Integrated on Farm Drainage Management

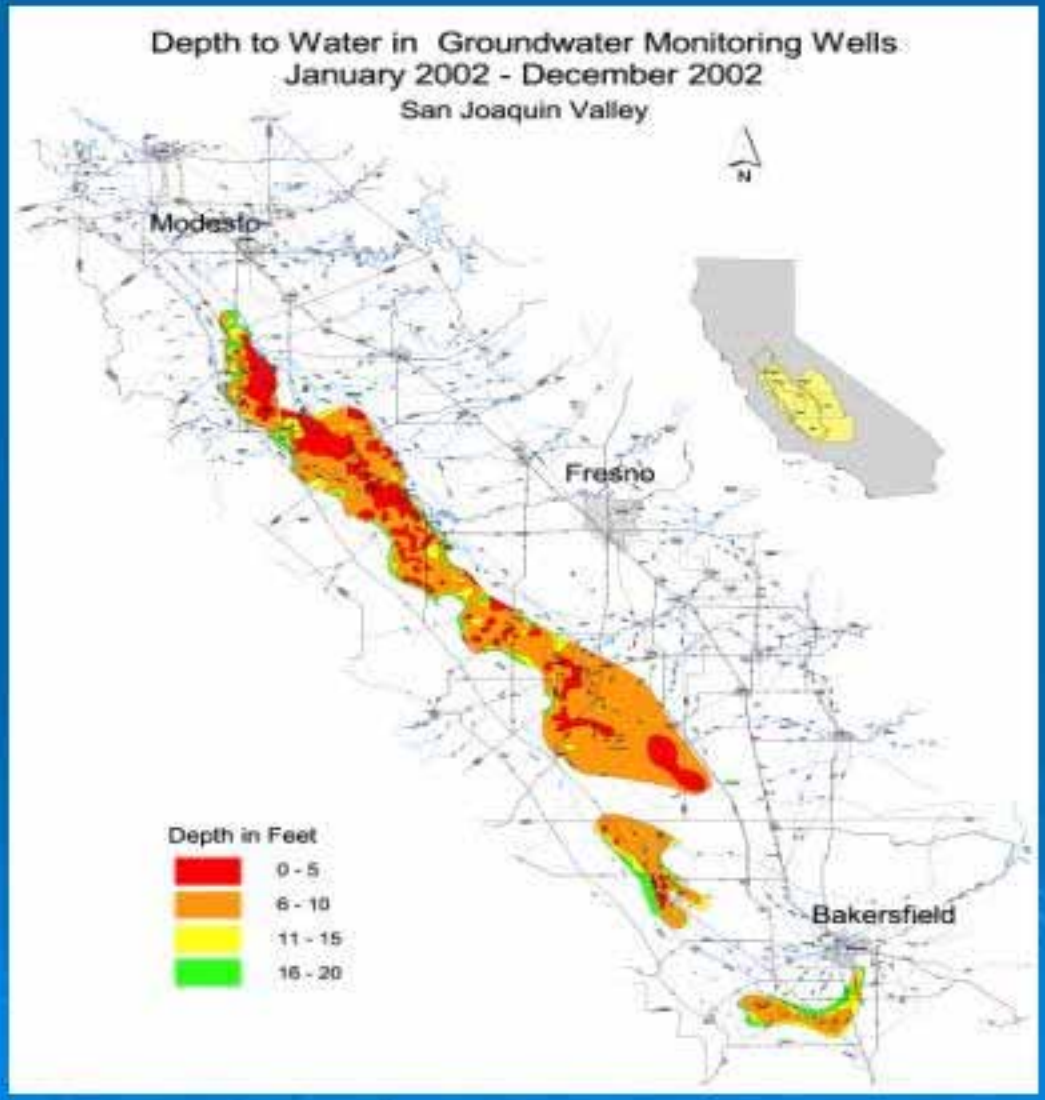
IFDM

Jose I. Faria, P.E

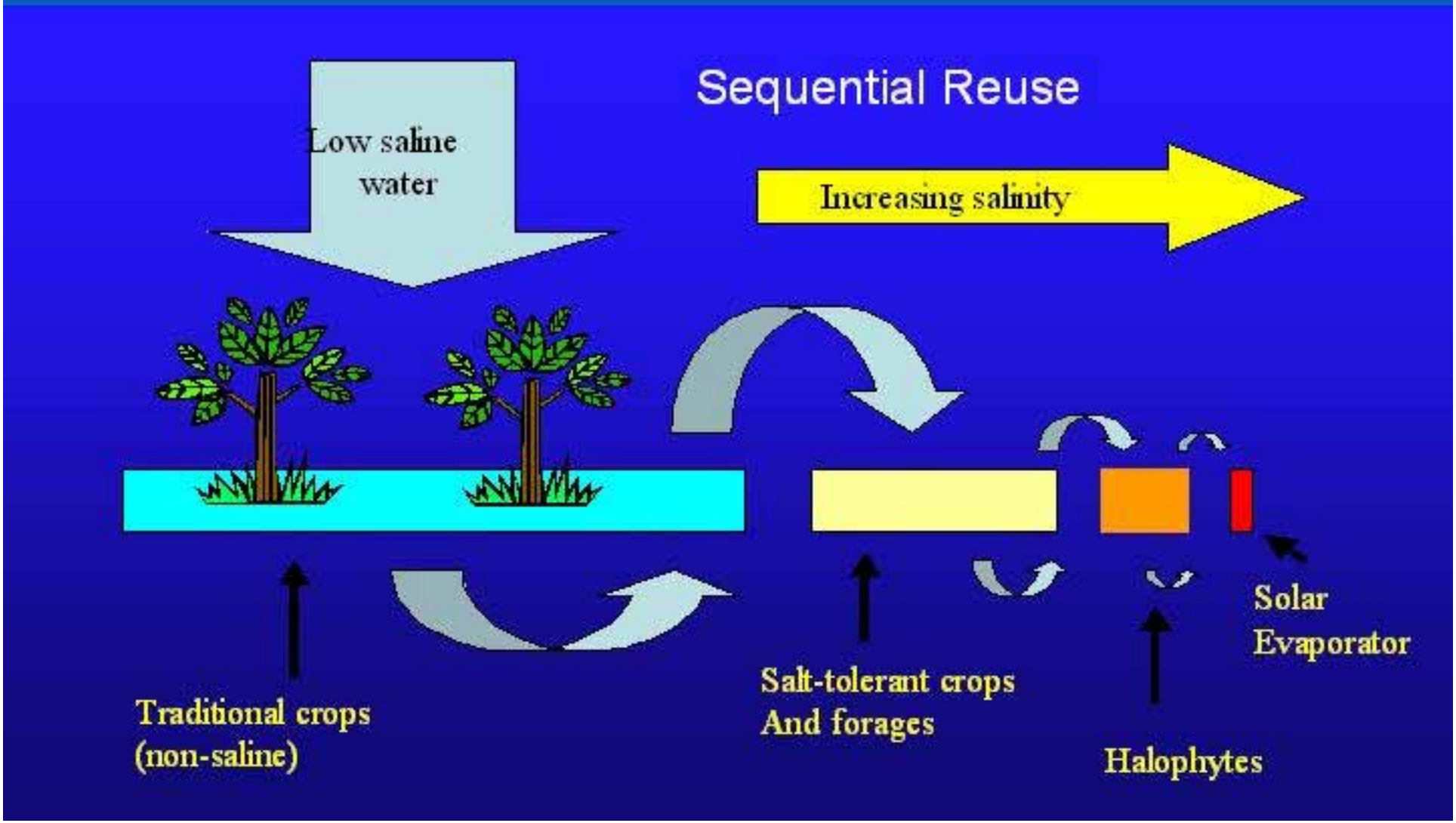
The Problem Area

San Joaquin Valley

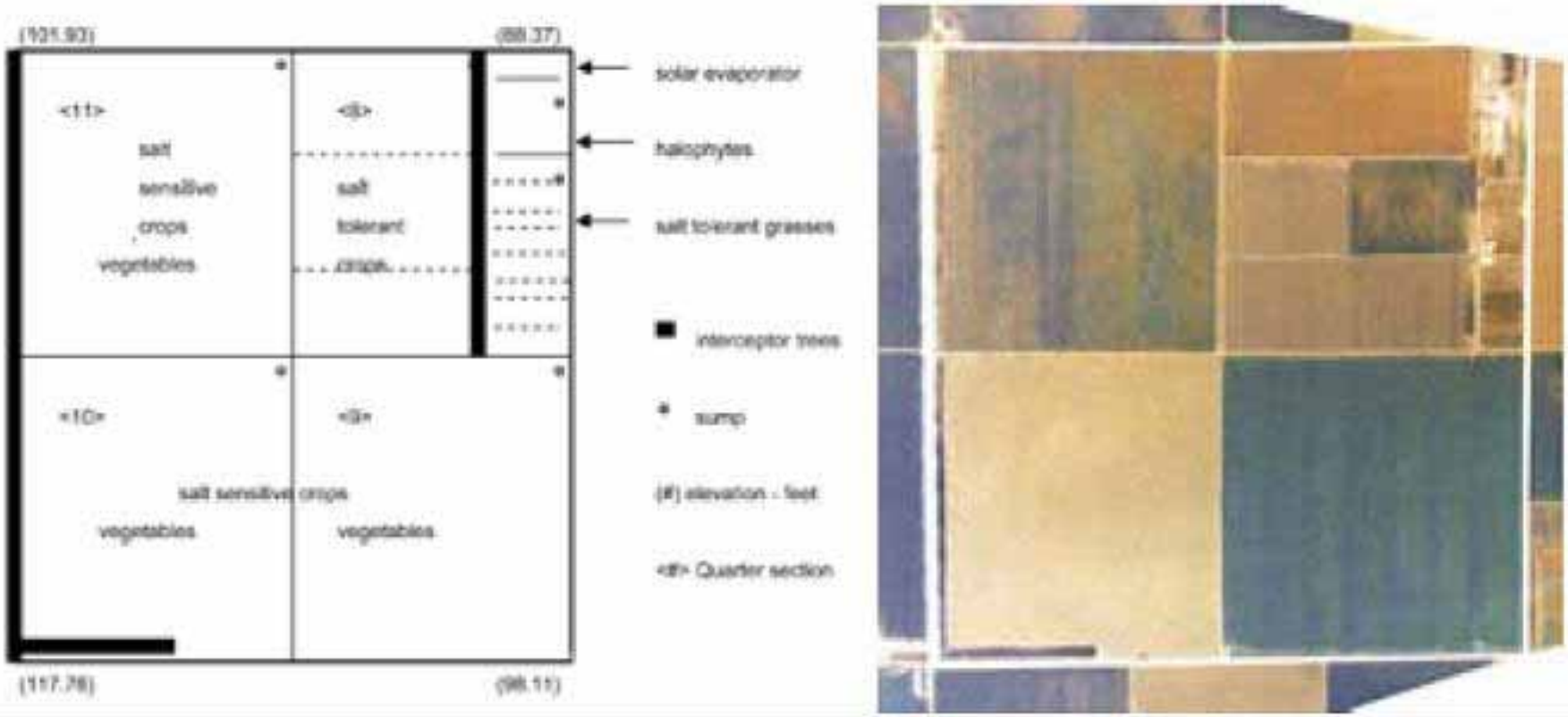
Depth of Shallow Groundwater

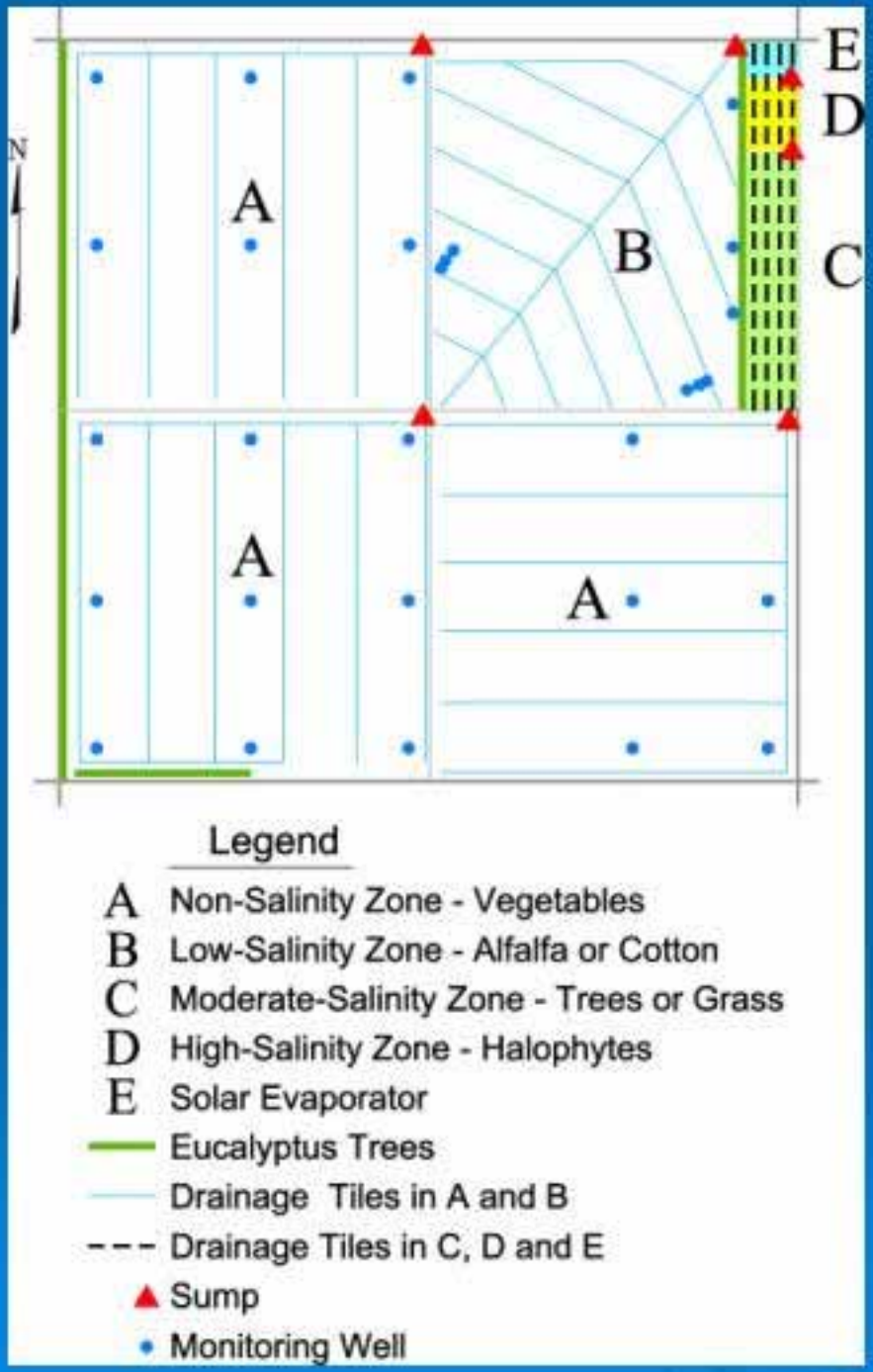


Integrated On Farm Drainage Management (IFDM)



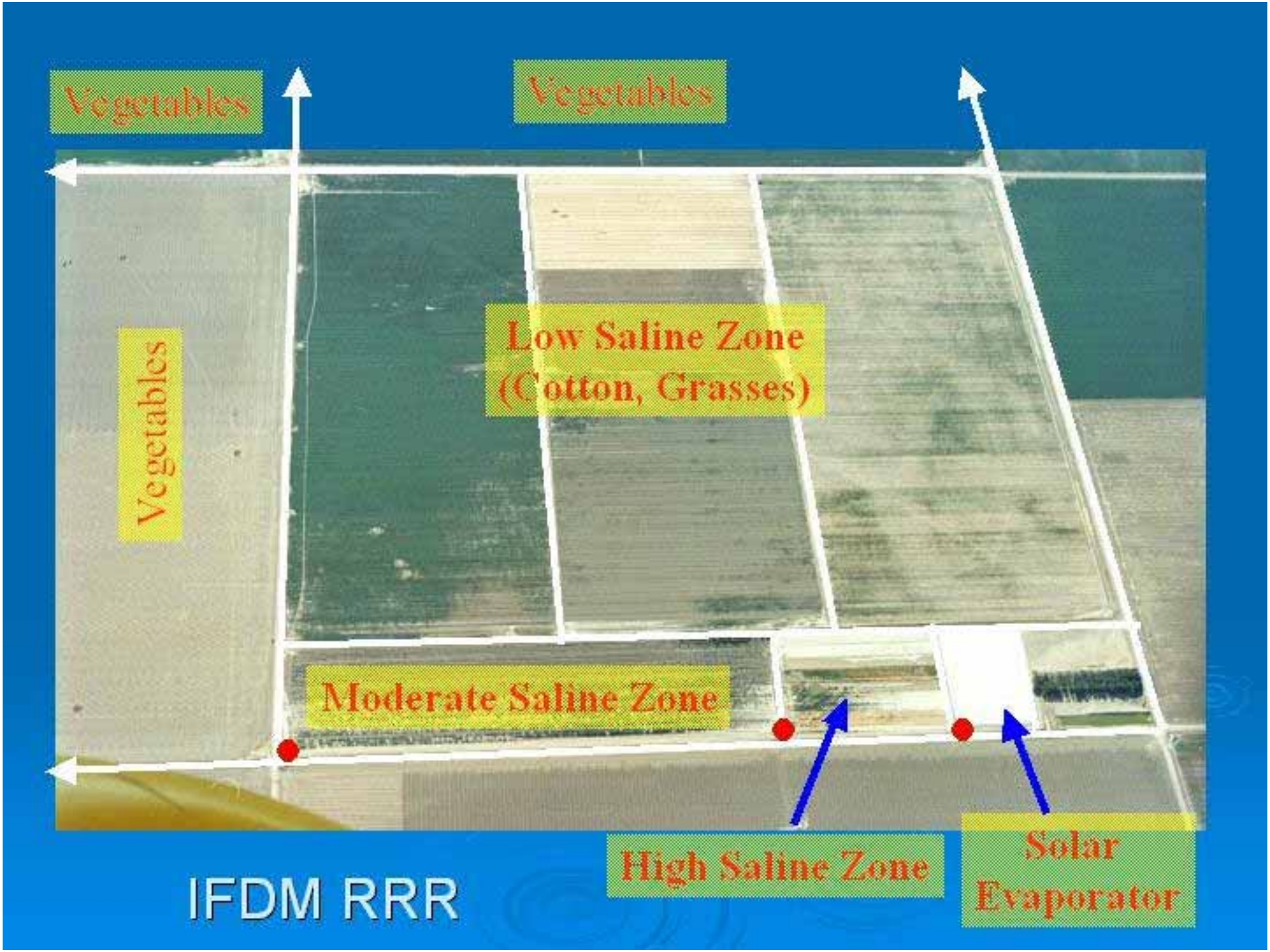
Red Rock Ranch IFDM System





IFDM

RED ROCK RANCH
DRAINAGE SYSTEM LAY OUT


Vegetables
Vegetables
Vegetables
Low Saline Zone
(Cotton, Grasses)
Moderate Saline Zone
High Saline Zone
Solar
Evaporator
IFDM RRR

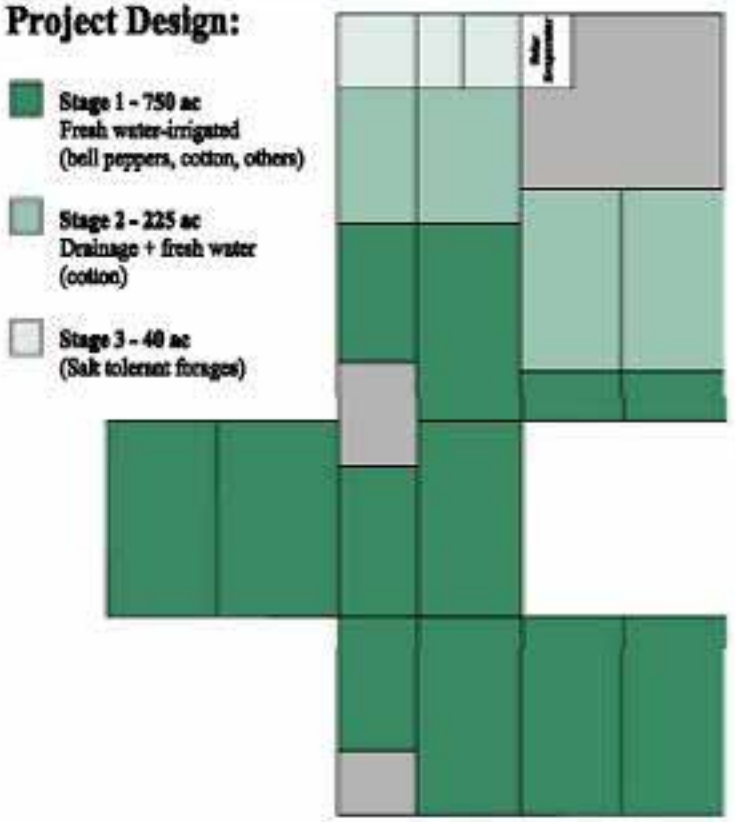
Red Rock Ranch Pre-project Conditions

IFDM – Andrews Ag

AndrewsAg IFDM Design - Kern County

- For a 15-year period, 1100-acres of irrigated land were drained using a 100-acre evaporation basin as the terminus for drainage water.
- For regulatory and economic reasons landowner opted to close evaporation basin. An IFDM system was implemented which includes a solar evaporator component to evaporate drainage water and collect salts.

Project Design:



Estimated Salt Balance Andrews Ag for 2005

	Crop	Area ac	Irr. Volume af	avg tds mg/l	Salt Volume tons
	Salt Sensitive	750	1,875	400	1,020
1st reuse	Salt Tolerant (blend)	225	675	1,300	1,193
2st reuse	Halophytes	40	200	16,560	4,504
	Solar Evaporator	20	75	27,140	2,768

Salt Tolerant Crops –First Reuse

Field Crops:

- Cotton
- Wheat
- Barley
- Sugarbeet
- Canola (Biodiesel)
- Sunflower (Biodiesel)
- Indian Mustard (Biodiesel)

Vegetables:

Artichoke

Asparagus

Red beet

Zucchini

Trees:

Pistachios

Salt Tolerant Crops – Second Reuse

Forages

- Jose Tall Wheatgrass
- Creeping Wild Rye
- Alkali Sacaton
- Bermuda Grass
- Paspalum
- Alfalfa

Salt Tolerant Crops –Third Reuse Halophytes

- Salicornia
- Saltgrass
- Allenrolfia
- Atriplex
- Cordgrass

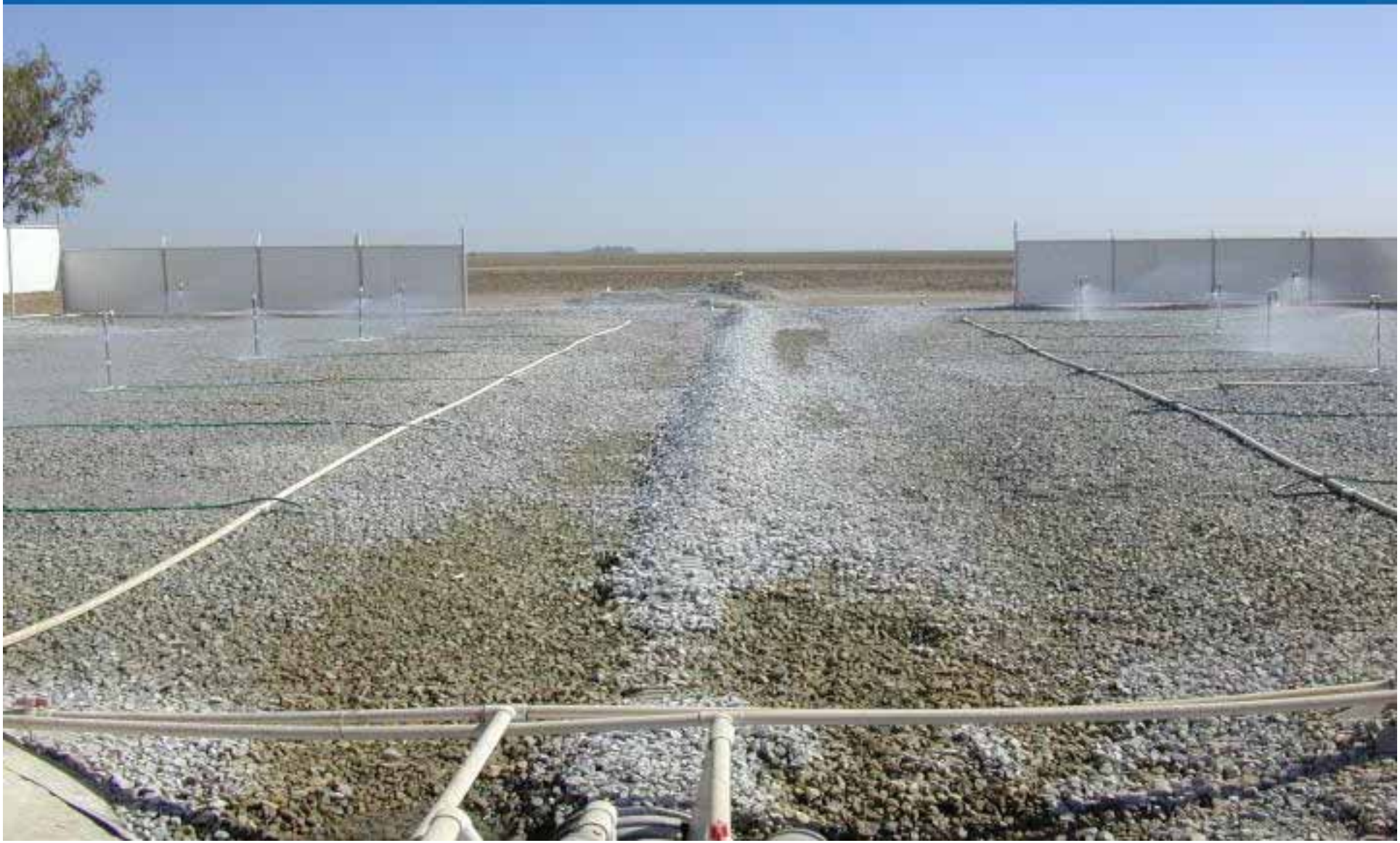
- Agriforestry: Prosopis Alba; Athel; Eucaliptus

Agriforestry
Shallow Groundwater Management

Prosopis Alba

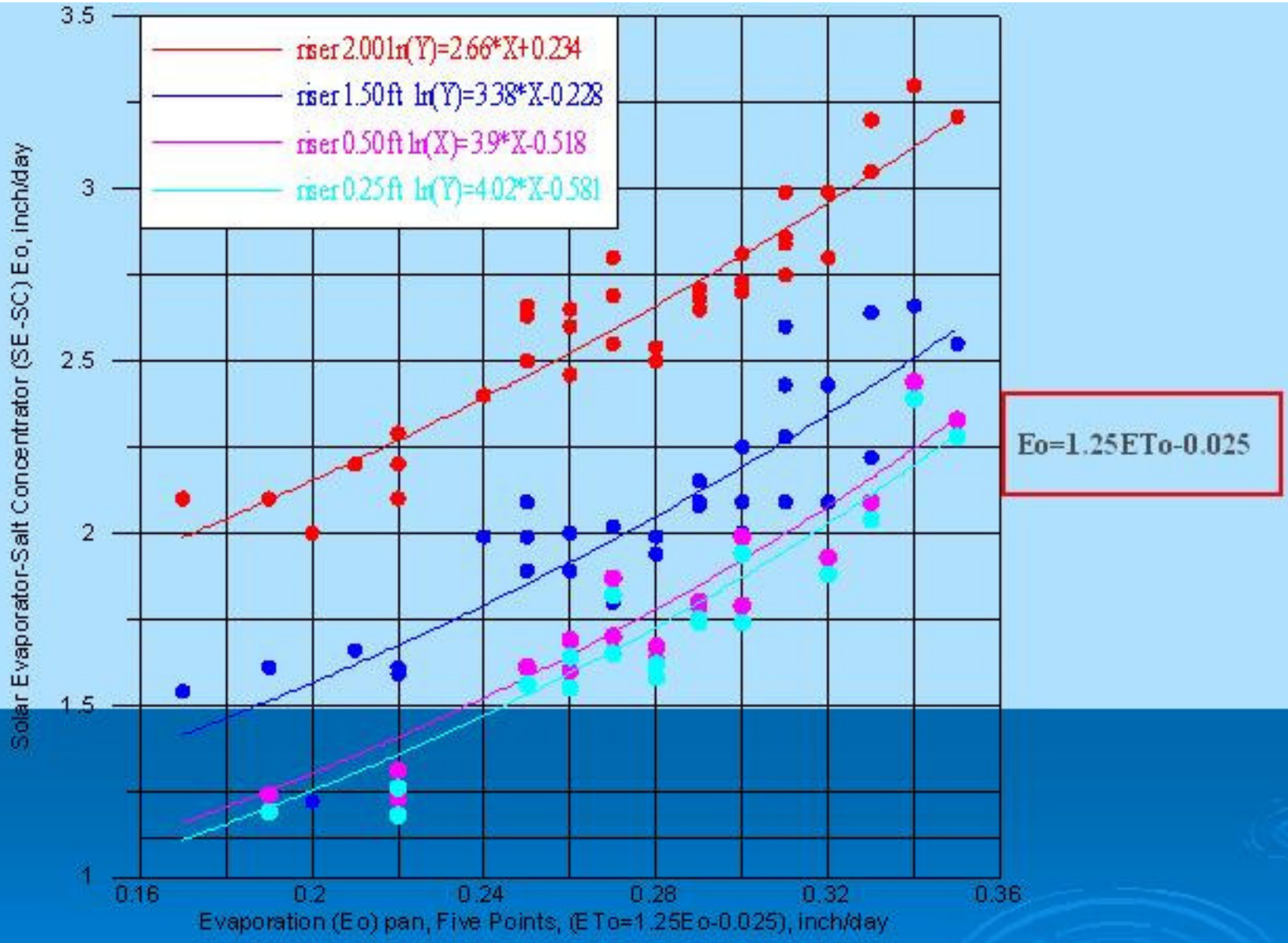
Eucalyptus Trees at RRR

RRR Solar Evaporator



SOLAR EVAPORATOR

Nozzles tested at the Center for Irrigation Technology (UC Fresno) and SE-SC (Red Rock Ranch)

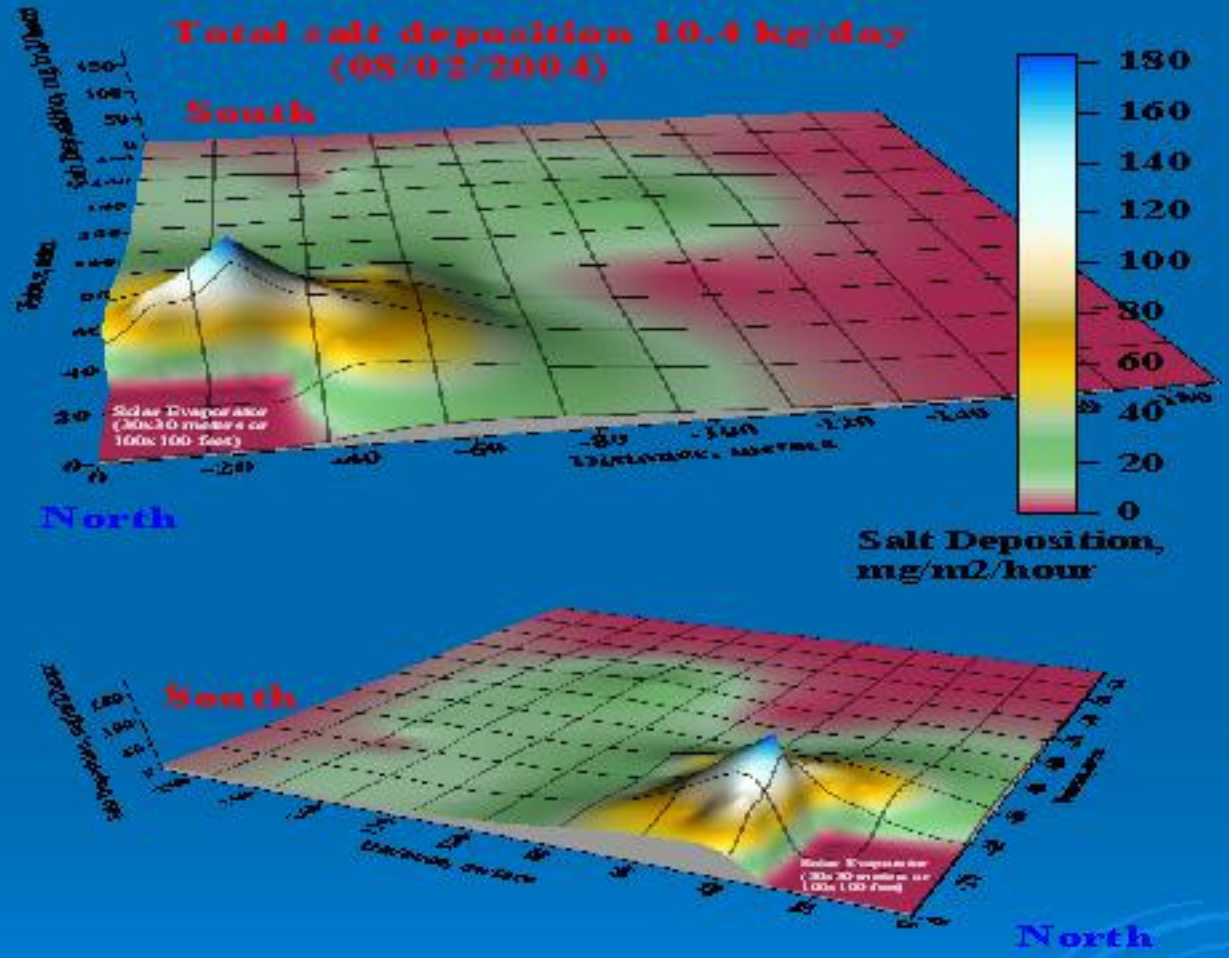


SOLAR EVAPORATOR

Relationship between actual evaporation (Eo pan) and enhanced evaporation

March-October 2004.

SOLAR EVAPORATOR
SALT DRIFT
Nozzles raised at 1.5 ft



Sodium Sulfate at Solar Evaporator RRR

Salt Utilization and Separation:
Extractable TDS Red Rock Ranch Constituents
Average % by Dry Weight and Average Market Price 2006

Sodium Sulfate	37%	$120/ton
Sodium Chloride	33%	$25/ton
Calcium Sulfate	16%	$30/ton
Magnesium Chloride	7%	$270/ton
Sodium Nitrate	3%	$300/ton
Calcium Carbonate	2%	
Boron	1%	$425/ton
Potassium Chloride	0.8%	$270/ton
Selenium	0.01%	$50/lb
Other	0.19%	

Current Agricultural Salt Management Activities

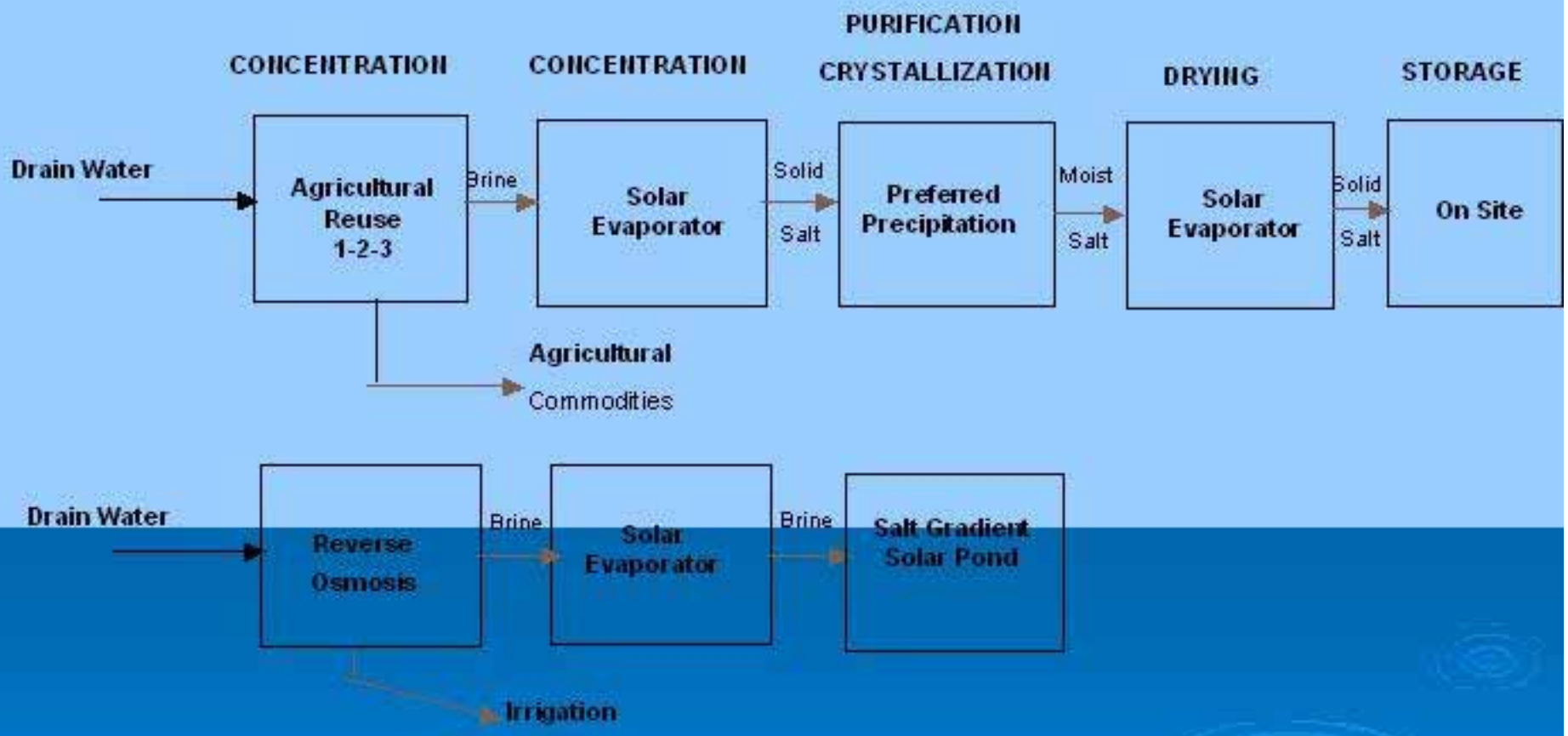
Discharge in Solar Evaporator (used as a part of IFDM a ZLD system)

Solar Evaporator Andrews Ag.

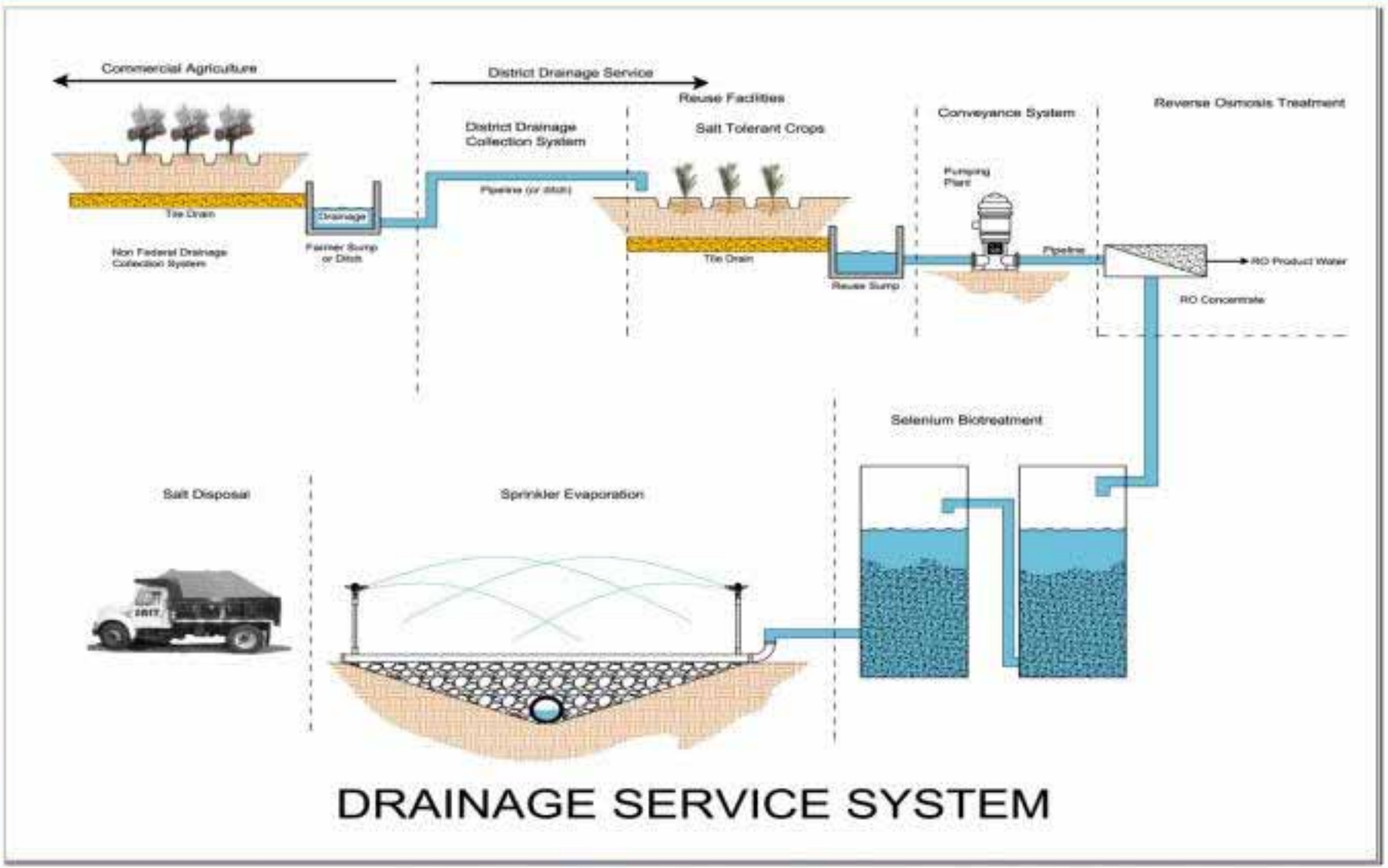
Stored Salts

Solar Evaporator Enhanced Evaporation
2-Naphthol Green Test Module at RRR

INTEGRATED ON FARM DRAINAGE MANAGEMENT PROCESS OPTIONS



REGIONAL INTEGRATED DRAINAGE MANAGEMENT SYSTEMS
Westlands Water District



DRAINAGE SERVICE SYSTEM

Regional Integrated Drainage Management systems
Grasslands Area Farmers

Drainage Reduction Process

Current Drainage Production

40,000 AF

Source Control and Recirculation: 18,500 AF remaining

Interception of Groundwater: 14,200 AF remaining

Concentrate Salts (Salt Tolerant Crops): 4,000 AF Remaining

Treatment and Disposal: 4000 AF

Zero Liquid Discharge

Salinity Solutions
SB 1347(Machado)

In 2002, SB 1372 was signed by Governor Davis, to encourage farmers to implement innovative and environmentally friendly drainage practices known as Integrated On-Farm Drainage Management.

In November 2006, Governor Schwarzenegger signed SB 1347, which makes a number of amendments to the original law, most importantly by allowing multiple farmers to use a single IFDM system to drain contiguous lands into one or more solar evaporators.

Multiple-farm IFDM systems will reduce the costs and risks to individual farmers, thus encouraging their use.

IFDM will become an increasingly important drainage management tool as the state proceeds to enforce conditions on farm runoff in the Central Valley.

SB 1347 (Machado) Solar Evaporators

Law revises required information submitted to the CVRWQCB

Allows multiples farms to use a single IFDM system

Alters the dates the solar evaporator must submit information to the CVRWQCB (every April and October)

Bimonthly collections of water flow and water quality data

Semiannual collection of groundwater monitoring data

Available Publications for IFDM

A Landowner's Manual
Managing Agricultural Irrigation Drainage Water

This manual serves as a guide for developing Integrated On-Farm Drainage Management systems and is the first part of an educational and outreach program to educate landowners on the advantages, disadvantages, costs, and environmental regulations involved within an IFDM.

A Technical Advisor's Manual
Managing Agricultural Irrigation Drainage Water

This manual is the second component of the program, and is designed to provide technical consultants and support personnel with the tools they need to assist farmers with developing and implementing an effective IFDM program.

Solar Evaporators: an Alternative for Evaporation Ponds

DEPARTMENT OF
WATER RESOURCES

Thank You