Searching for Reasonable Solutions to an Imperfect Situation

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SWRCB Hearing – SJ River Salinity

The REASONABLENESS of achieving water quality conditions is one of the factors that must be considered when setting salinity standards.

Water Code §13241

Considerations in Determining a Reasonable Standard:

BACKGROUND

-Cause of Elevated Salinity in SJR

-The SJR as a DRAIN

-Beneficial Uses

- -Drinking water supply
- -Agricultural irrigation

-Regional nature and salinity sources

CHOICES

-De-designate as drinking water supply.

-Set water quality objectives by river section.

-Allow surface drainage

-Take a hard look at specific ECiw numbers

Point

The San Joaquin River between Mendota and Vernalis is no longer a pristine, natural channel.

The Basic Truths

- There is substantial irrigation on the West Side of the San Joaquin Valley.
- All irrigation water contains salts.
- The salts must be removed to prevent salinization of the soil.
- The only DRAIN available is the San Joaquin River.

Reality

When the CVP was constructed it was known that drainage would be needed – yet functional artificial drainage has not been supplied.

The options are:

- Artificial drainage
- Recirculate salts and eventually stop irrigating.
- Reverse Osmosis ($$, plus disposal questions)
- Use the San Joaquin River as a drain.

Responsibility

This Board’s D-1641 findings:

CVP is the cause of water quality problems in the West Side of the San Joaquin Valley.

Fact:

Deep Percolation (Tile Drainage and accretions) is saltier than source water.

Using a simplistic salt balance for illustration

- Leaching Fraction of 0.2
- No deep percolated rainfall
- Irrigation water EC_{iw} = 0.7 dS/m

The Drainage Water EC

= ECiw/LF = 3.5 dS/m

It is unreasonable to require a drainage water quality that is better than the source water quality.

Delta-Mendota Canal Mean Monthly EC (Check 21)

Mean Monthly EC values computed from daily data provided by USBR

Bold indicates exceedance of San Joaquin River salinity targets

(All values are in dS/m)

	1993	1994	1995	1996
Jan	**1.10**	0.73	0.49	0.65
Feb	0.88	0.41	0.61	0.48
Mar	0.81	0.81	**1.30**	0.36
Apr	0.65	**0.89**	0.63	0.42
May	**0.72**	**0.88**	**0.73**	0.38
Jun	0.65	**0.77**	0.20	0.39
Jul	0.48	**0.79**	0.21	0.36
Aug	0.25	**0.69**	0.36	0.37
Sep	0.43	**0.70**	0.35	0.39
Oct	0.45	0.62	0.24	0.37
Nov	0.56	0.49	0.42	0.44
Dec	0.65	0.70	0.44	0.51
Average	0.64	0.71	0.50	0.42

Point (repeated)

The San Joaquin River between Mendota and Vernalis is no longer a pristine, natural channel.

- It is the only drain.
- Drainage is necessary.
- Drainage was not provided by CVP
- Drainage water has a higher salinity than the source water.

Beneficial Uses

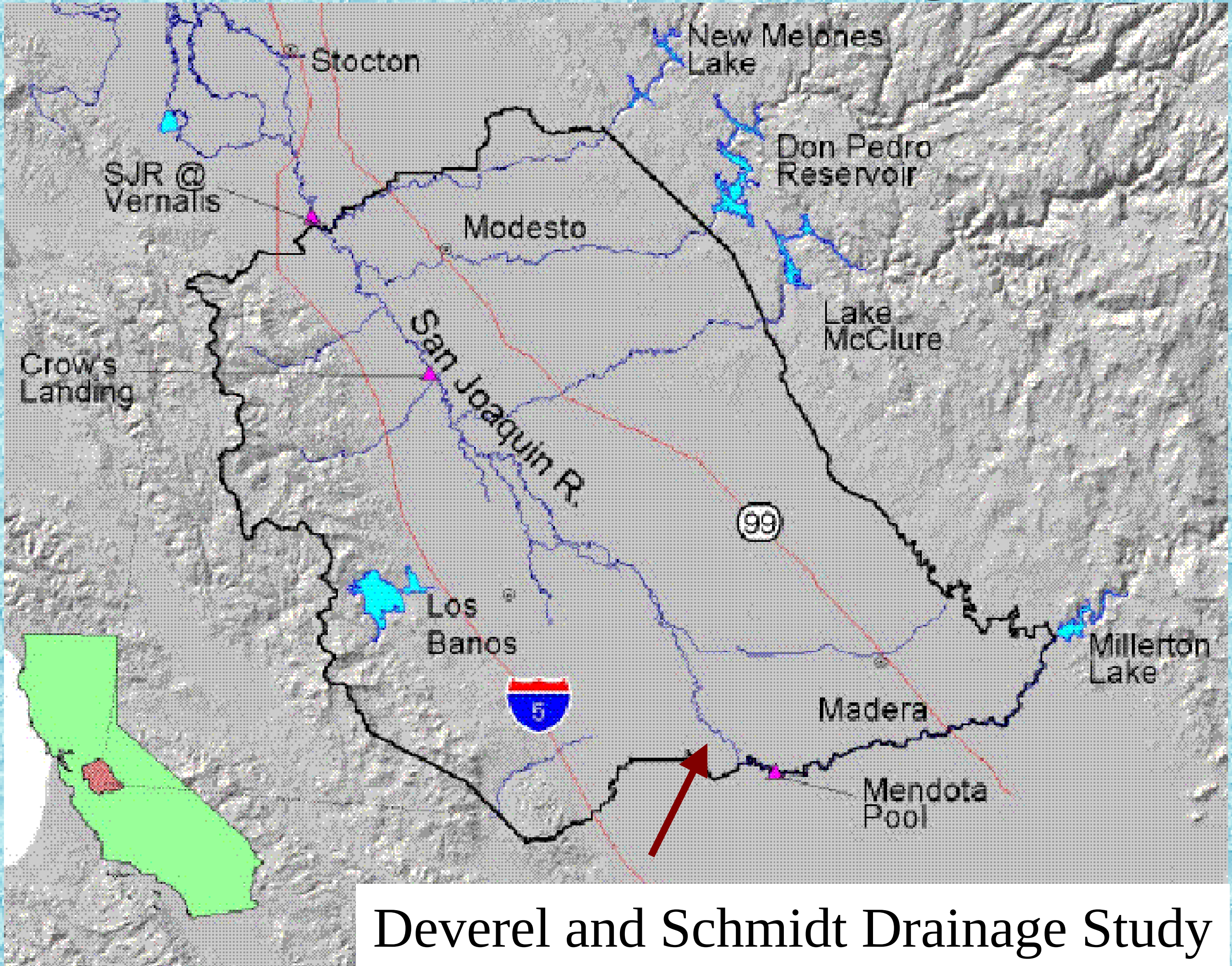
State Water Board Res. # 88-63 provides for **excepting** (de-designating) surface waters with the designation of **municipal or domestic** supply if one of these apply:

- TDS > 3000 ppm, and water is not reasonably expected to supply a public water system.
- The pollution present cannot be reasonably treated either using BMP’s or best economically achievable treatment practices.

By de-designating Municipal/Domestic as a beneficial use (the recommended action for this Board),

this leaves Agriculture.

Accretions and Tile Drain outflows do not always originate within the boundaries of the discharger.

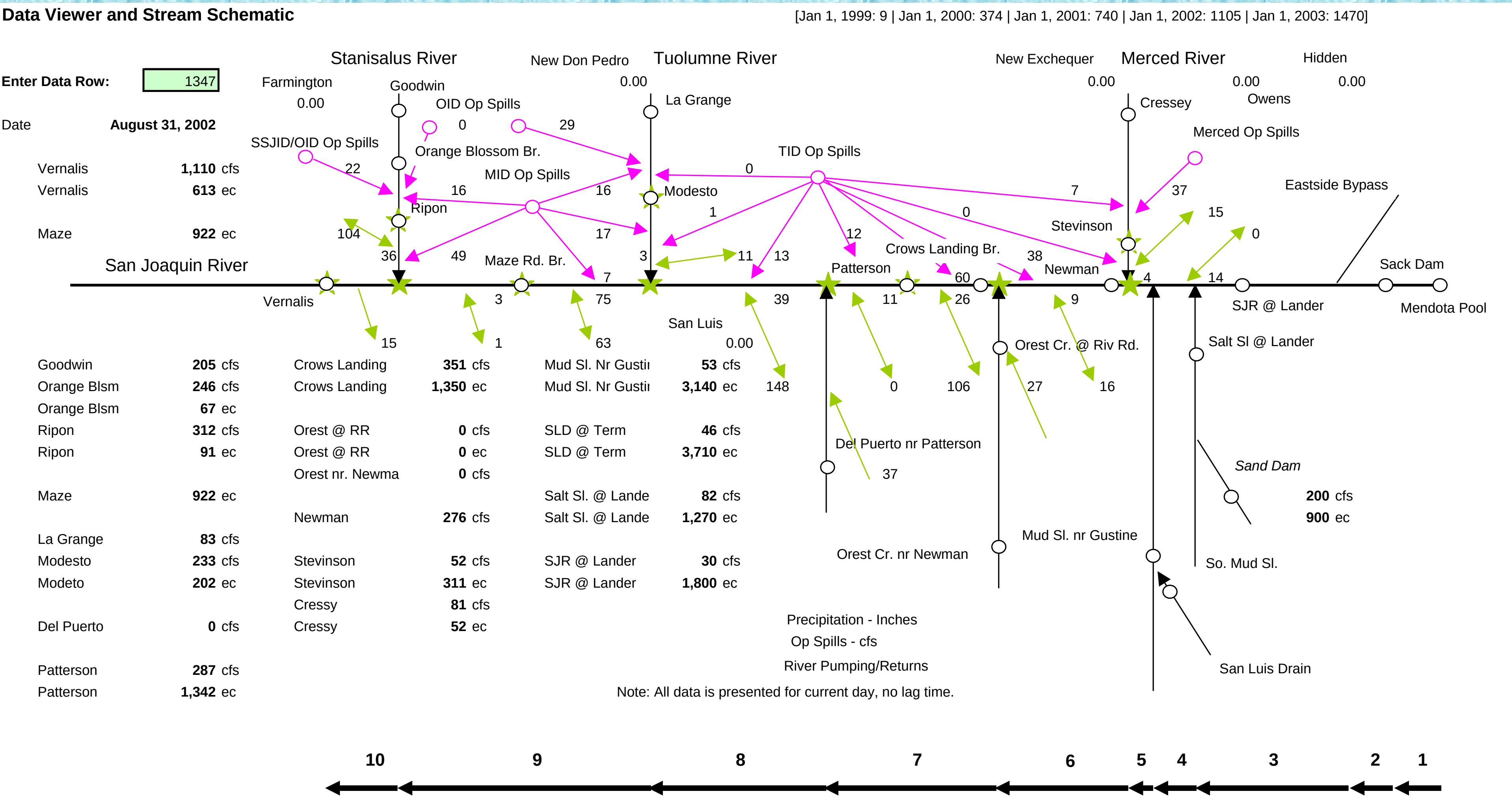


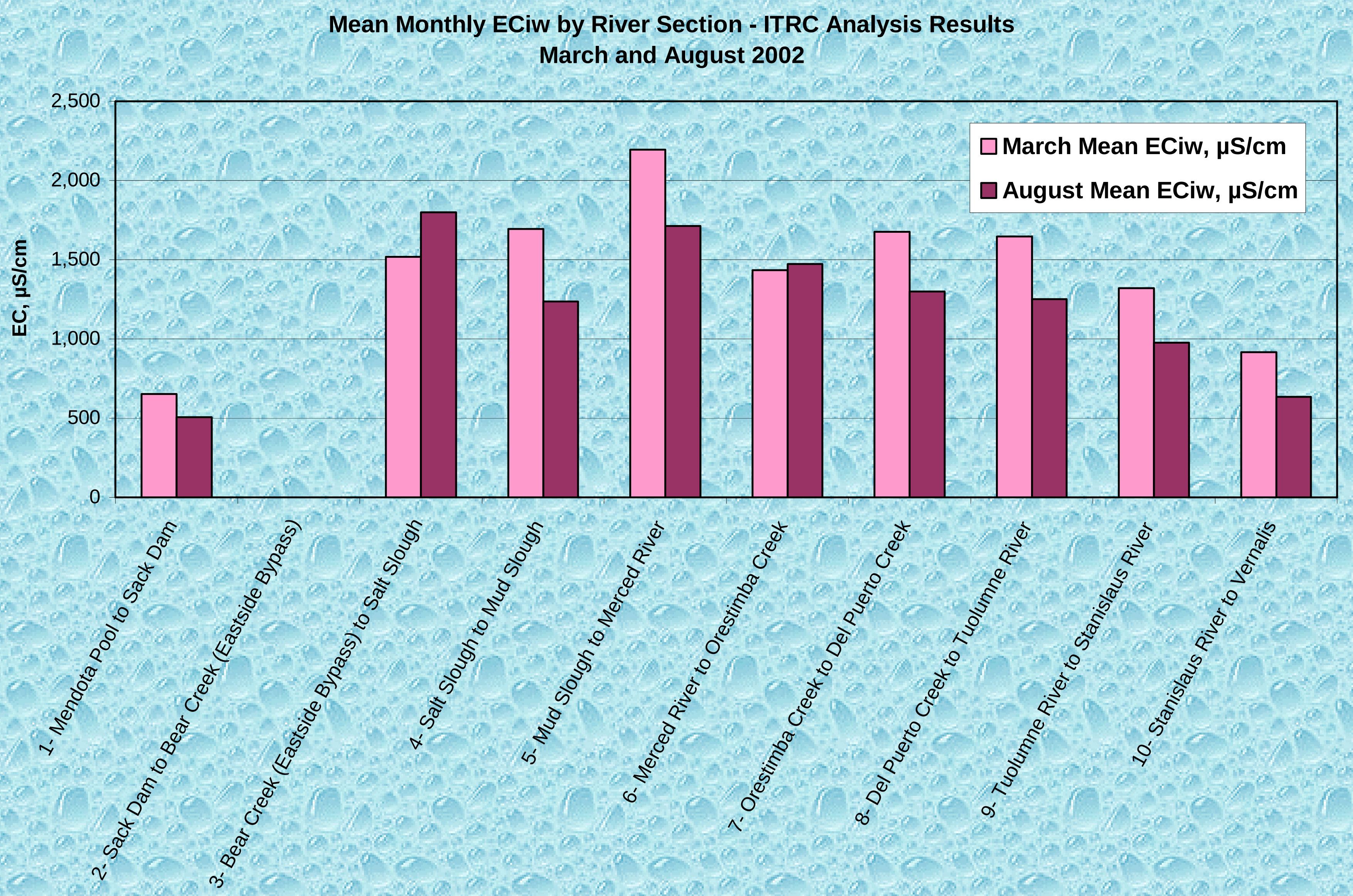
Deverel and Schmidt Drainage Study

The Salinity Objective

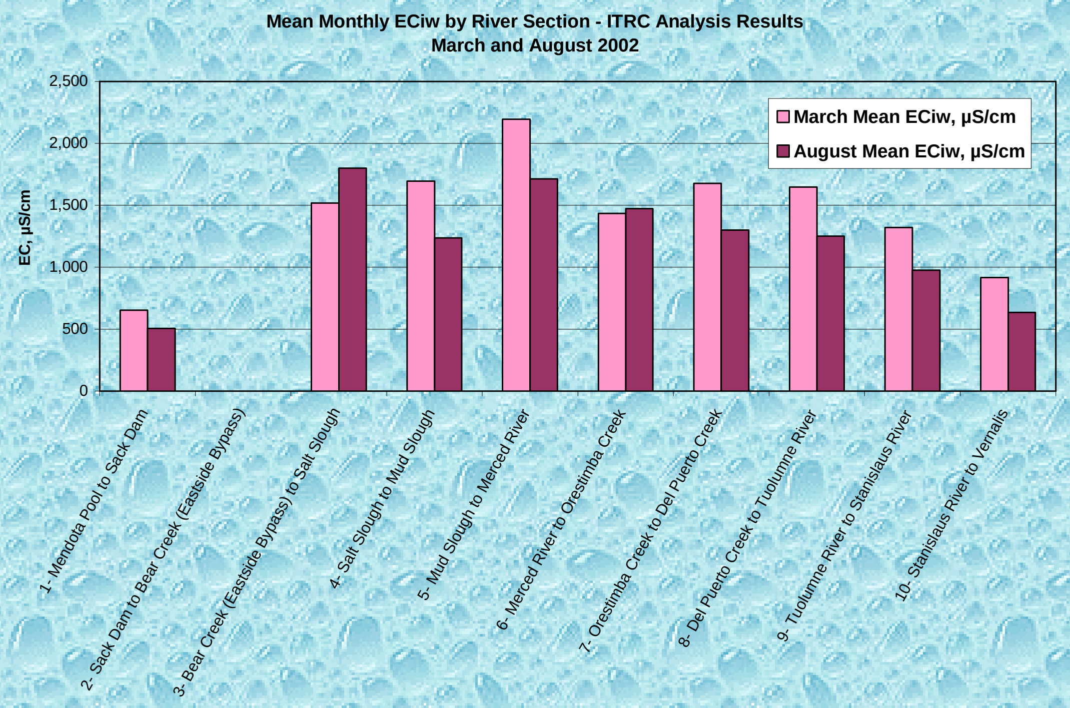
- De-designate as drinking water supply (already mentioned)
- Set objectives by river section
- Set objective or also restrict surface drainage??
- Modify the specific ECiw objective

Setting salinity objectives by river section



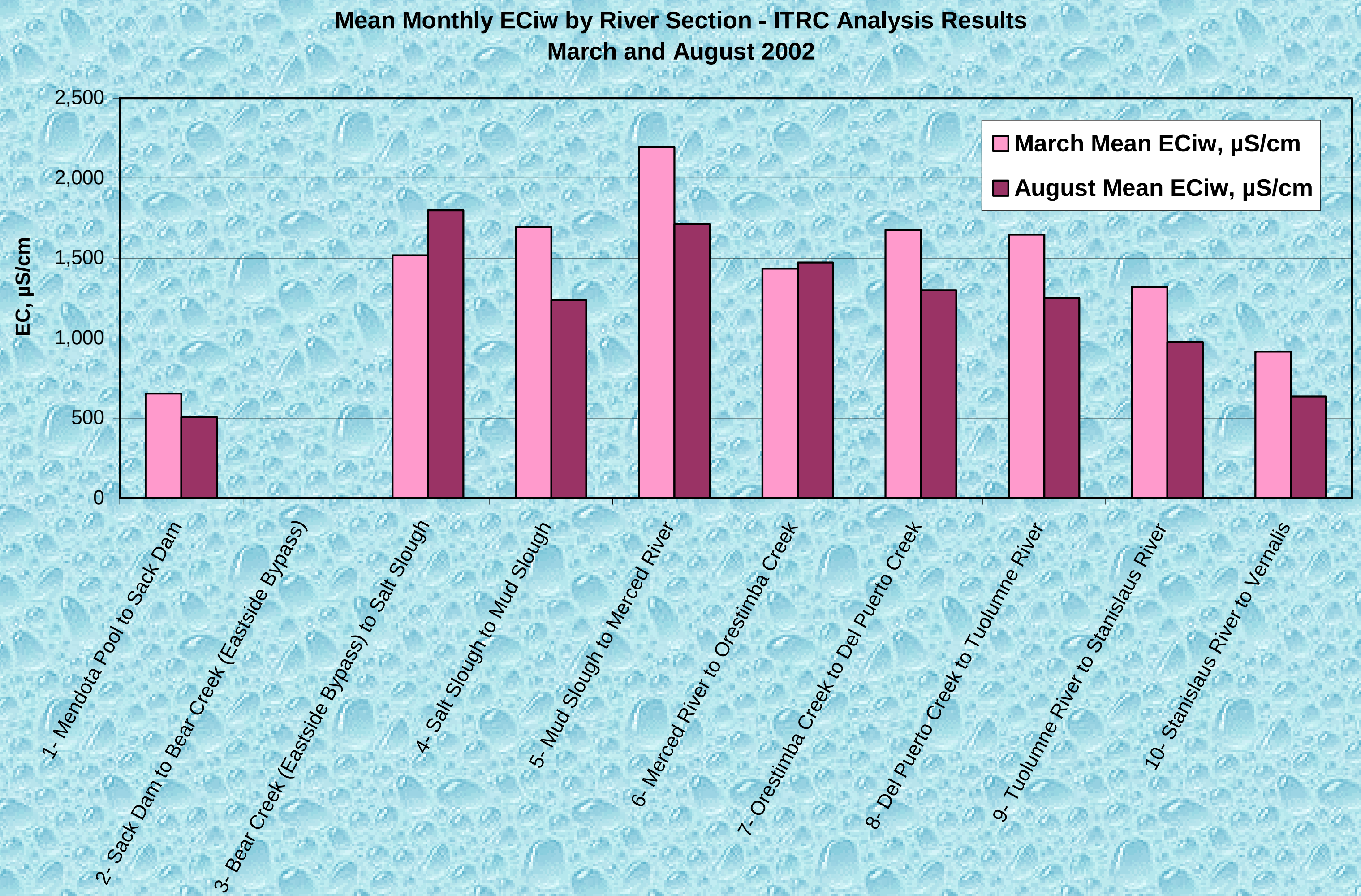


Mean Monthly ECiw by River Section - ITRC Analysis Results
March and August 2002
EC, µS/cm
2,500
2,000
1,500
1,000
500
0
March Mean ECiw, µS/cm
August Mean ECiw, µS/cm
1- Mendota Pool to Sack Dam
2- Sack Dam to Bear Creek (Eastside Bypass)
3- Bear Creek (Eastside Bypass) to Salt Slough
4- Salt Slough to Mud Slough
5- Mud Slough to Merced River
6- Merced River to Orestimba Creek
7- Orestimba Creek to Del Puerto Creek
8- Del Puerto Creek to Tuolumne River
9- Tuolumne River to Stanislaus River
10- Stanislaus River to Vernalis



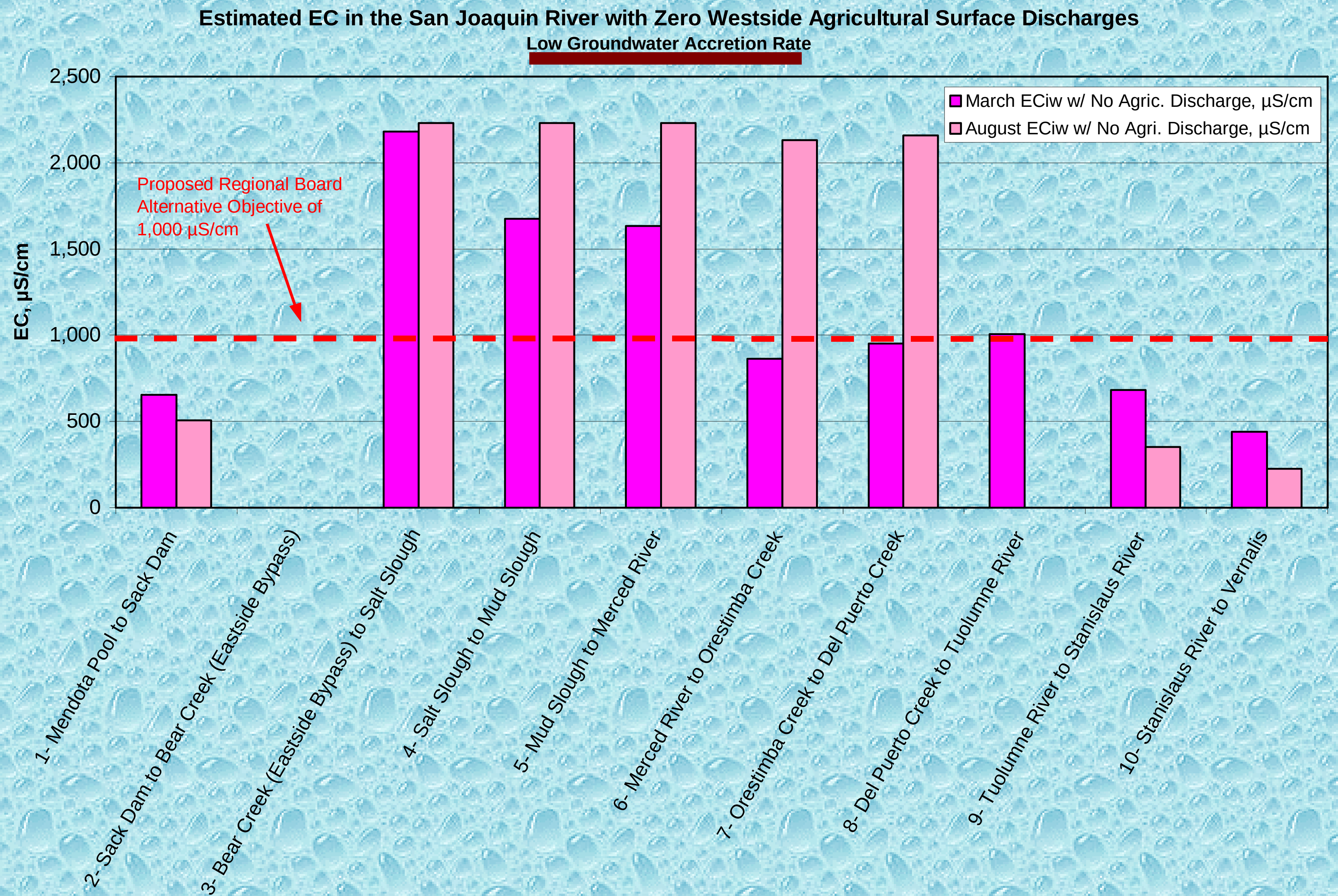
Major points:

1. Salinity is different by river section.
2. Crop mixes and diversions are different by river section.



These values look high. Why not restrict surface inflows from the WEST SIDE?

It's not as simple as eliminating WEST SIDE surface discharges!



Where did 0.7 dS/m and 1.0 dS/m come from?

- Testimony will show that it comes from
  - Beans
  - No yield decline

Where did 0.7 dS/m and 1.0 dS/m come from?

My point will be that it reflects an inaccurate understanding of

- **Leaching REQUIREMENT**
- **Leaching FRACTION**
- **FIELD vs. LABORATORY conditions**
- **ECe vs. ECiw vs. ECsw vs. ECdw**

Understanding salinity is not intuitive.

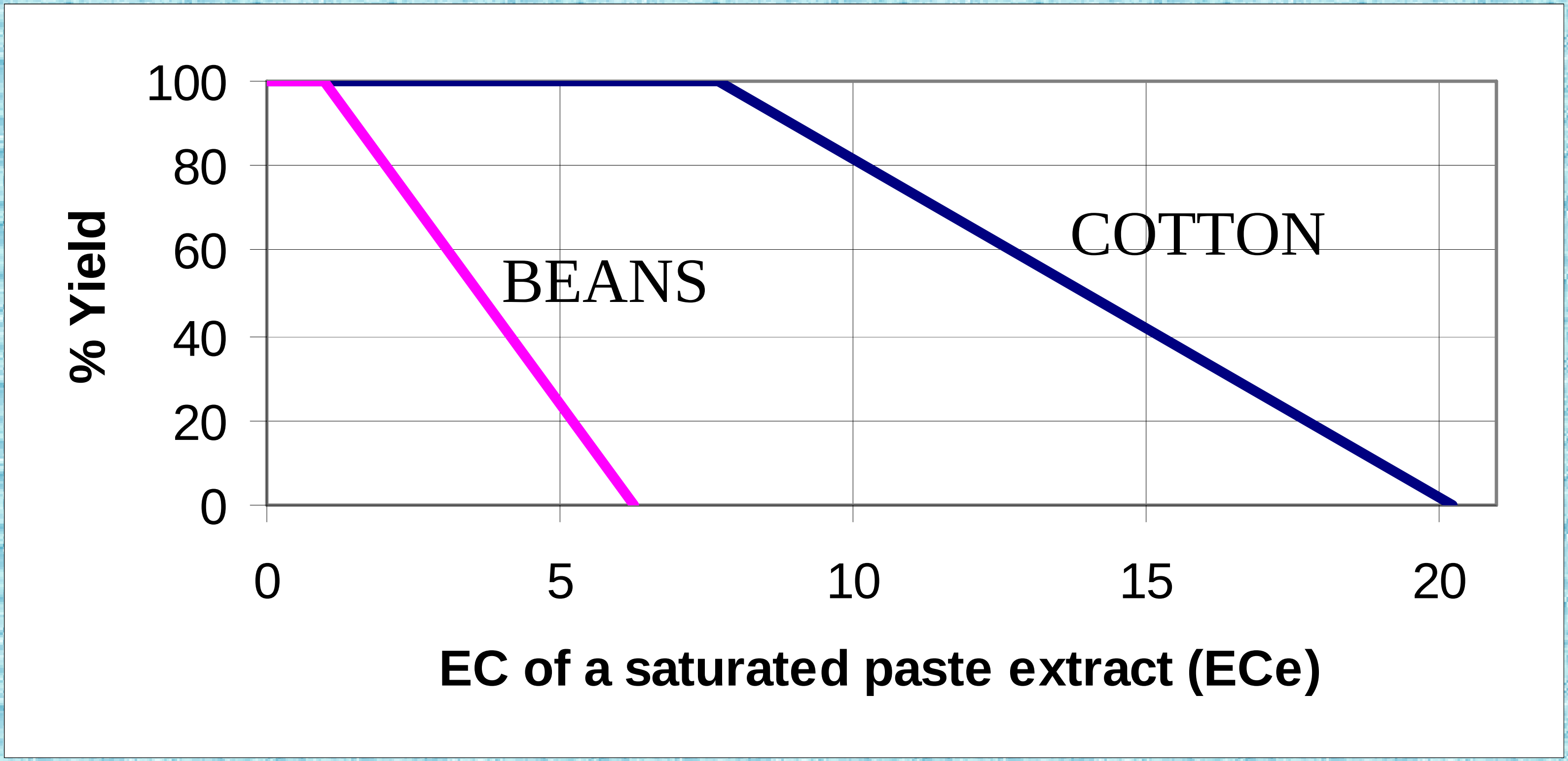
It’s also not an exact science.

Nevertheless, there are certain fundamentals that everyone should understand when discussing a salinity objective.

Some basic principles

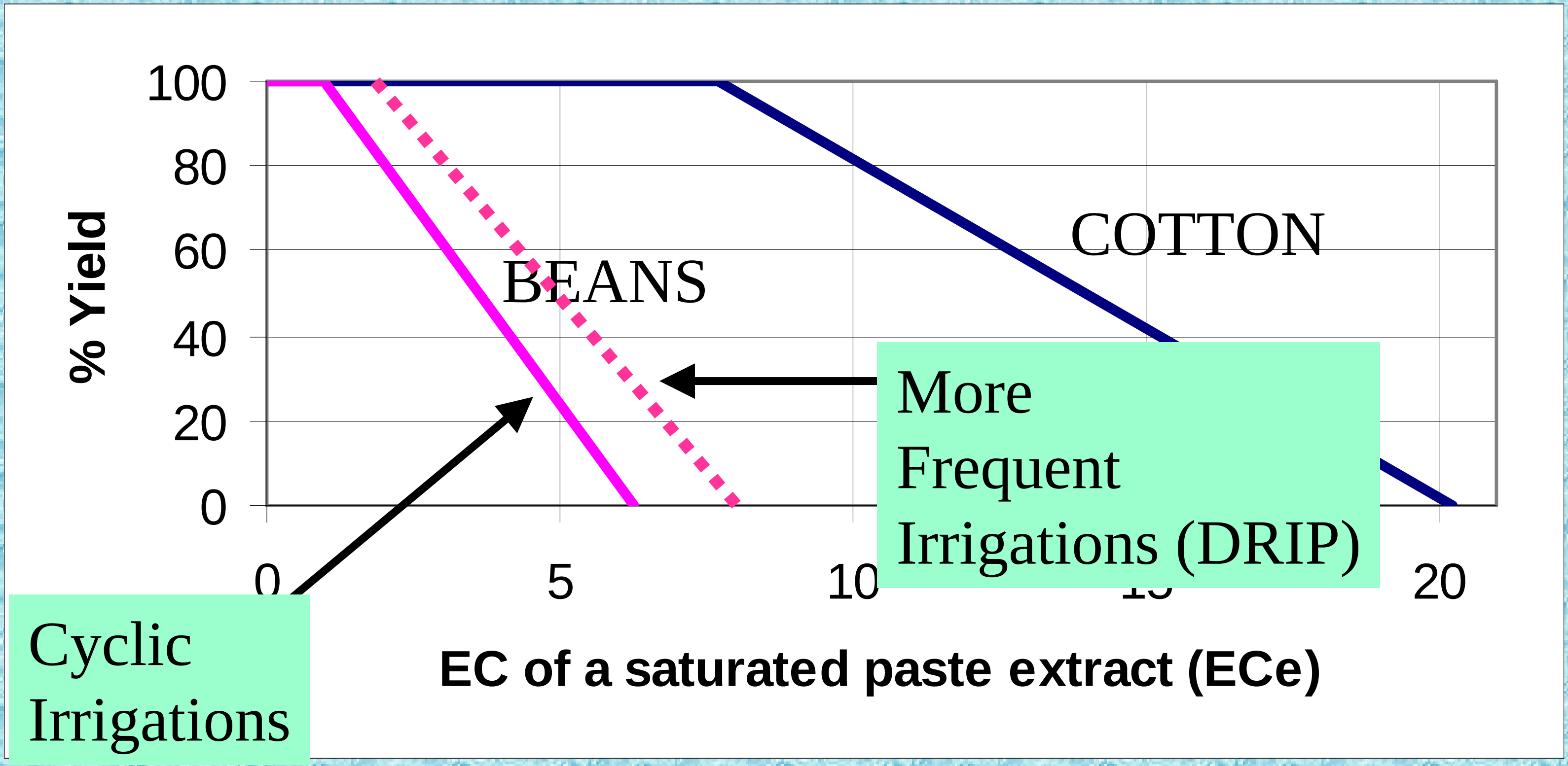
- Crop tolerance levels – ECe
- Maintenance leaching vs. reclamation leaching.
- LR (leaching requirement) formulas
- Impact of rainfall
- Actual field irrigation – LF (leaching fraction)
- Bottom line – ECe is manageable.

Threshold ECe and Rates of Yield Decline



***For typical cyclic irrigations*

Threshold ECe and Rates of Yield Decline..are not FIXED in concrete



Leaching Requirement Concept

- Irrigation water has salt.
- The incoming salt must be removed.
- Leaching can occur with rainfall….or with irrigation water.
- Leaching is DEEP PERCOLATION
- The leaching must be frequent (once/year is often sufficient). “Frequent” is a relative term.

Leaching Requirement Concept

KEY IDEAS THAT MAY HAVE BEEN MISSED!

- Salt tolerance values are ECe, not ECiw

- Plants respond to soil salinity.

- ***For a specific WATER salinity, farmers can manage for a wide range of SOIL salinities.

The formula that we used in our analysis.

LR = Fraction of applied irrigation water that must deep percolate to maintain the desired ECe in the plant root zone (soil).

If LR = 0.10,

That means 10% of the applied irrigation water at a point in the field must deep percolate.

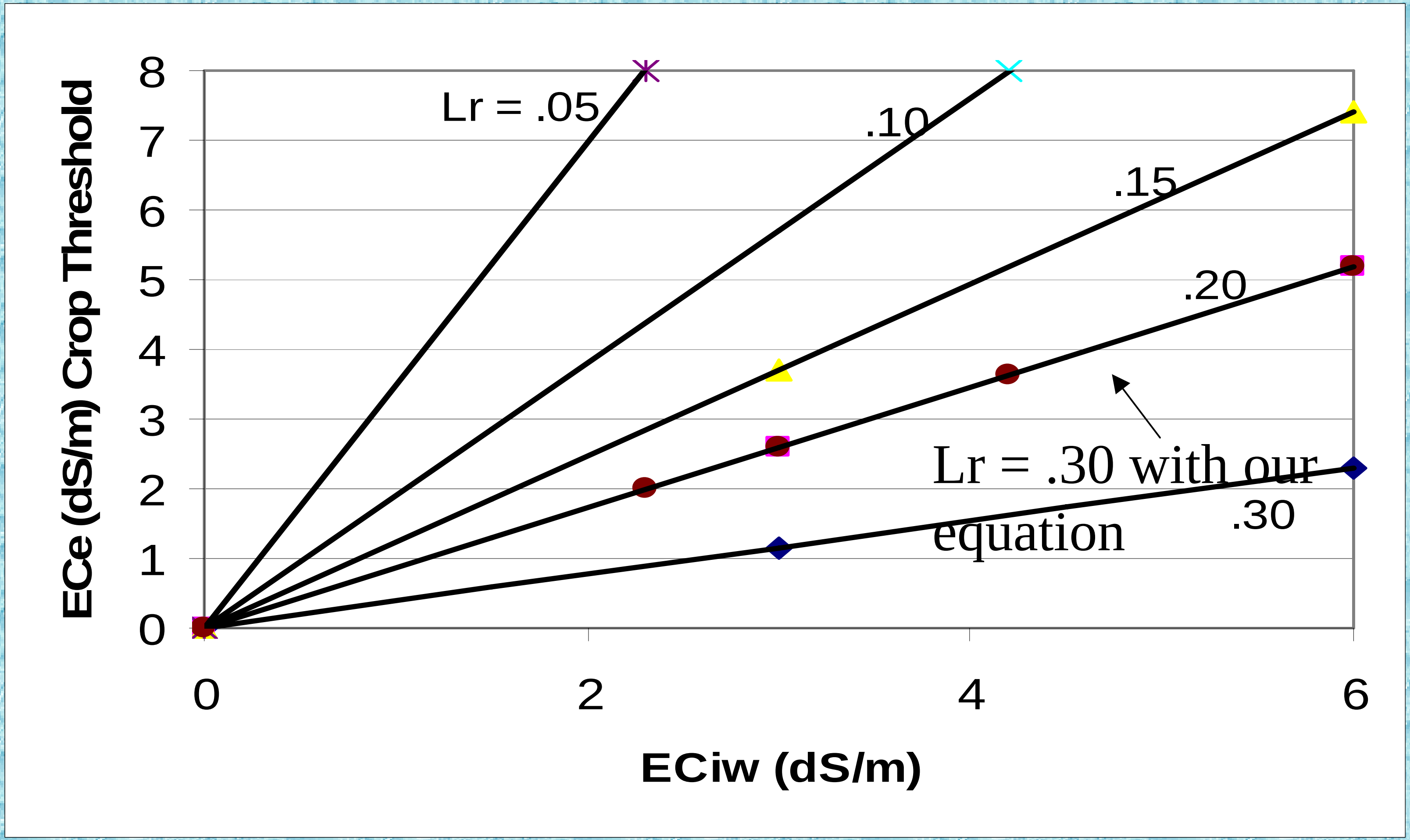
The formula that we used in our analysis.

LR = Fraction of applied irrigation water that must deep percolate to maintain the desired ECe in the plant root zone (soil).

$$LR = \frac{ECiw}{(5 \times ECe) - ECiw}$$

Where ECe = target ECe in the soil.

Other, less restrictive recommendations exist.



Tanji, et al. 1990. Agricultural Salinity Assessment and Management. American Society of Civil Engineers. Div. of Irrig. and Drainage. ASCE manuals and reports on engineering practice: no. 71. 619 pg.

The major point

With an ECiw of irrigation water of 2.0 dS/m, one can manage for an average root zone salinity (ECe) of 1.0 dS/m – by controlling the leaching fraction.

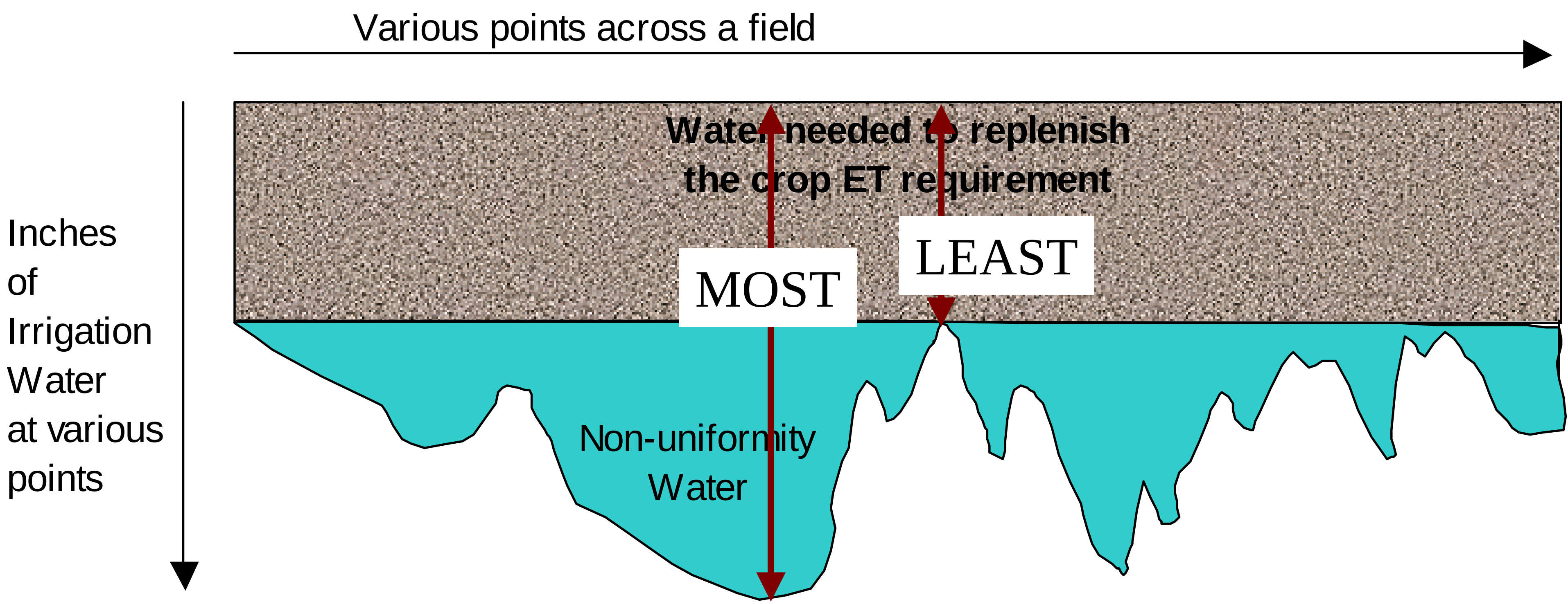
…and rainfall eases the management even further.

But there’s another important fact that has not been brought forward.

All irrigations are non-uniform.

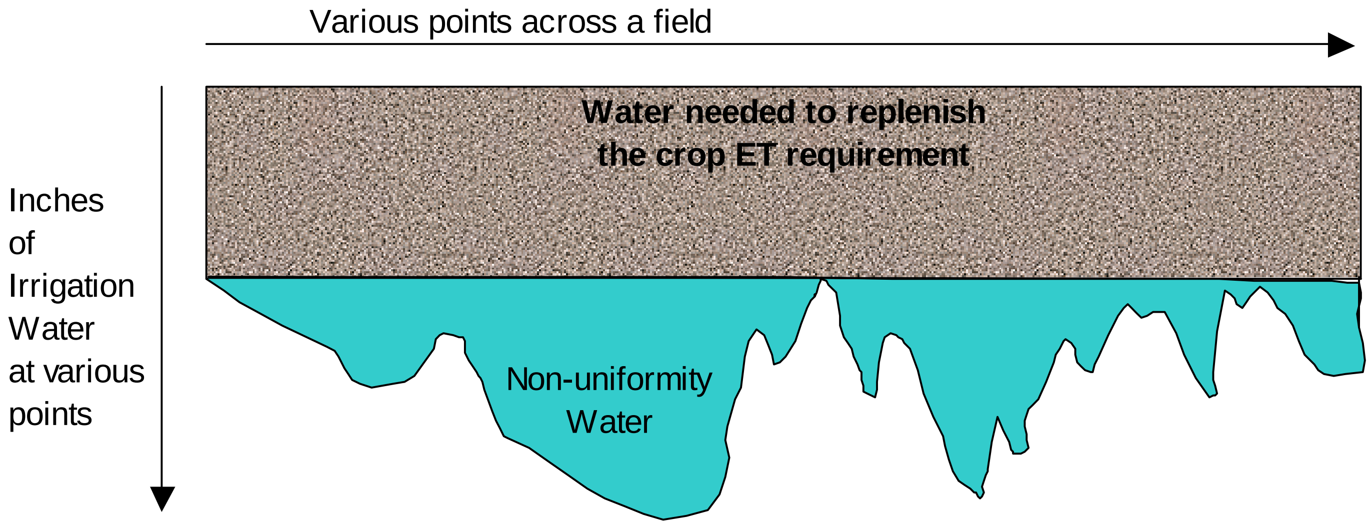
The “distribution uniformity” (DU) is always less than a perfect 1.0

Non-uniformity is a very real fact in all irrigation.
A typical ratio of (most/least) water = 2.0



STANDARD IRRIGATION WITHOUT ADDING EXTRA WATER FOR LR

…..BUT……LF = about 0.4



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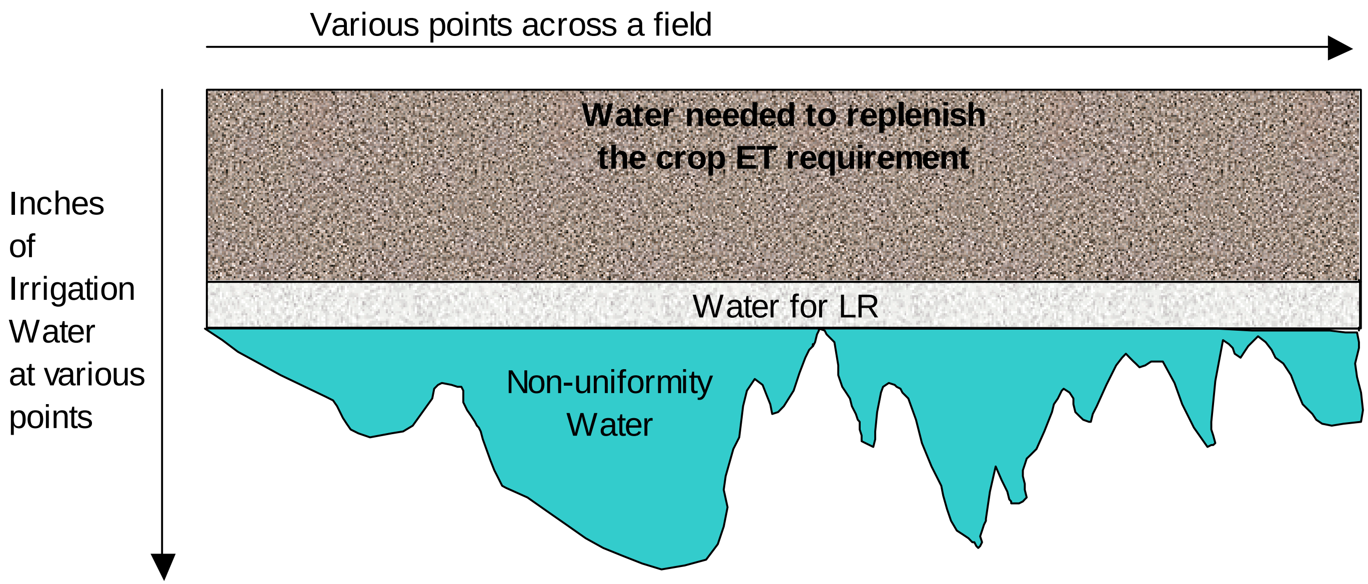
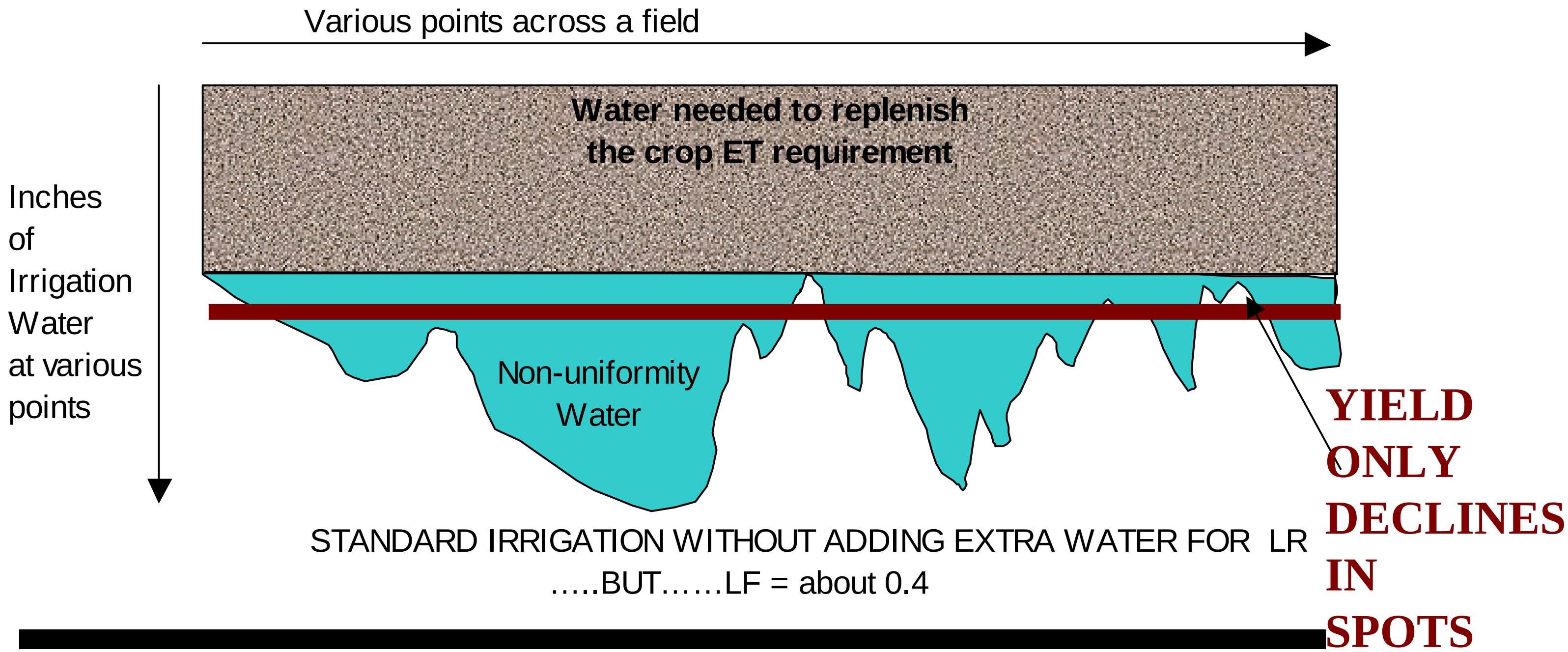


Irrigation considering LR. This provides a LF at the point that receives the least.

LR = .15; LF = about 0.55



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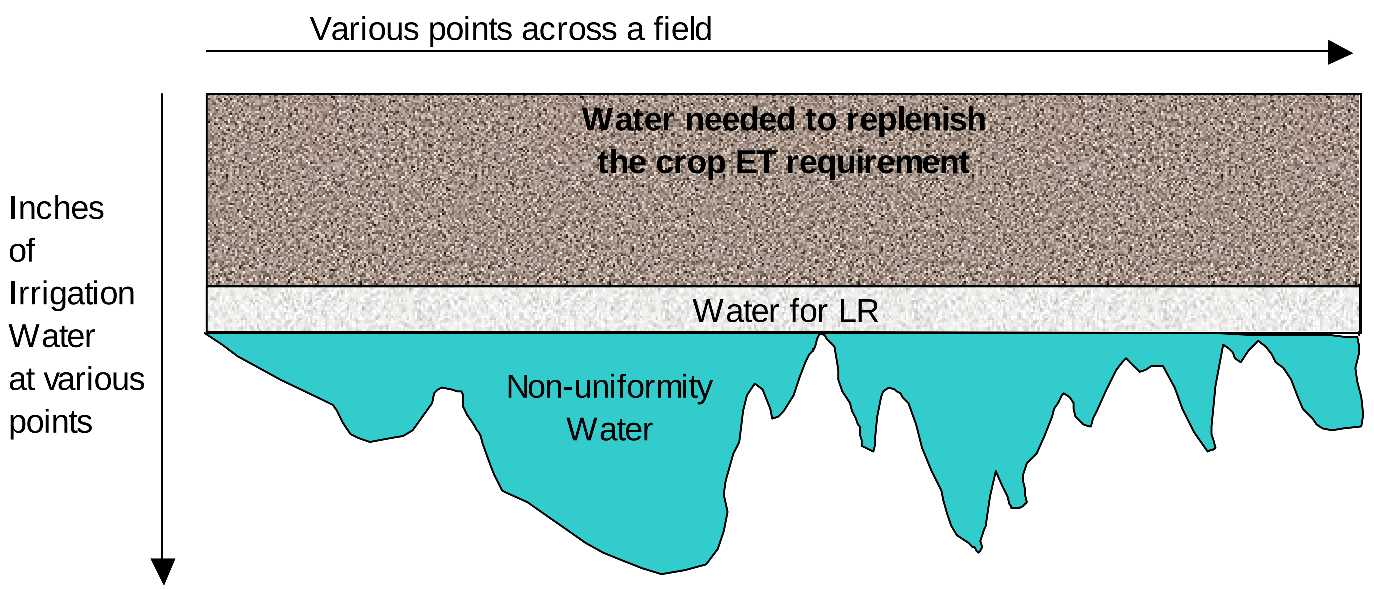

Irrigation considering LR. This provides a LF at the point that receives the least.
LR = .15; LF = about 0.55

Points from the previous slides

- The soil salinity is not “fixed” by the irrigation water salinity.
- Most of a typical field receives adequate leaching from non-uniformity without even applying the “LR” equation.

When we put it all together

Considering

- Availability of water in the river for leaching.
- The crops upstream of Vernalis
- The variation in EC during the year.
- Rainfall
- Crop sensitivity to salinity
- Salinity of CVP water
- Groundwater accretions to the river
- etc.

Reasonable actions to a difficult challenge:

- **De-designate municipal/domestic water uses.**
- **Standards must recognize the use of the SJR as a salt drain.**
- **Do not eliminate surface inflows from the West Side.**
- **From Merced River to Vernalis, a <u>maximum</u> water salinity objective = 2.0 dS/m**
- **From Sack Dam to Merced River, a maximum water salinity objective could be higher (2.5).**

Thank you.