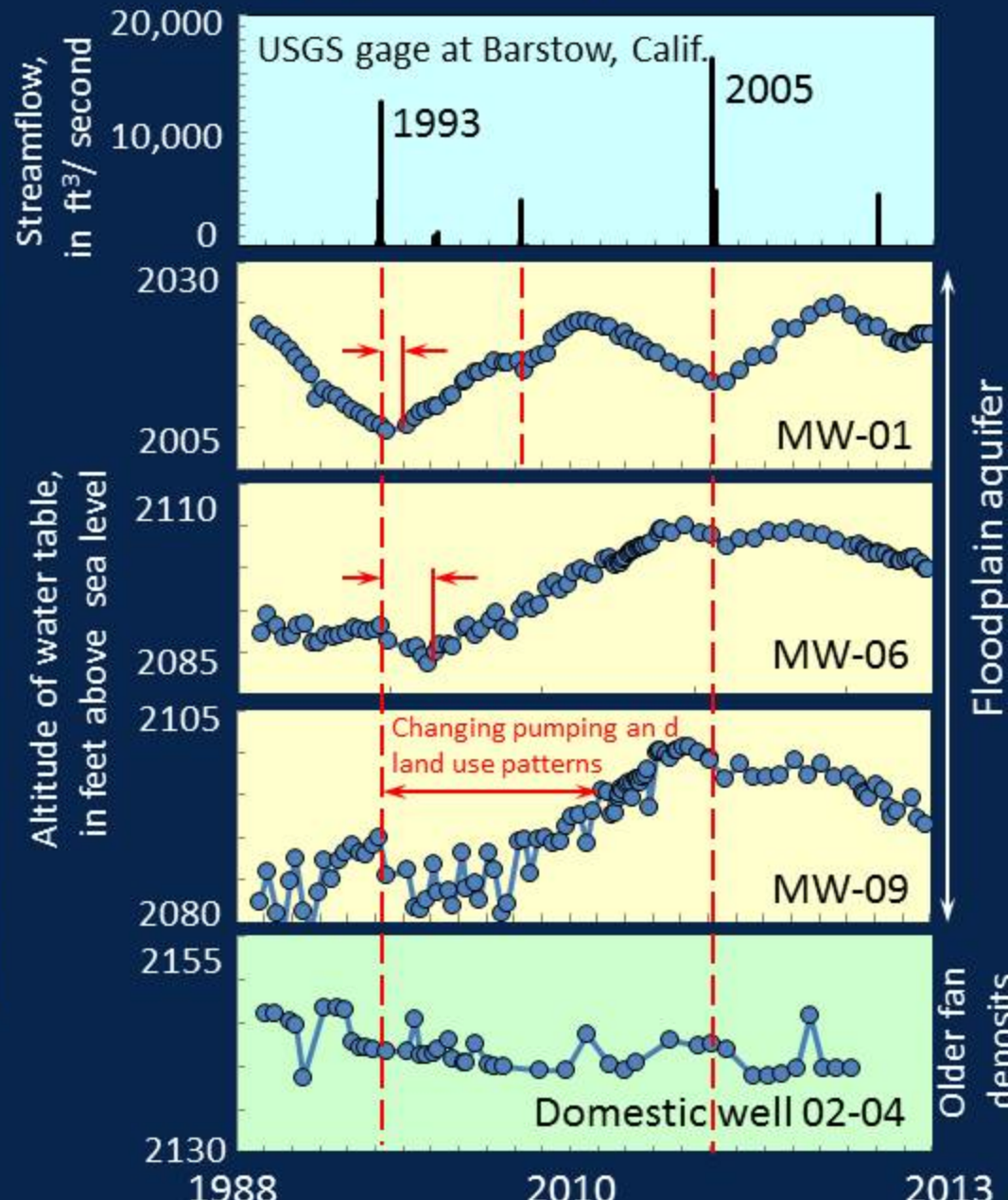
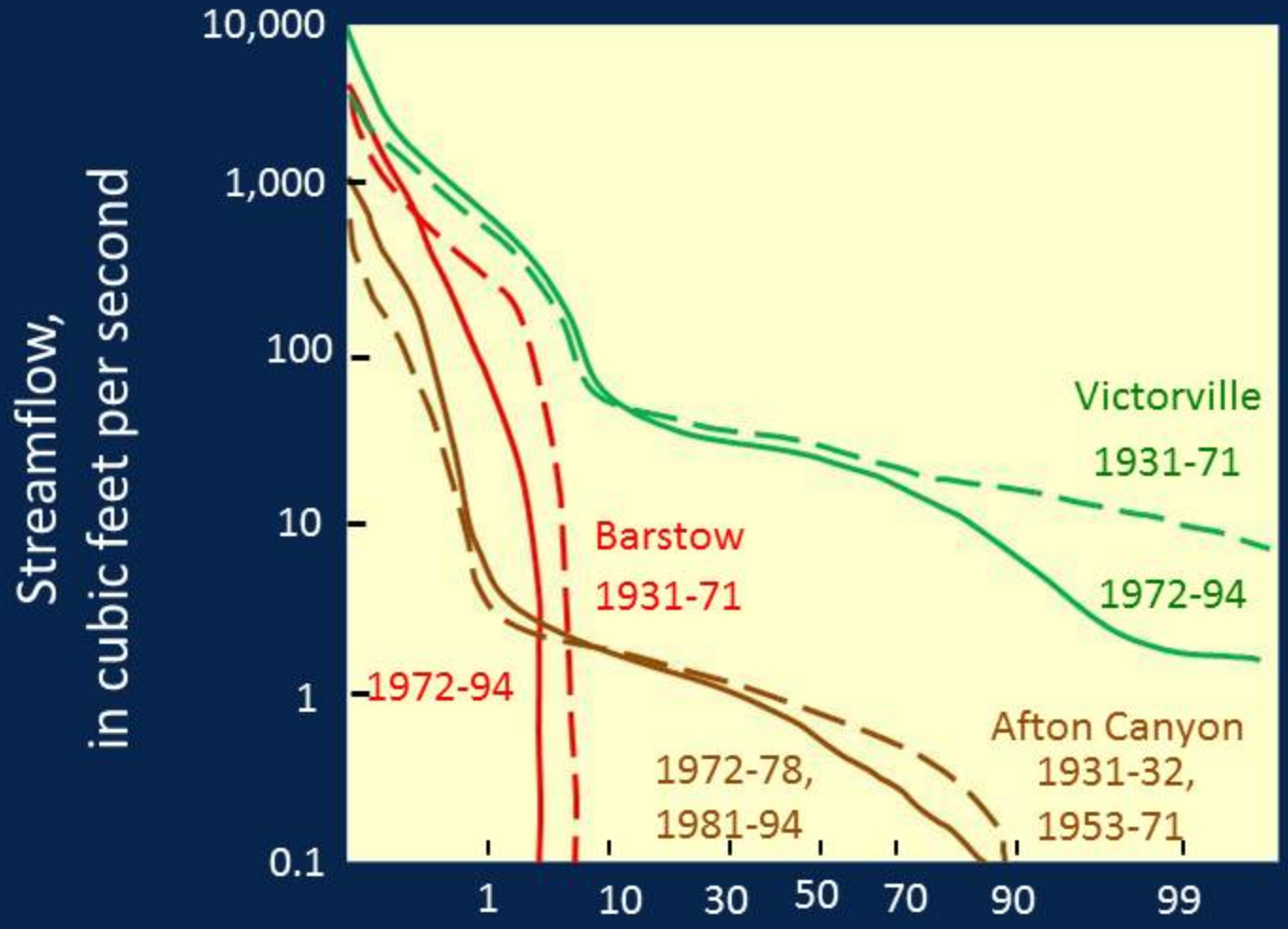
Water-level response to recharge, Hinkley Calif.



Mapped extent of Cr VI, near Hinkley, Calif.
(Data from PG&E)



Streamflow duration in the Mojave River at Victorville, Barstow, and Afton Canyon, 1931-1994



Large streamflows in Mojave River at Barstow occur infrequently

Mojave River at Barstow is normally dry

(From Lines, 1996)

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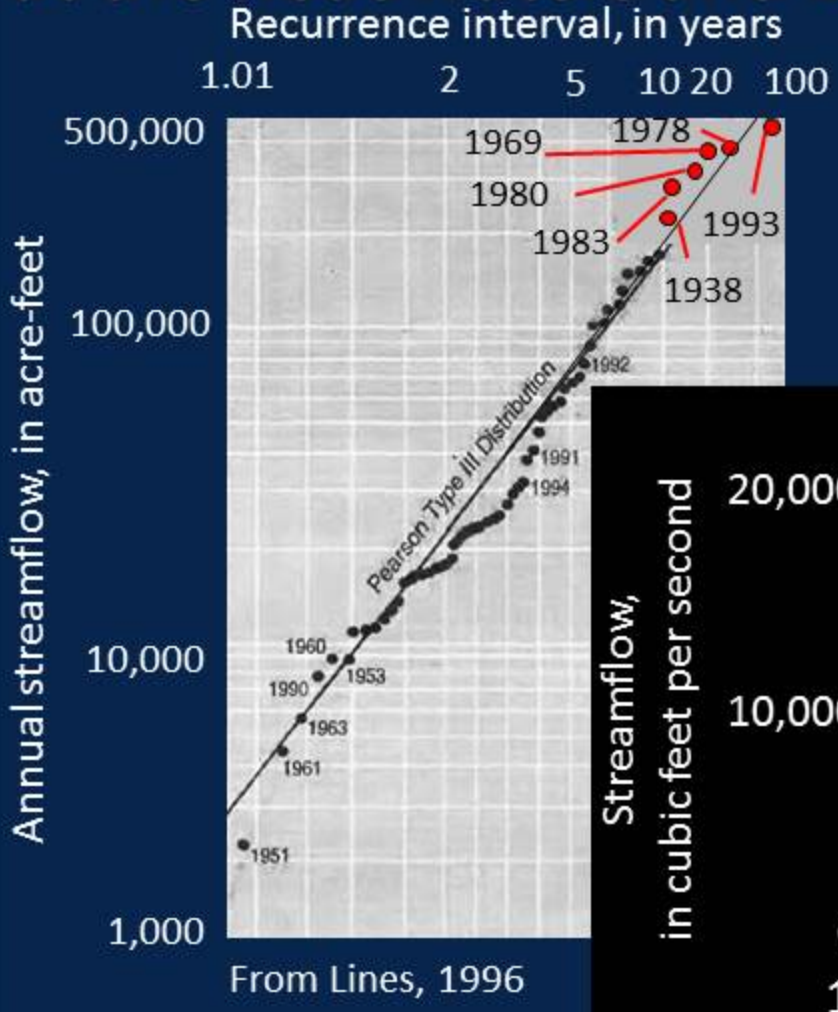
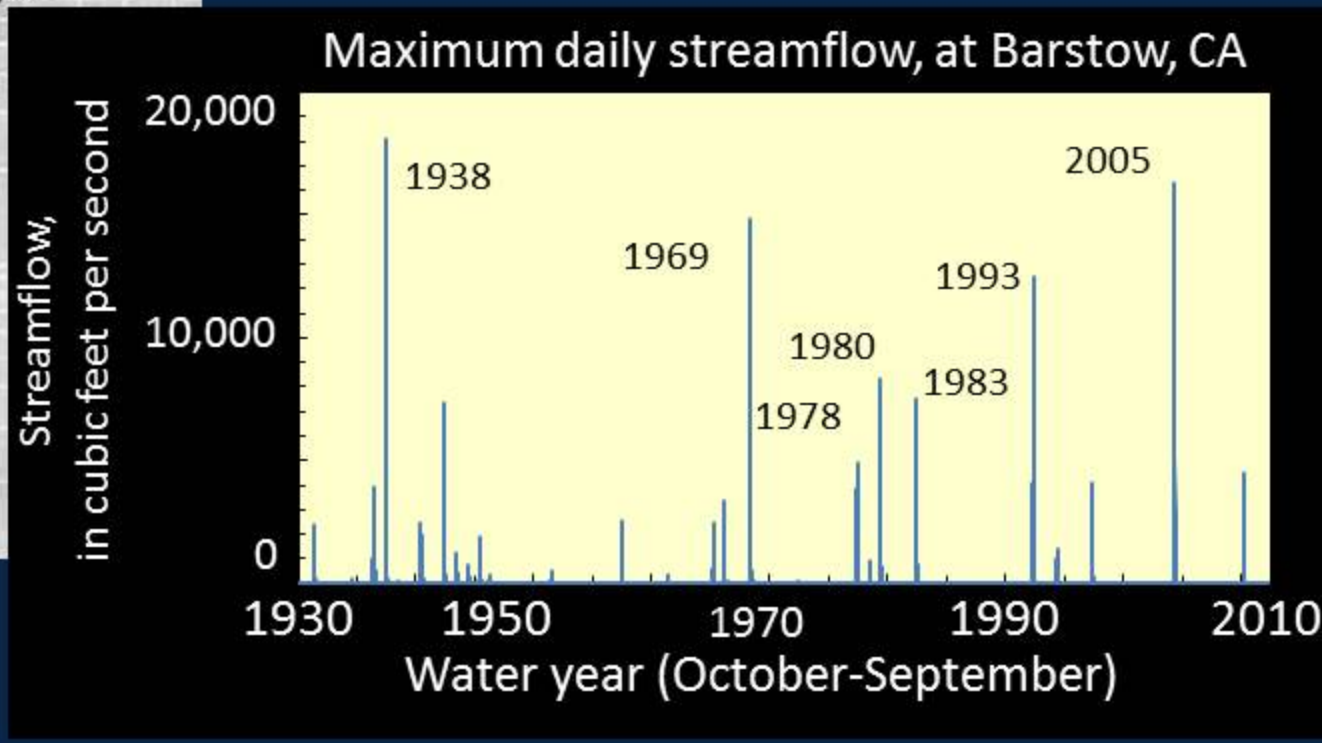
Streamflow recurrence in the Mojave River at the headwaters and Barstow, Calif.



From Lines, 1996

Recurrence interval for total annual flow in the Mojave River at headwaters



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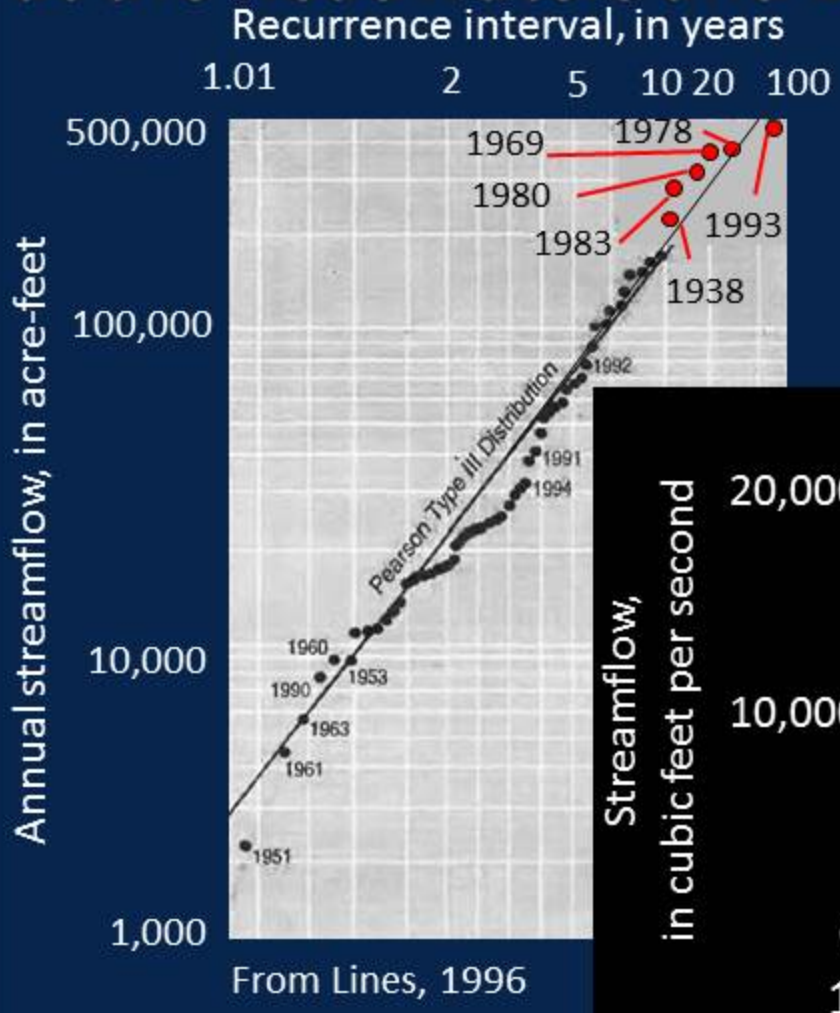

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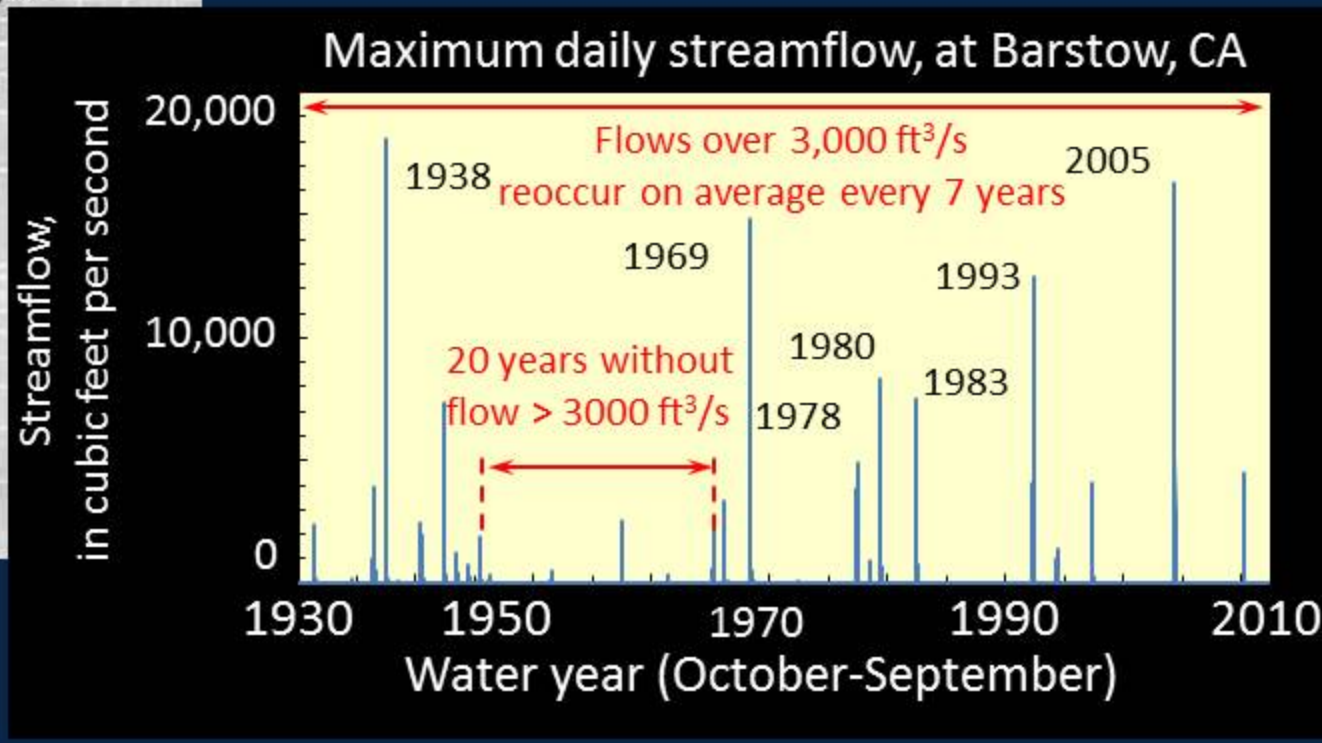

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Conclusions

Mojave River at Barstow, January 18, 1993. Flow is about 4,200 cubic feet per second (From Lines, 1996)

- Climate in the Mojave Desert has been changing for millennia
- Uncertainty as to the long-term changes in climate on Groundwater recharge from the Mojave River—generally drier climate versus larger and more frequent extreme events
- Other man-made influences have already created measurable impacts on groundwater recharge and availability
- The existing record (1931 to present) shows streamflows greater than 3000 ft^3/s and subsequent large-scale recharge occurs on average every 7 years, but that extended periods of up to 20 years can occur without significant flow and recharge from the Mojave River

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