~~How~~ Should IWR be Determined?

- For Canal Design? Yes
- For Water Operations by Owners? Yes
- For Basin Accounting by Planners? Yes
- For Court Decree? ? ?

1.How get decreed “amount of use”?

A) climate data times empirical factor gives CIR.

B) CIR times another handbook factor gives IWR.

Trouble is: factors vary 10x

2. How get balanced transfer amount?

Not decree of CIR.

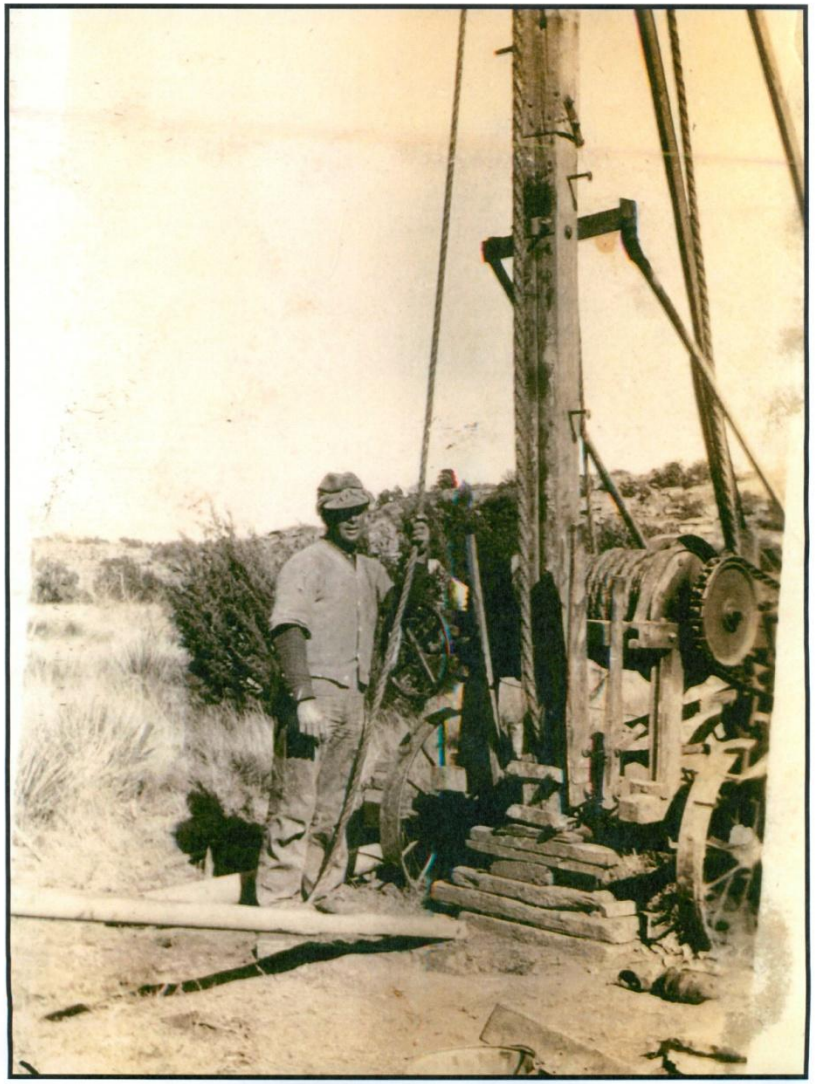
Trouble is: continued losses at move-from site.

3. How can decree aid conservation?

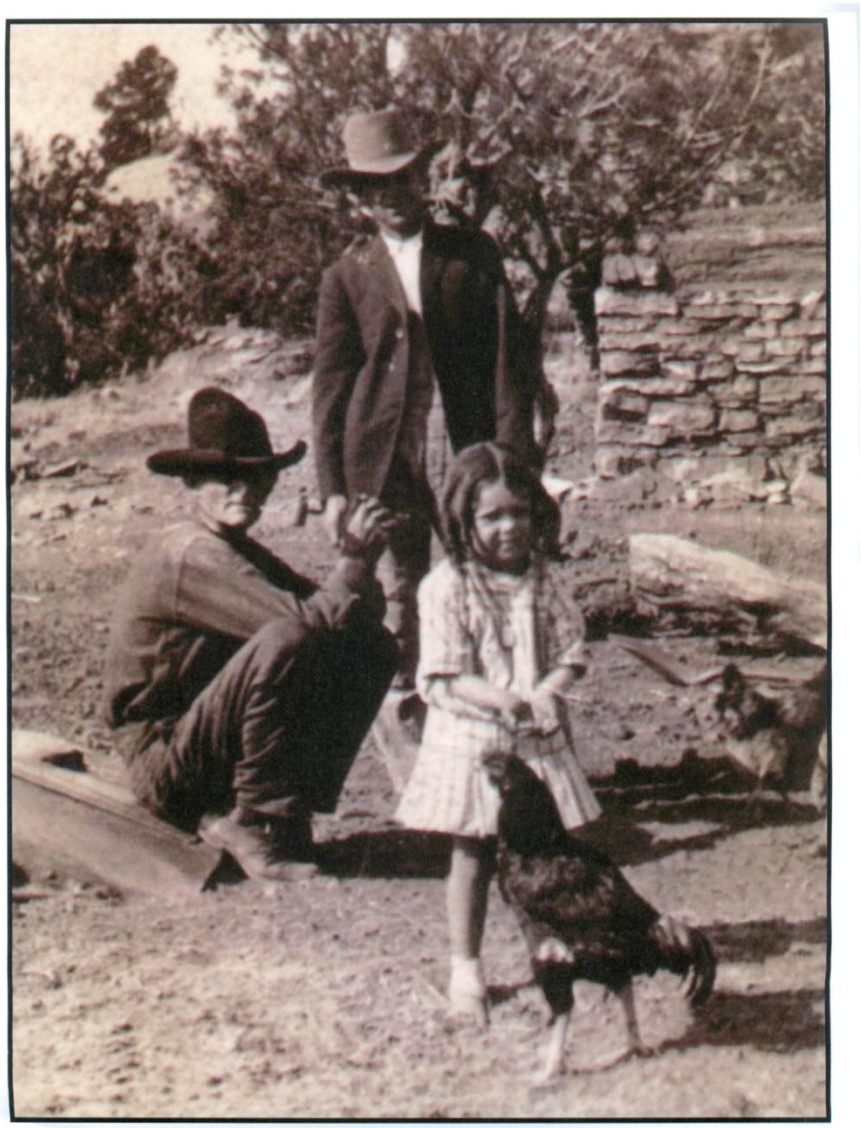
Not in water-short basins under priority.

Trouble is: constraining senior rights expands junior uses of fixed divertible supply (and increases depletion).

A Good Well of Water
Guadalupe Co, NM 1916



NM Garden and Livestock water users 1916



Same water user in 2011 asks:

Why no priority enforcement for 100 years?

Can’t you figure out the basis, measure and limit of a water right?

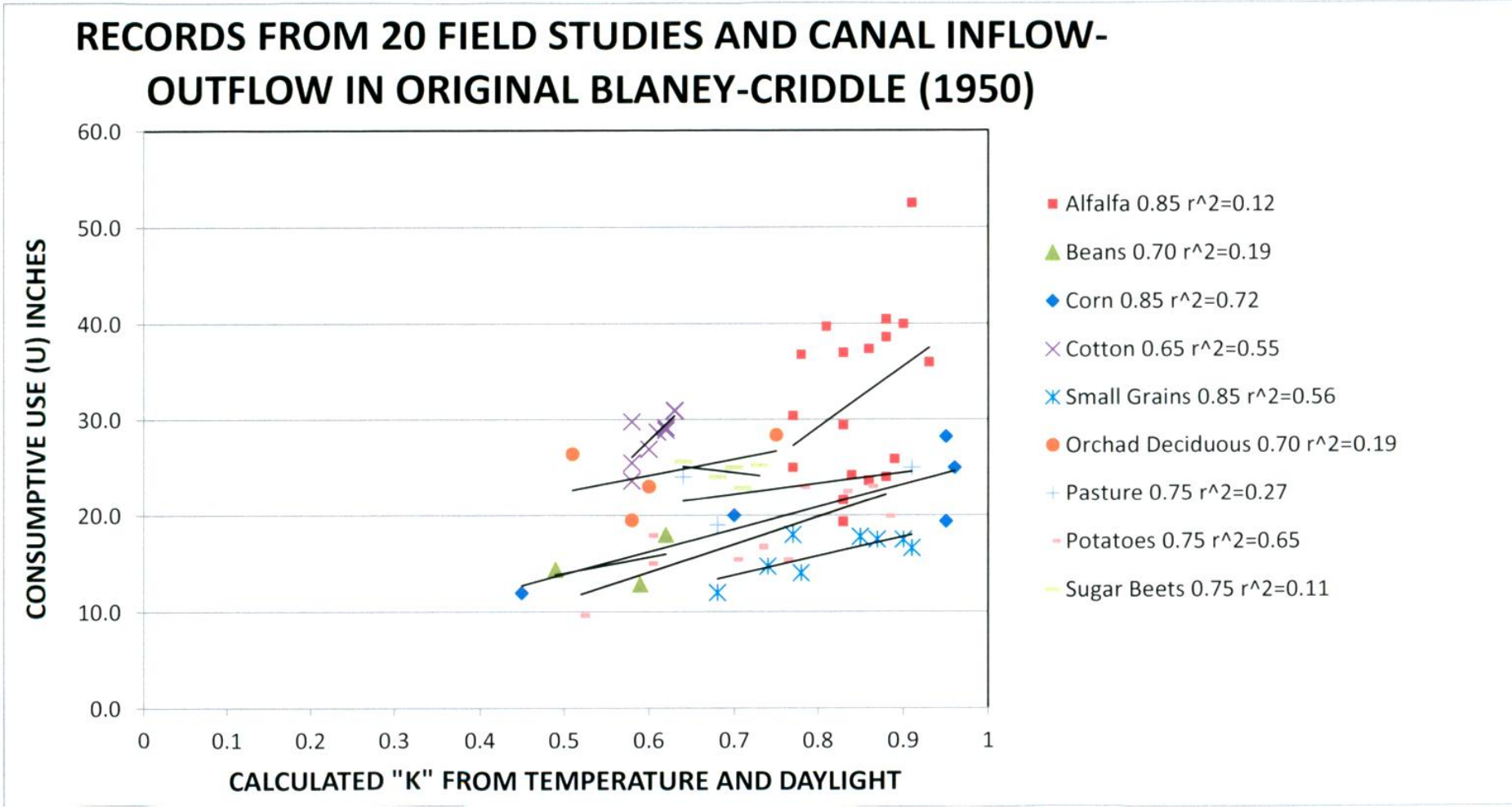
CIR Methods

- Empirical – “BC”, (temp, daylight hours and handbook factor Kc)
- Physical Theory – “Penman”, (governing energy and atmospheric equations with Kc)
- Measured – “Lysimeters”, (weight of water loss in soil, to 1% accuracy)
- Remote-Sensing – Imagery, “(temp, microwave reflectance, LANDSAT ¼ acre pixel area x signal intensity, can give relative strength or be calibrated to mm/day)

(All rely on CIR converted to IWR assuming uncertain efficiencies of farm operations)

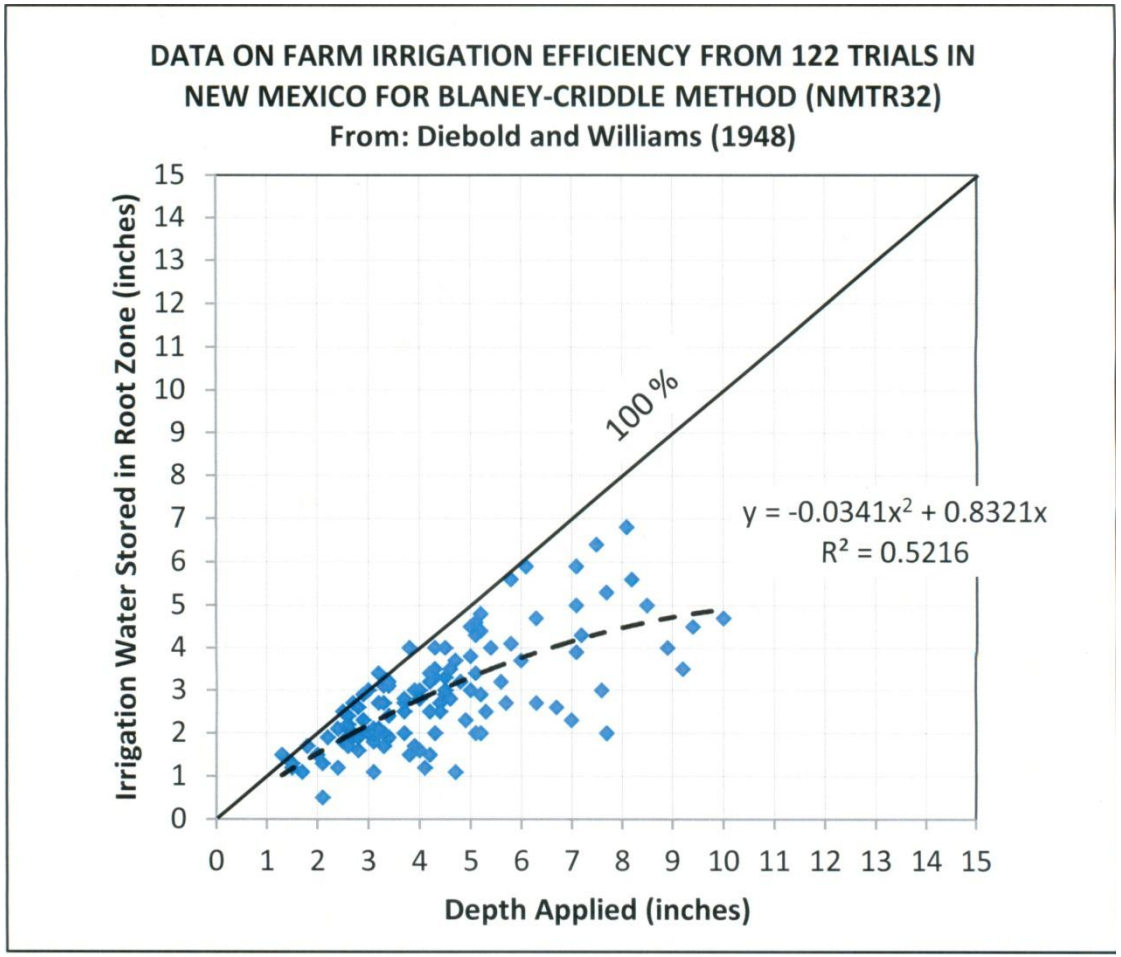
BC scatter in CU data vs Kc

(temp and daylight explain small part of variation, information is lost in averaging)



BC scatter in on-farm efficiency

(>90% at deficit irrig,<50% at high applic.)



Lysimeter Noisy Pattern of ET, measured accurately
(Wright and Jensen, 1978)

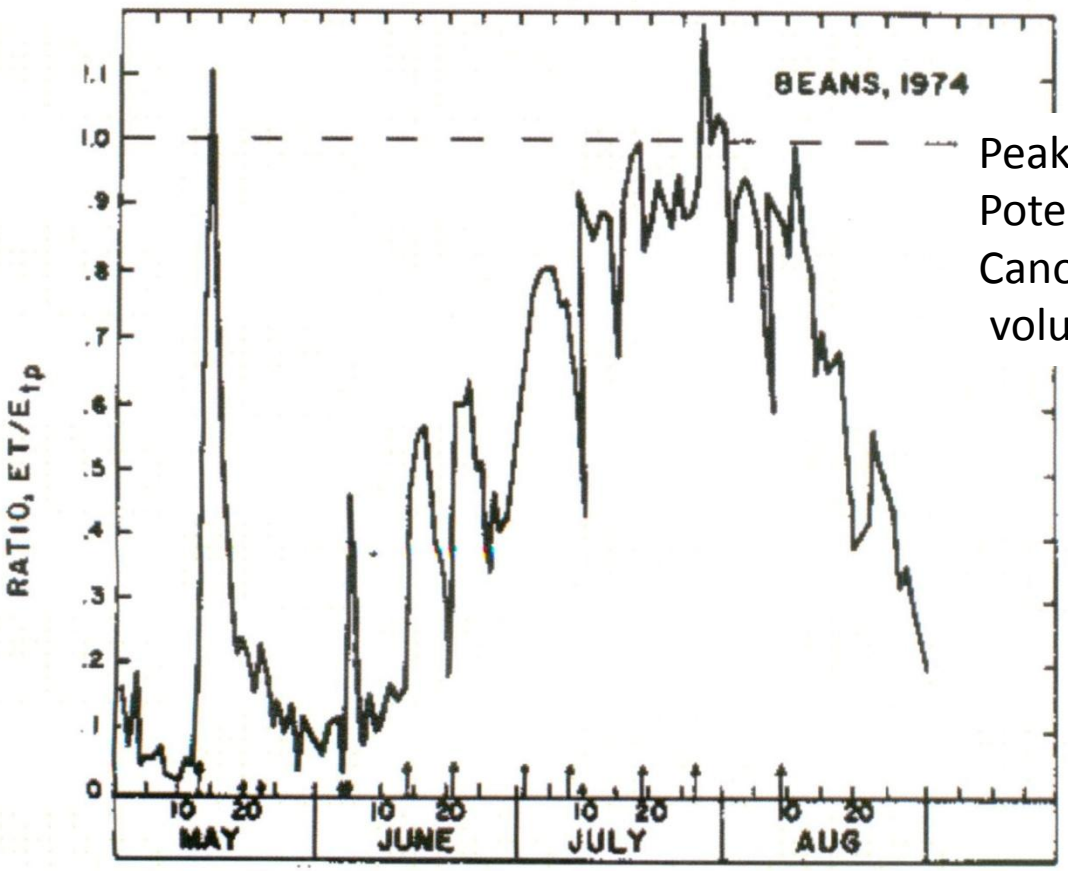


FIG. 2 Lysimeter-measured ET for furrow-irrigated snap beans raised for seed as a fraction of estimated potential ET [E_{tp}], with irrigations [large arrows] and rains [small arrows] as shown, Kimberly, ID.

Peak CU is near Potential for many crops. Canopy height and volume density is sensitive.

Penman formula vs accurate lysimeter measurement (Wright and Jensen, 1978)

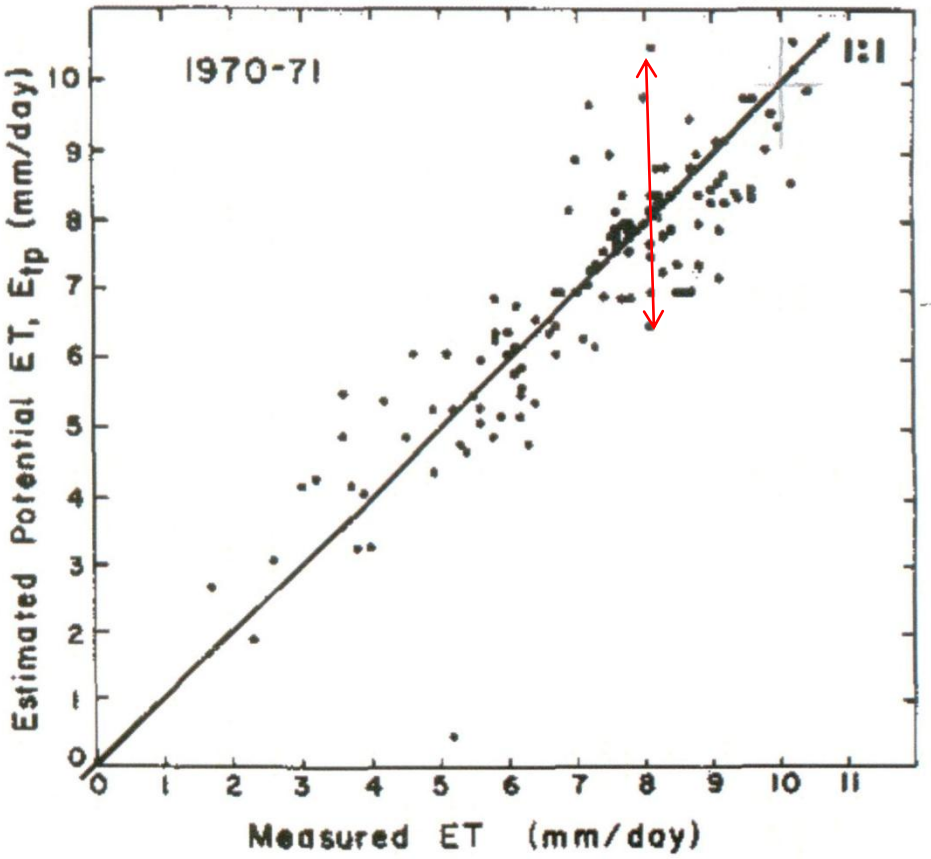
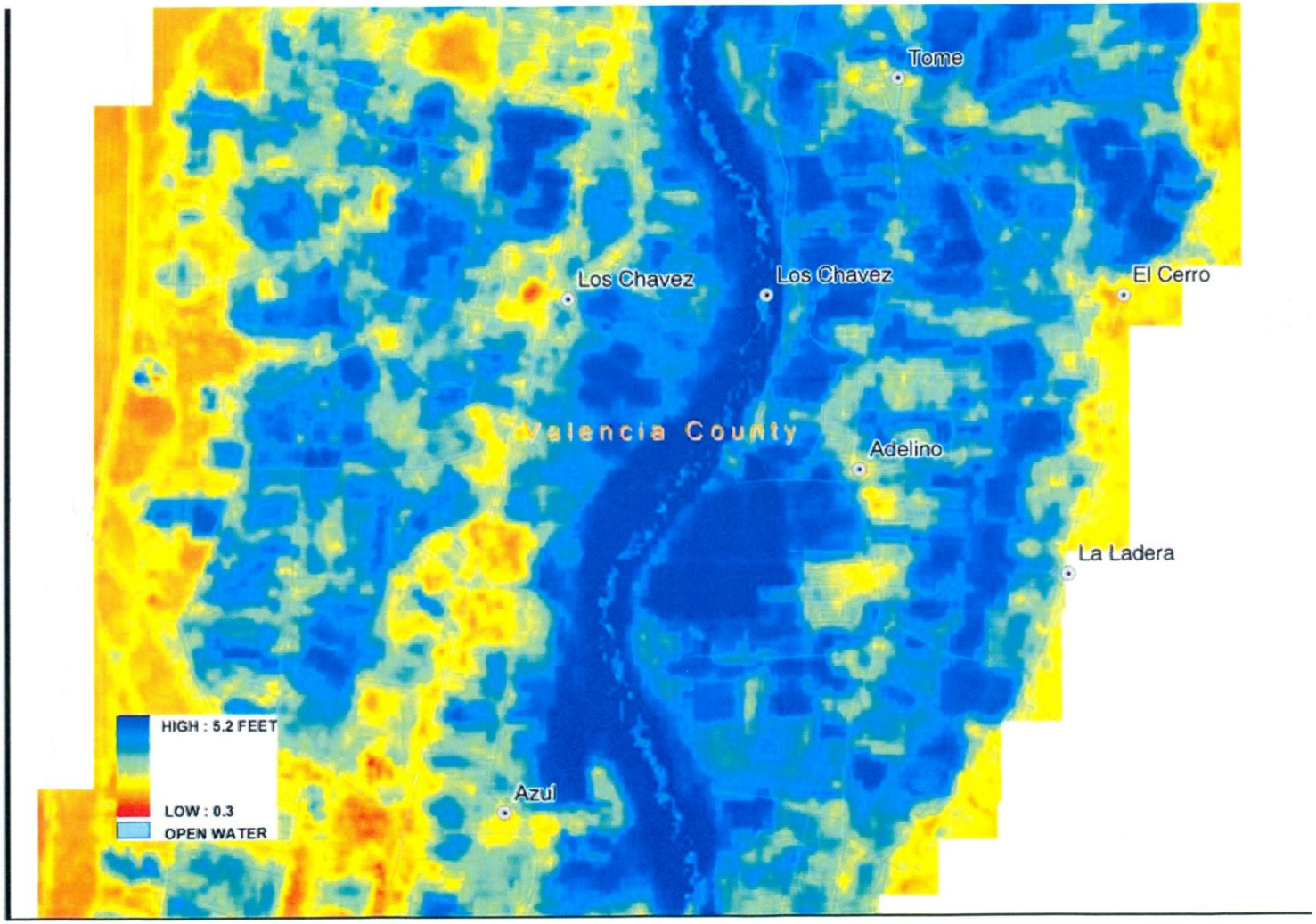


FIG. 1 Estimated potential daily ET [E_{tp}] calculated with equation 1, which is a modified Penman equation [Wright and Jensen, 1972], compared with ET measured with a weighing lysimeter for a well-watered crop of alfalfa with full cover at Kimberly, ID.

LANDSAT Tract Variation of CU in Valencia Co., NM (Bosque most intense)



Surface Energy Balance

Irrigation budget, average of 17 western states

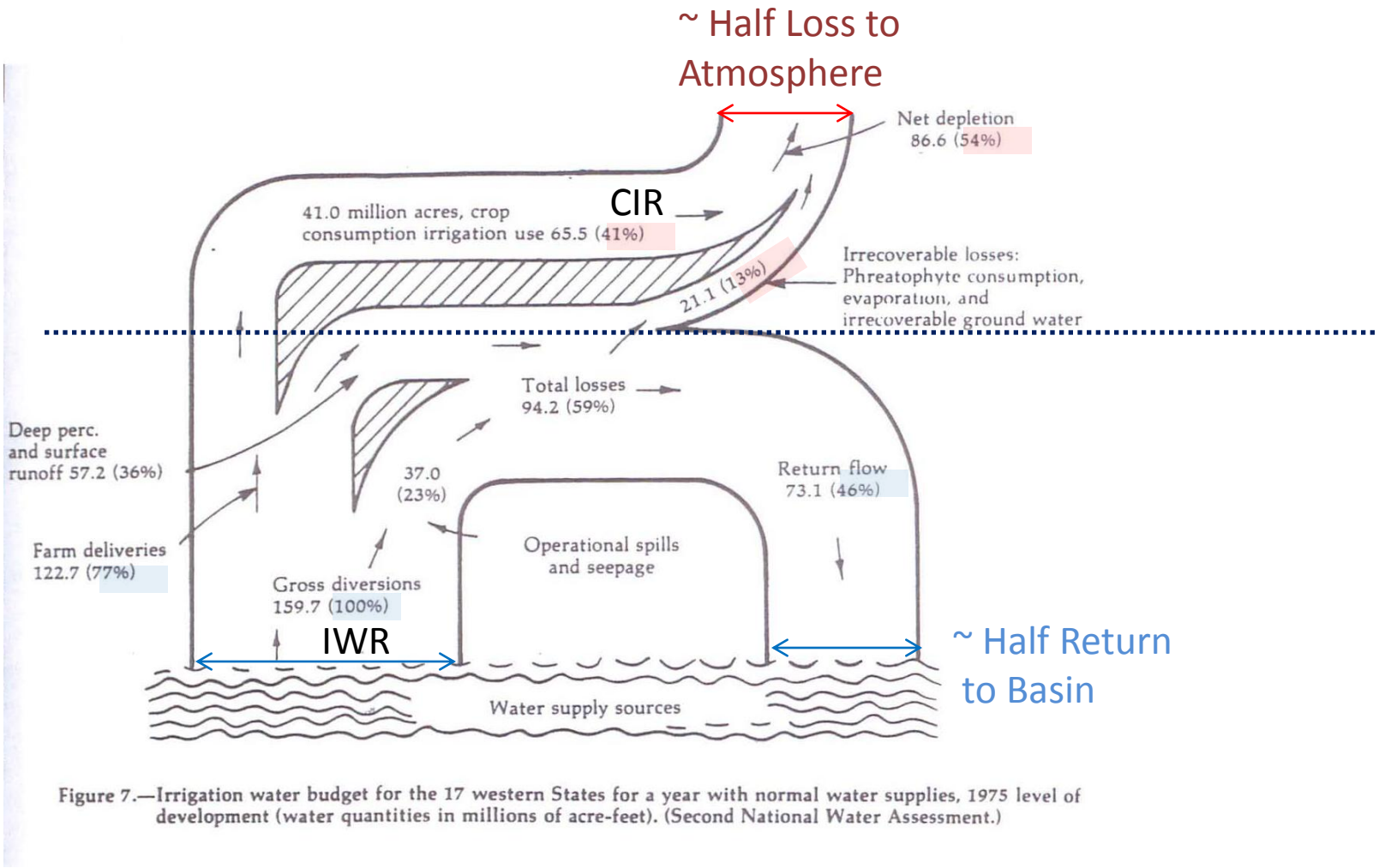
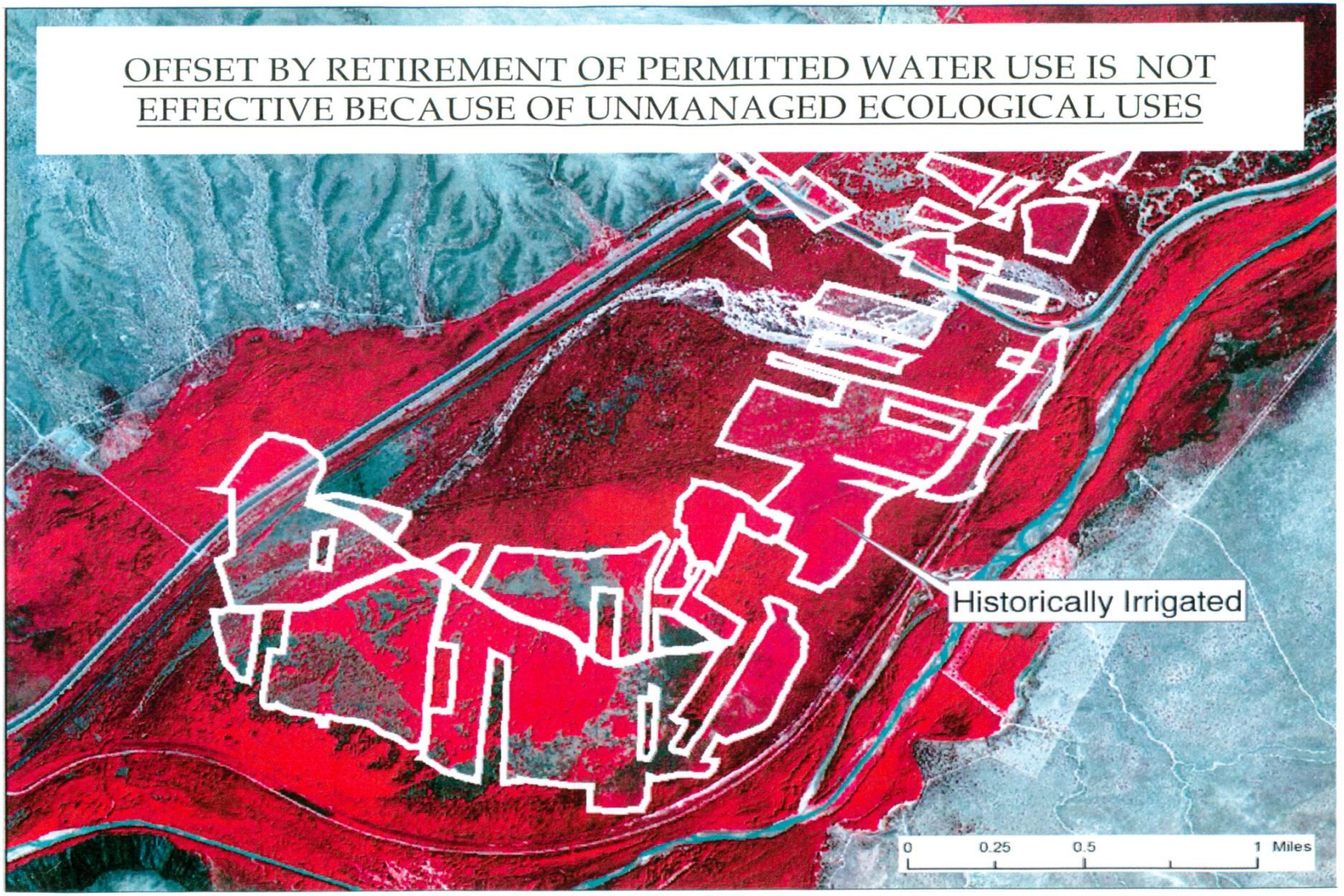


Figure 7.—Irrigation water budget for the 17 western States for a year with normal water supplies, 1975 level of development (water quantities in millions of acre-feet). (Second National Water Assessment.)

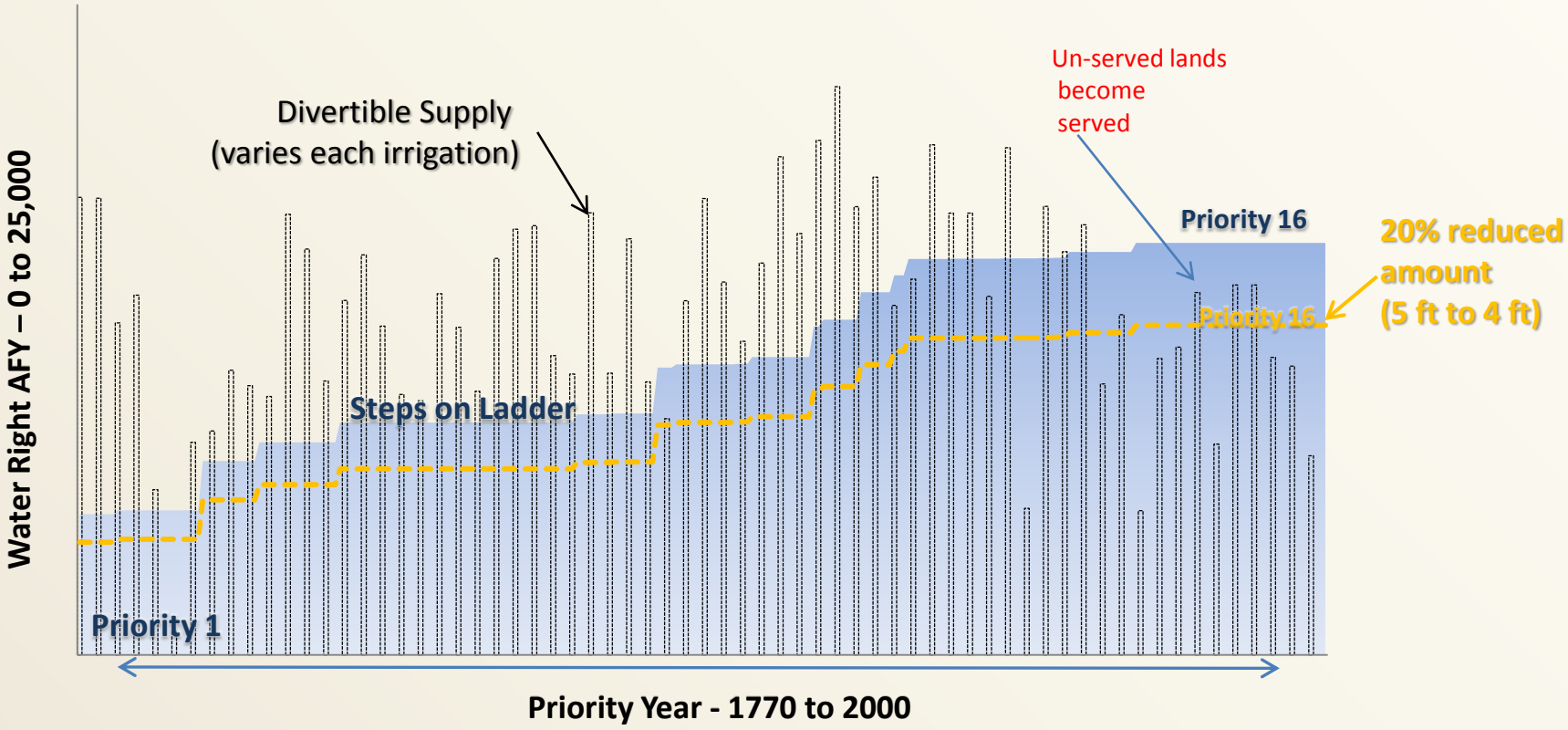
Decree of CIR insufficient for balanced* transfer amount



*Is balance necessary with Compact spills?

Ladder of Priority steps 1-16 and Partial Final Decree of water rights – showing effect of understating decreed amount

Note: Full 5 ft decree amount serves fewer rights, thus depleting less than the more efficient farm alternative 4 ft decree amount which adds service to junior rights with increased acreage, and increased depletion and CIR on additional farms. A conservative decree amount further depletes the water-short basin discharge for downstream obligations.



National Water Commission Final Report (1973)

"Quantifying Use Under Water Rights "

- *"It will be difficult… Uncertainties can be better resolved by promulgation of specific standards… expressed either in ~~a number of acre-feet of water per acre per year or~~ a rate of flow in cubic feet per second (cfs) for a prescribed number of acres."*

- *"The allowable water loss in transmission facilities is commonly calculated as some amount of water per mile of ditch. This method…has been most effective as a part of general adjudications of water rights."*

- Recent News. Lewis case, Gallinas River Section (Order 3-13-2012*) "establish a procedure…for resolving the members' claims for water related to conveyance losses, hydraulic pressure, and the flushing of silt."* A rule-of-thumb for PDR might not be sufficient.

- Note on Irrigation Scheduling: 70 acres per cfs is a peak summer rate suited to NM climate. The peak relationship applies to district-wide acreage units in scheduling rotation water to individual tracts. A minimum of 2 cfs is needed for effective flood irrigation in periodic rotation even on small tracts of a few acres. This complicates stating an amount for a farm vs an amount for a canal or project. PDR is *" a collective quantity…not simply an aggregate of the conveyance losses determined for each member on an individual basis without reference to the collective diversion." (*Order above)

Conclusions

- The largest part of water use is other than crop ET. The prevailing methodology is inadequate to the adjudication task, due to the order of magnitude uncertainty of conditions attached to each water operation.

- The amount of water used in irrigation is indicated better by the verified capacity of the canal or well, alongside the acreage claim of the operator.

- Satellite-image analysis of strength of ET is invaluable for inventory, planning and management to promote satisfactory hydrologic conditions.

- With few exceptions, priority has <u>not</u> been administered in NM for over a century, suggesting that decreeing and administering IWR is not high among the felt needs of modern society. Likely, an example of “cognitive dissonance.”