



RECLAMATION
Managing Water in the West

Lower Colorado River Basin Salinity Economic Impact Model

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Multi-State Salinity Coalition, Las Vegas, NV

Brief history

- Originally developed to assess water efficiency in the Lower Colorado River Basin in the 1980's
- A second model developed to improve representation of the Central Arizona Project in early 2000
- Both models used in tandem from 2003-2016
- Models are implemented within Excel

Recent efforts

- Improve usability, efficiency and transparency
- Combine and improve the models
 - Began in 2016
 - Effort overseen by a SEIM committee

SEIM Committee Representation

Federal	State	Agencies
Reclamation	Arizona	CAP and ADWR
	California	MWD and CRB
	Nevada	SNWA and CRC

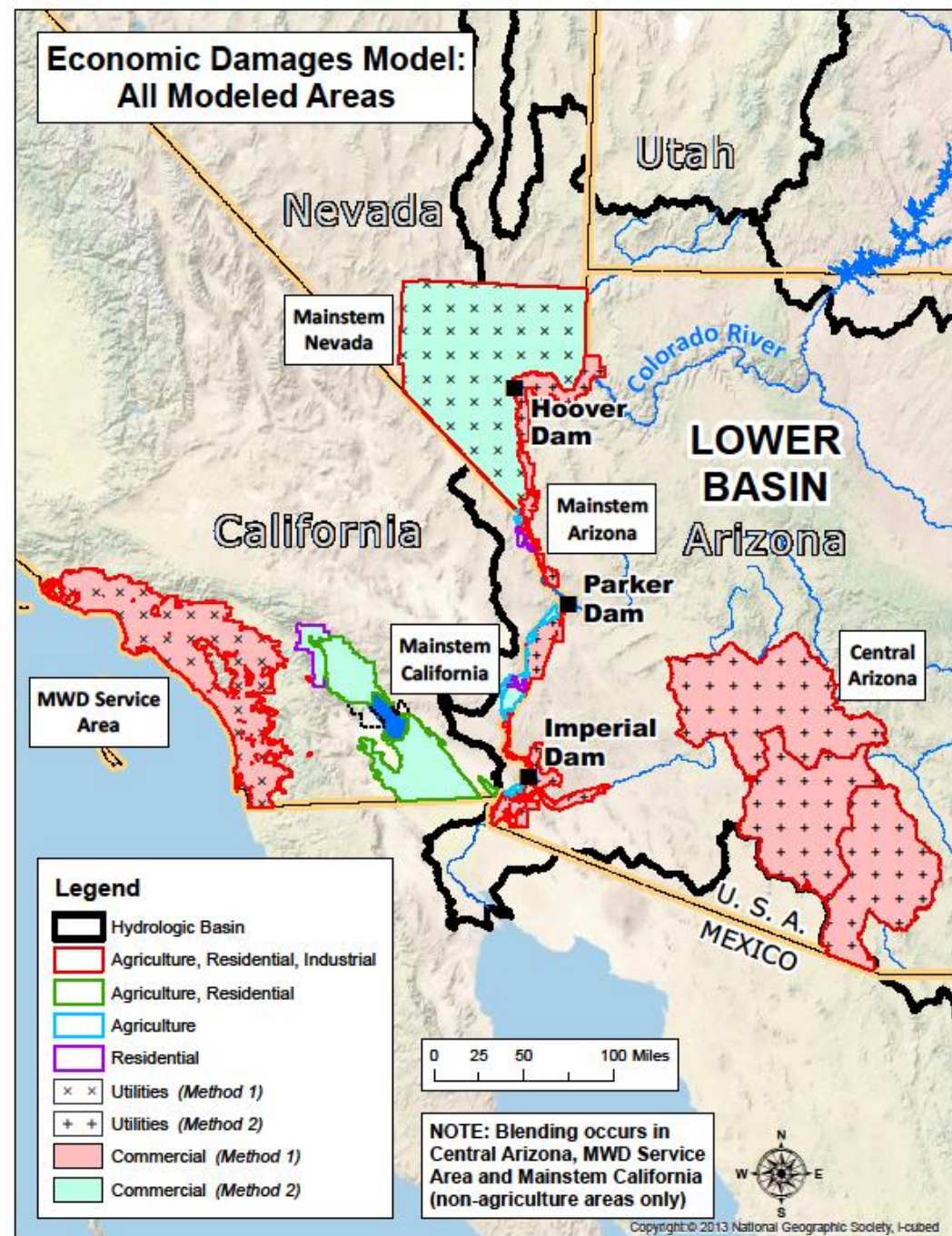
Model Structure

Locations, Damage Sectors, and Regions Included in SEIM

Diversion Points	Economic Sectors	Regions
Hoover Dam	Agriculture	Central Arizona
Parker Dam	Residential	Mainstem Arizona
Imperial Dam	Commercial	Mainstem Nevada
	Utility	Mainstem California, Non-MWD
	Industrial	MWD Service Area California
	Groundwater	
	Recycling & POTW ¹	

¹ Only applies to MWD Service Area

Model Spatial Extend



Model Structure

Subareas within Each Region included in SEIM

Region	Subarea
Central Arizona	Phoenix AMA ¹ , Pinal AMA, Tucson AMA
Mainstem Arizona	Mohave County, La Paz County, Yuma County
Mainstem Nevada	Clark County
Mainstem California Non-MWD	Imperial County, San Bernardino County, Riverside County
MWD	Northwest, Los Angeles, West Basin, Central Basin, San Gabriel, Chino Basin, Orange County, Western Riverside, San Diego, Eastern Riverside

¹ These are active management areas (AMA) in Central Arizona in which groundwater use is strictly regulated by the Arizona Department of Water Resources. Nearly 80% of Arizona's population resides in these 3 AMAs.

Economic Sector Impact Category Items

Economic Sector	Impact Category Items
Residential	Water Pipes, Water Heater, Faucet, Garbage Disposal, Clothes Washer, Dishwasher, Water Softener, Detergent
Commercial	Sanitary, Cooling, Irrigation, Kitchen, Laundry, Misc.
Industrial	Process Water, Cooling Tower, Boiler, Sanitation, Irrigation
Water Utilities	Treatment Plant, Distribution System
Groundwater	Direct Recharge, Indirect Recharge, Incidental Recharge
Recycled Water & POTW	Irrigation, Direct Groundwater Recharge, Indirect Groundwater Recharge
Agriculture	MWD Subareas Crops: Strawberry, Nursery, Cut Flowers, Misc. Vegetable, Citrus, Avocado, Vineyard, Pasture/grain, Deciduous, Field Crops All Other Subareas Crops: Head Lettuce, Leaf Lettuce, Romaine Lettuce, Broccoli, Cauliflower, Alfalfa Hay, Onions, Avocados, Cantaloupe, Carrots, Oranges, Tangerines, Lemon/Limes, Grapefruit, Table Grapes, Potatoes, Corn, Wheat, Cotton, Barley, Olives, Honeydews, Tomatoes, Leaching Management Costs

Modeling cost relationships

- Relies on damages functions for each sector
- Founded on 4 studies
 1. Lohman, Loretta C., J. Gordon Milliken, and William S. Dorn with Kyle E. Tuccy. (1988). *Estimating the Economic Impacts of Salinity of the Colorado River, Final Report, February 1988*. Littleton, CO: Milliken Chapman Research Group, Inc
 2. Brummer and Yahnke. (1999). *Crop Salinity Damage Estimation Procedures*
 3. Metropolitan Water District of Southern California and Bureau of Reclamation. (1999). *Salinity Management Study, Final Report, Technical Appendices*.
 4. Bureau of Reclamation. (2003). *Central Arizona Salinity Study*

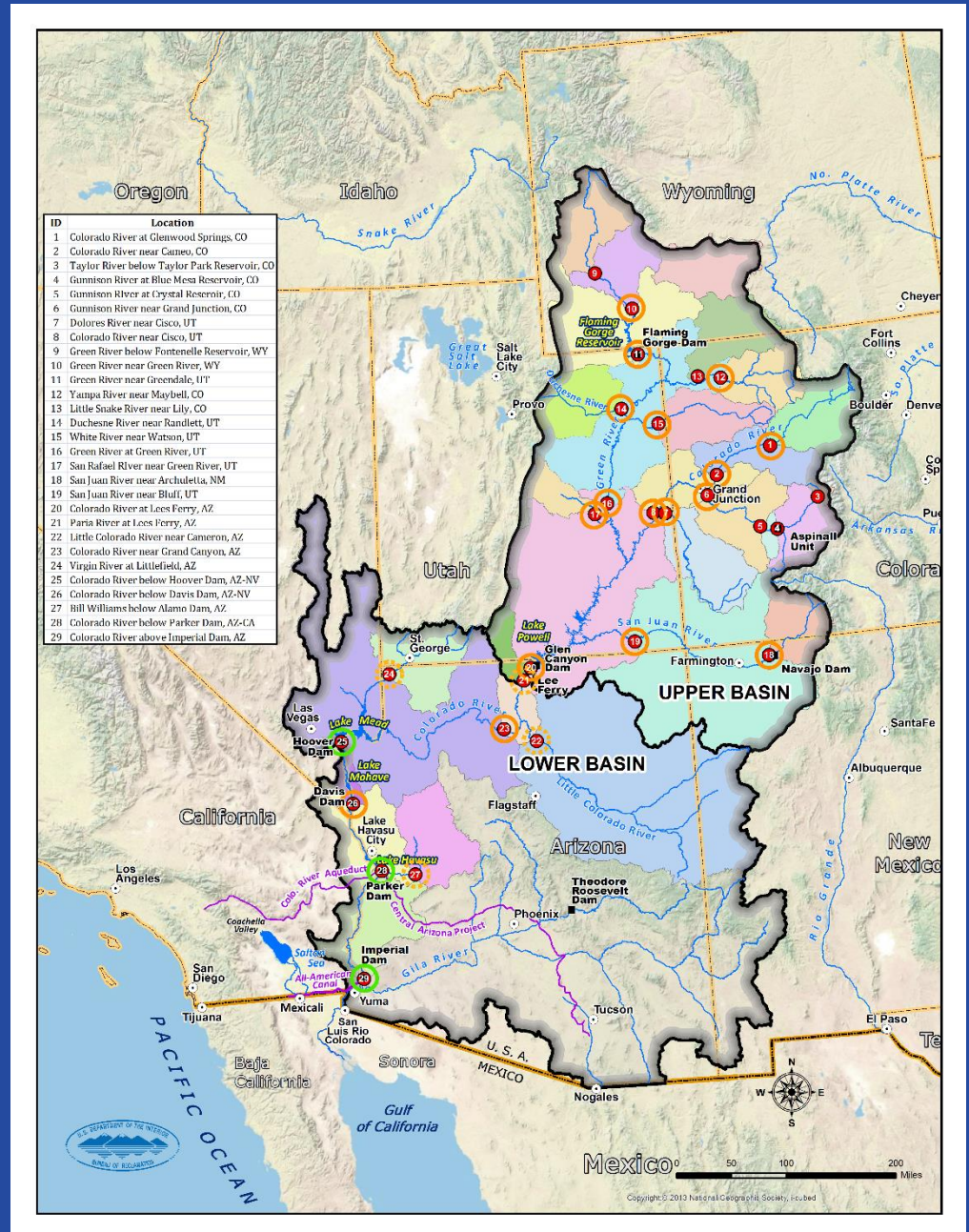
Modeling approach

- Estimates economic impacts due to salinity concentration as compared to baseline 500 mg/L
- All annual costs are reflected as 2014 dollars
- Includes costs related to
 - leaching agricultural lands in Central AZ
 - Blending local water sources with Colorado River Water in the MWD Service Area and Central AZ
- Recently updated with States help
 - Population
 - Non Agricultural Water use
 - Irrigated Acres and Crop Distribution

Monitoring Network

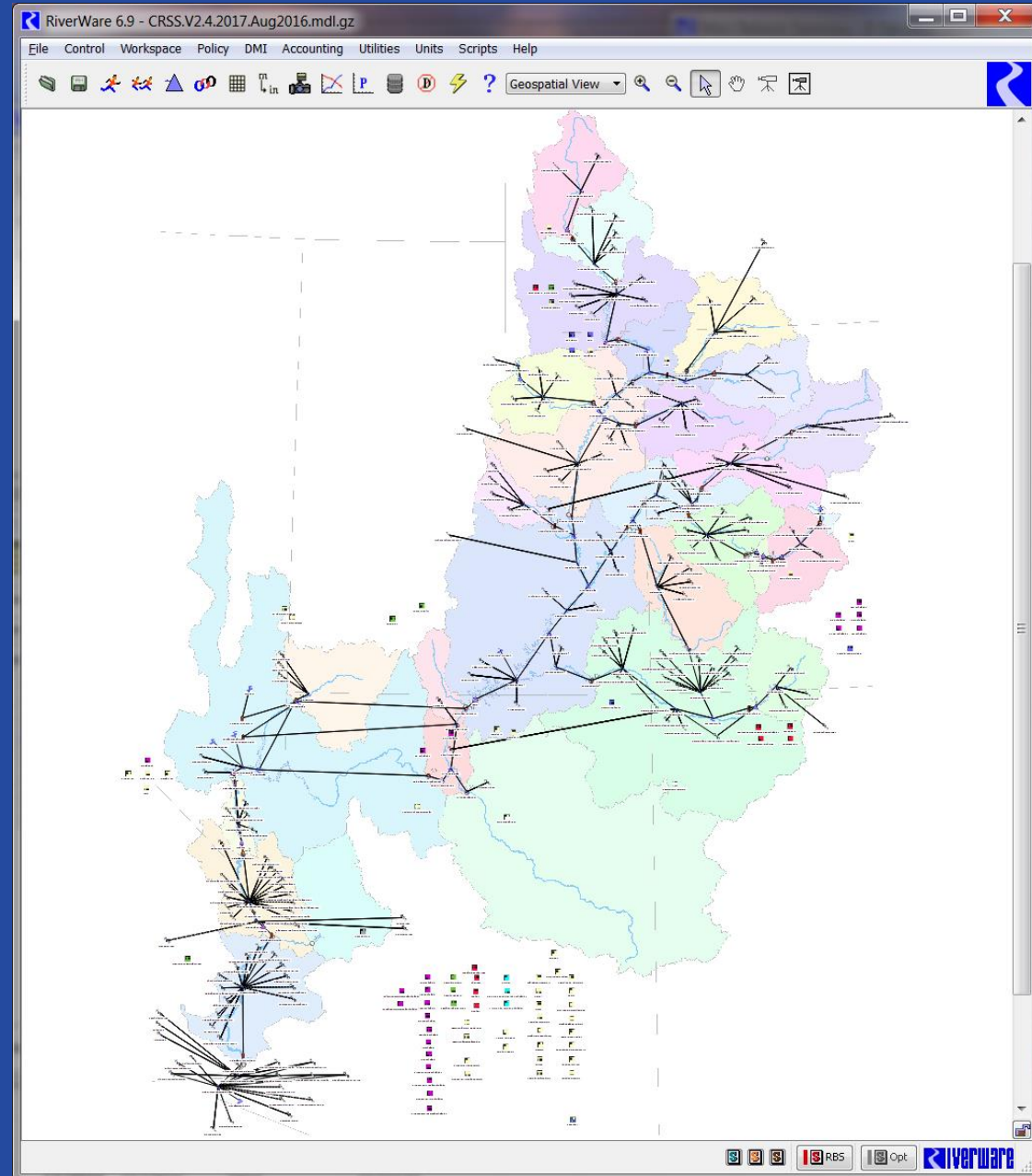
- Salinity gaging sites
 - 15 upper basin
 - 5 lower basin
 - 3 numeric criteria sites

- Flow gaging sites
 - 21 upper basin
 - 8 lower basin



Colorado River Simulation System (CRSS)

- Long-term basin planning model
- Captures basin policy
- Developed in RiverWare (Zagona et al. 2001)
- Run on a monthly time step



Example SEIM Results

2035							
	Average Annual Concentration (mg/L)			Average Annual Quantified Damages (\$ millions)			
Alternative	Hoover	Parker	Imperial	Hoover	Parker	Imperial	Total
1.33M tons removed	641	660	797	\$78.361	\$222.814	\$273.013	\$574.188
1.39M tons removed	636	655	791	\$75.583	\$215.347	\$267.124	\$558.054
1.66M tons removed	619	637	769	\$66.120	\$188.775	\$245.541	\$500.436
1.79M tons removed	611	630	760	\$61.665	\$179.040	\$236.710	\$477.415

Annual Damages and Damage Reductions under the 2017 Review

Alternative	Salinity Reduction at Imperial Dam in 2035 (mg/L)	Total Quantified Damages (2014 Dollars)	Annual Damage Reductions as Compared to No Additional Future Controls Beyond 2017
1.33 Mtons removed	--	\$574.2M	--
1.39 Mtons removed	6	\$558.1M	\$16.1M
1.66 Mtons removed	28	\$500.4M	\$73.8M
1.79 Mtons removed	37	\$477.4M	\$96.8M

All damage and reduced-damage estimates correspond to year 2035.

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