

# Colorado River Basin Salinity Control Program

**Don Barnett, P.E., P.G.**  
**Colorado River Basin Salinity Control Forum**

WESTCAS 2015 Fall Conference  
October 29, 2015  
Tucson, AZ



# Outline

- Quick Overview
- Impetus for the Program
- Early History
- Organization of the Forum
- Why a Salinity Problem
- Program Nuts and Bolts
- Program Funding
- Economic Damages



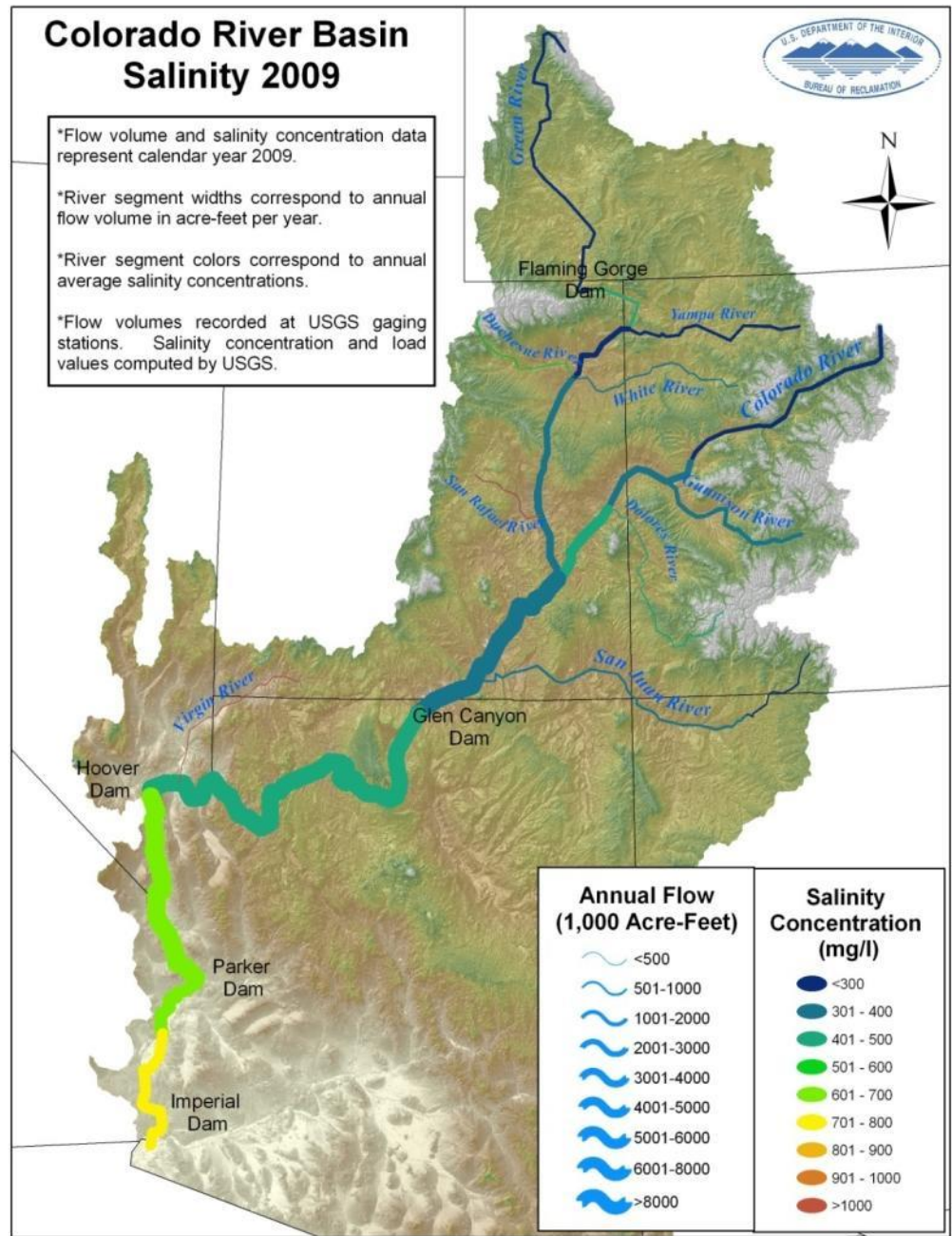
# The “Greatest”

## Facts/Results:

The Colorado River Basin Salinity Control Program...

- reduced the annual salt load by about 1.3M tons (1.2M tonnes)
- reduced the concentration at Imperial Dam by 90-100 mg/L (80-90 mg/L below Hoover)
- reduced quantified damages by several hundred million \$/yr
- \$50/ton

The Colorado River's salinity concentration increases from about 50 mg/L to 800 mg/L plus as it flows from its headwaters to the lowest diversion in the United States









# *Tale of Two Rivers*





# Upper Basin

- Good Quality Water
- Limited M&I Usage
- Often High Spring Water Supply
- Marginal Farm Economic Output
- Underlain by Saline Soils





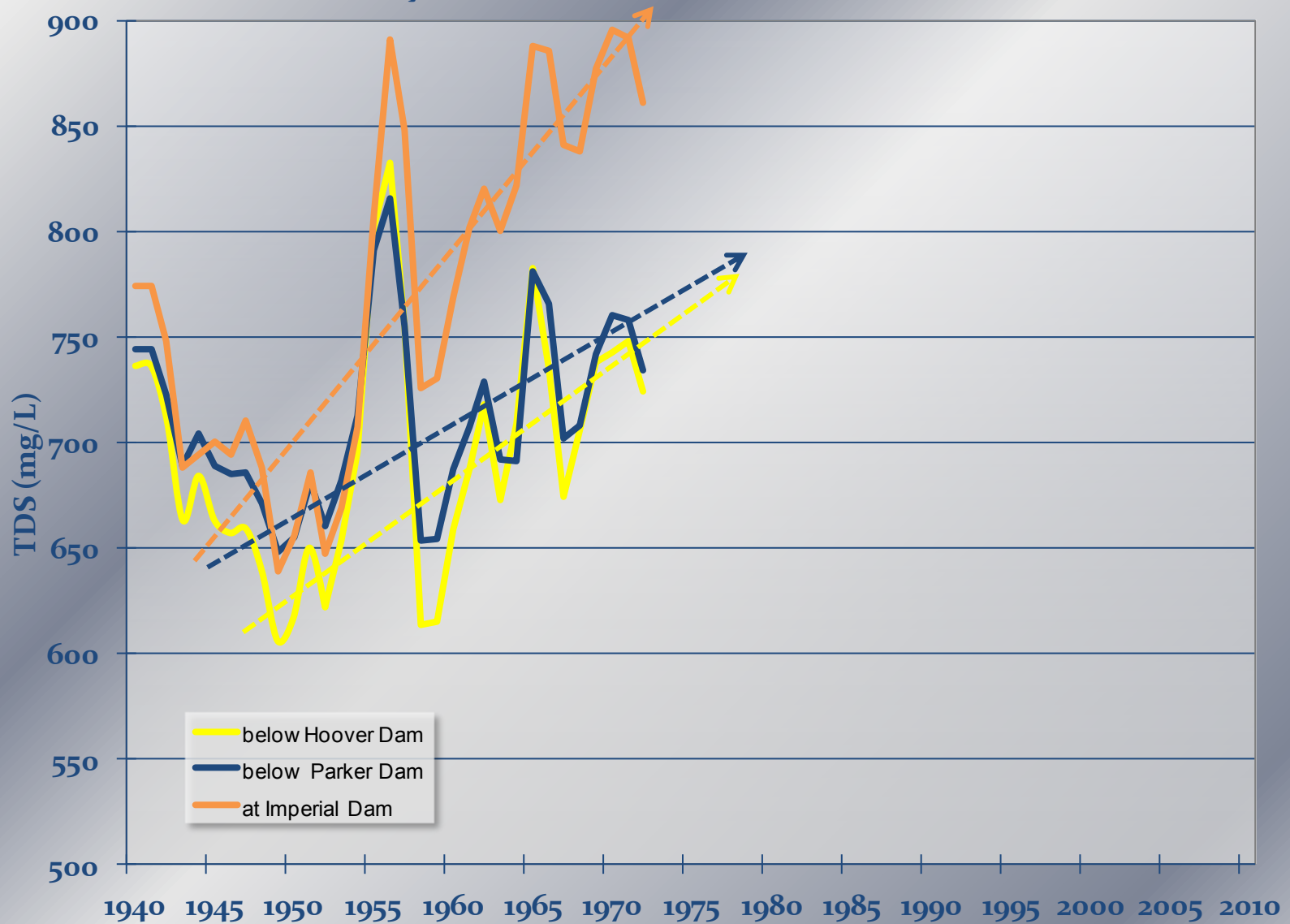
# Lower Basin

- Significant M&I Usage
- Very High Economic Output from Farms
- Have Saline Soils
- Need to Deal with Saline Water Supply





## Colorado River Salinity Concentrations at Numeric Criteria Sites

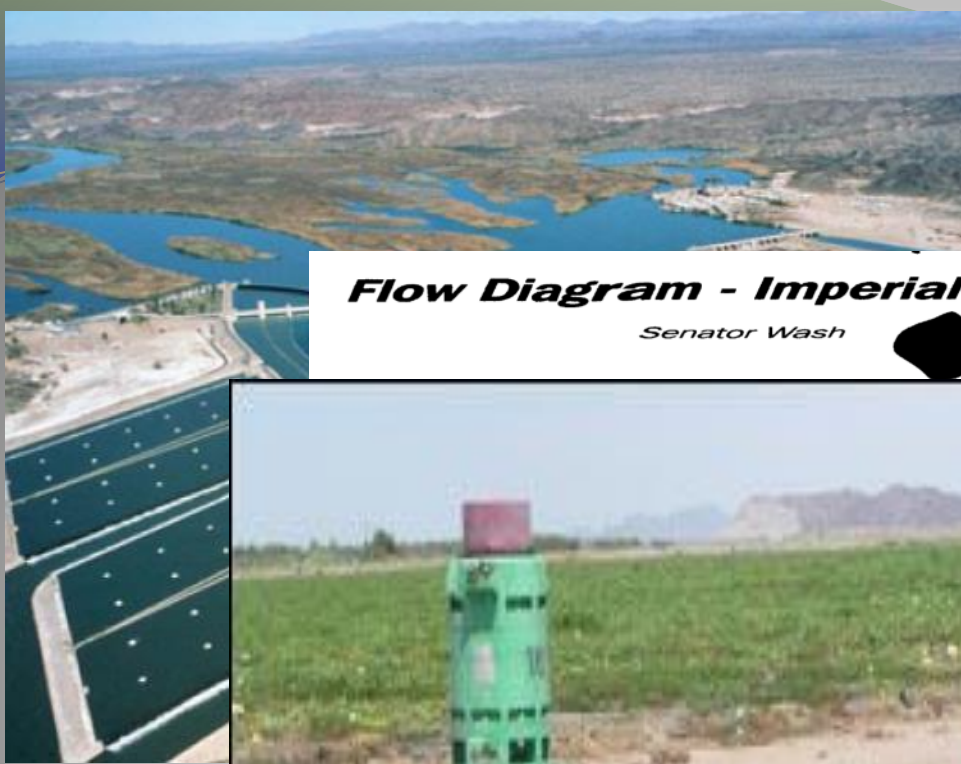


# Salinity Control Program History

- Early 1970's
  - Salinity of the Colorado River was rising
  - Significant concerns by Mexico







# ogram History

## Flow Diagram - Imperial Dam to SIB - 1995

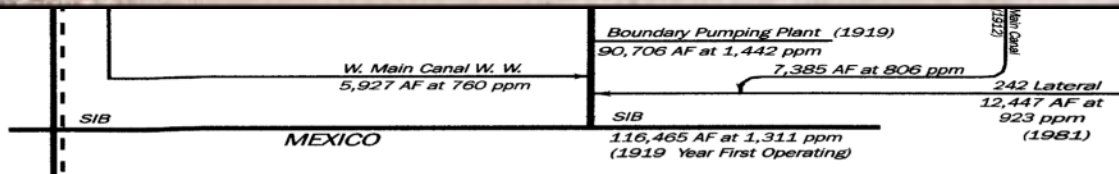
Senator Wash



6,064,340 AF at 788 ppm

Imperial Dam

243,040 AF at 795 ppm



Unmeasured Return Flows: 60,357 af at 1,859 ppm

--- = MOD, MODE, Bypass Drain

() = Date facility put in operation

/adams/don's stuff/Don9.cdr

4/10/1995 2:04 PM

ect

# Salinity Control Program History

- Early 1970's

- Salinity of the Colorado River was rising
- Significant concerns by Mexico
- The Basin States were concerned about the implications of the newly passed Federal Water Pollution Control Act amendments





# Salinity Control Program History

- 1973 – created the Colorado River Basin Salinity Control Forum (Forum)
  - Conference on the Matter of the Pollution of the Interstate Waters of the Colorado River and its Tributaries (concl'd 1972)





# Colorado River Basin SALINITY CONTROL FORUM

## GOVERNORS

Doug Ducey, AZ  
Jerry Brown, CA  
John Hickenlooper, CO  
Brian Sandoval, NV  
Susana Martinez, NM  
Gary R. Herbert, UT  
Matthew H. Mead, WY

## FORUM MEMBERS

### Arizona

Thomas Buschatzke  
Marie Pearthree  
Linda Taunt

### California

Bill Hasencamp  
Thomas Howard  
Tanya Trujillo

### Colorado

James Eklund  
Pat Pfaltzgraff  
David W. Robbins

### Nevada

Leo M. Drozdoff  
John J. Entsminger  
Jayne Harkins

### New Mexico

Tom Blaine  
Trais Kliphuis

### Utah

Leah Ann Lamb  
Eric Millis  
Gawain Snow

### Wyoming

Patrick T. Tyrrell  
David Waterstreet

## EXECUTIVE DIRECTOR

Don A. Barnett

106 West 500 South, Ste. 101

Bountiful, UT 84010

(801) 292-4663

[dbarnett@barnettwater.com](mailto:dbarnett@barnettwater.com)

[www.coloradoriversalinity.org](http://www.coloradoriversalinity.org)

- Interstate Organization
- Governors Appoint up to 3 Forum Members
- Generally:
  - Water Quantity Lead
  - Water Quality Lead
  - Major Water User Rep.
- No Rules/Bylaws
- Have Done Things for more than 40 Years by Consensus
- Meets 2 Times Each Year
- Each State Pays Dues
- Has a Standing Technical Work Group and Committees as Needed
- Forum's Roles:
  - Communicator
  - Consensus Builder
  - Advocate and Lobbyist
  - Cheerleader/Pusher
- COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL

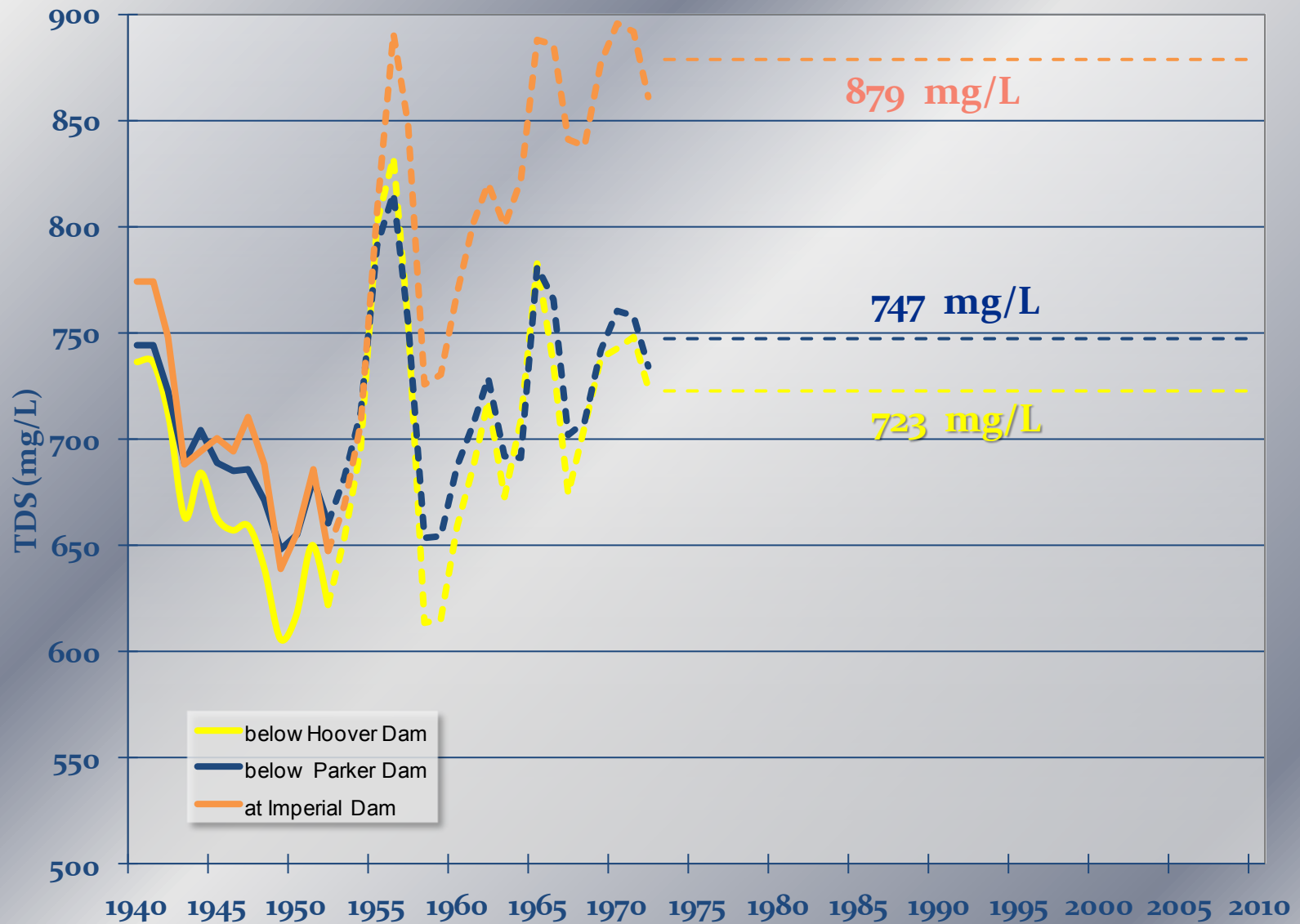


# Salinity Control Program History

- 1973 – created the Colorado River Basin Salinity Control Forum (Forum)
  - Conference on the Matter of the Pollution of the Interstate Waters of the Colorado River and its Tributaries (concl'd 1972)
- 1974 – passed the Colorado River Basin Salinity Control Act (Act)
  - Title I and Title II
- 1975 – adopted salinity standards for the Colorado River



## Colorado River Salinity Concentrations at Numeric Criteria Sites



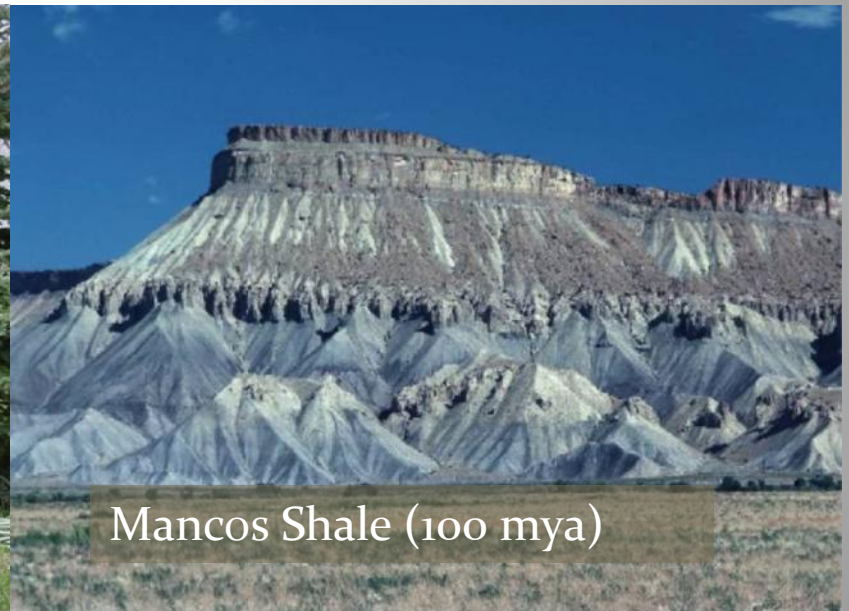


# Why is There a Salinity Issue in the Colorado River Basin?

It's the geology...



Paradox Basin (and Eagle) evaporites (300 mya)



Mancos Shale (100 mya)

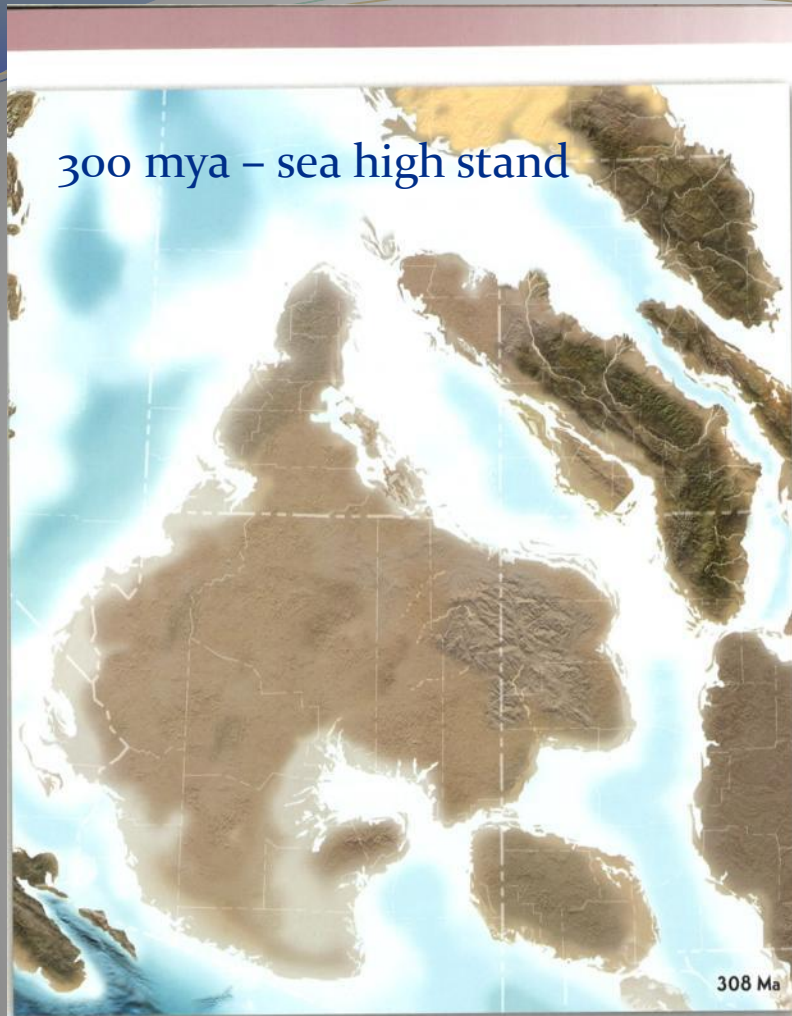


About 300 mya –  
formation of  
Pangea super  
continent

(paleogeographic map  
from Blakey and  
Ranney, 2008)

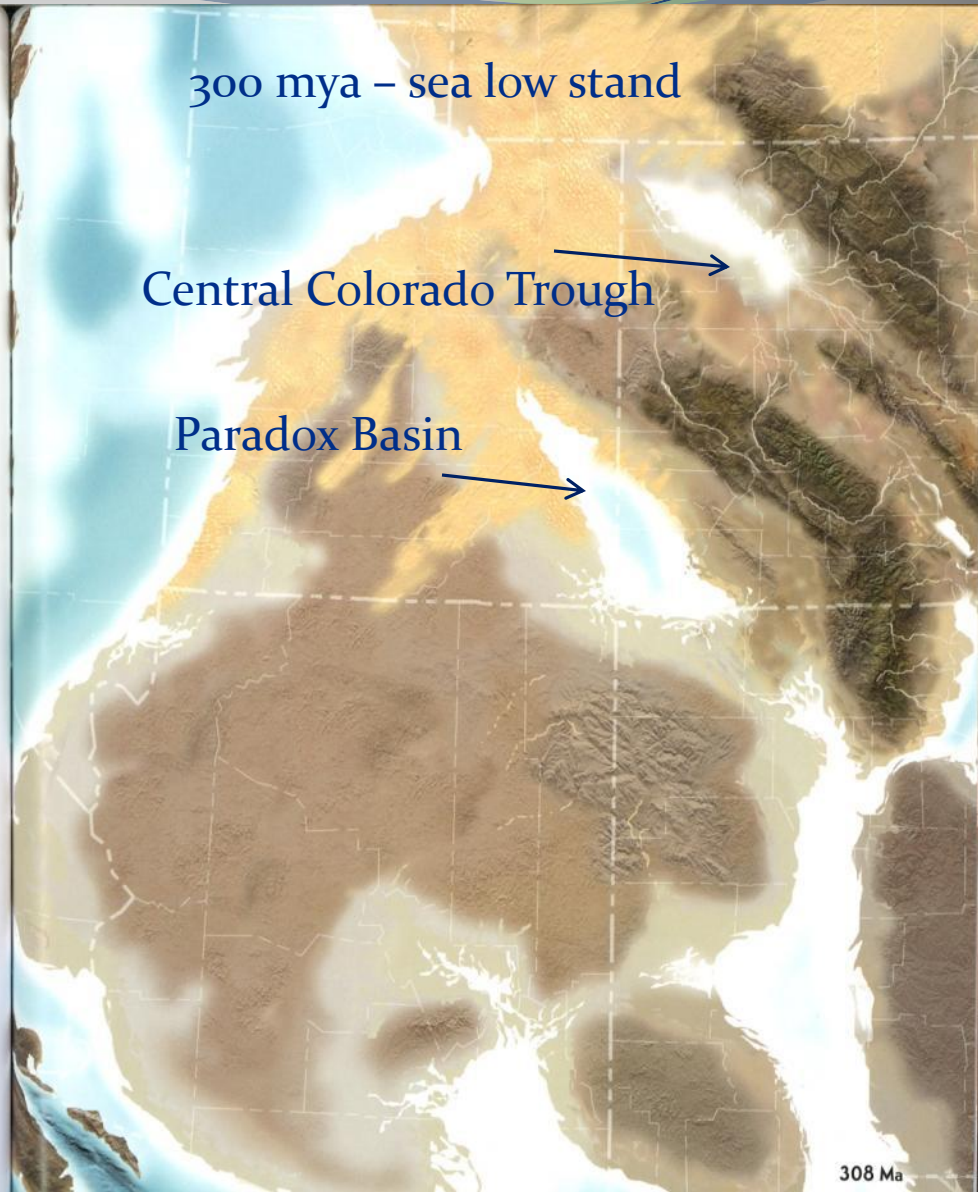






Above: Middle Pennsylvanian paleogeography (308 Ma). This map shows deposition during a sea level high. In southwestern Colorado and southeast Utah, normal marine deposits of the Paradox Formation were preserved.

Opposite: Middle Pennsylvanian time (308 Ma) during low sea level. The Paradox and Eagle basins became the sites of isolated seas (like the modern Caspian Sea), and large amounts of salt precipitated in the warm, restricted water. Calculations suggest a 400–600-foot difference between high and low sea levels, and the changes may have occurred rapidly in less than 200,000 years. As many as sixty cycles have been documented and resulted from fluctuating glaciations in the Southern Hemisphere.





Paradox Evaporite Diapir

Overlying Bedrock

Roaring Fork River



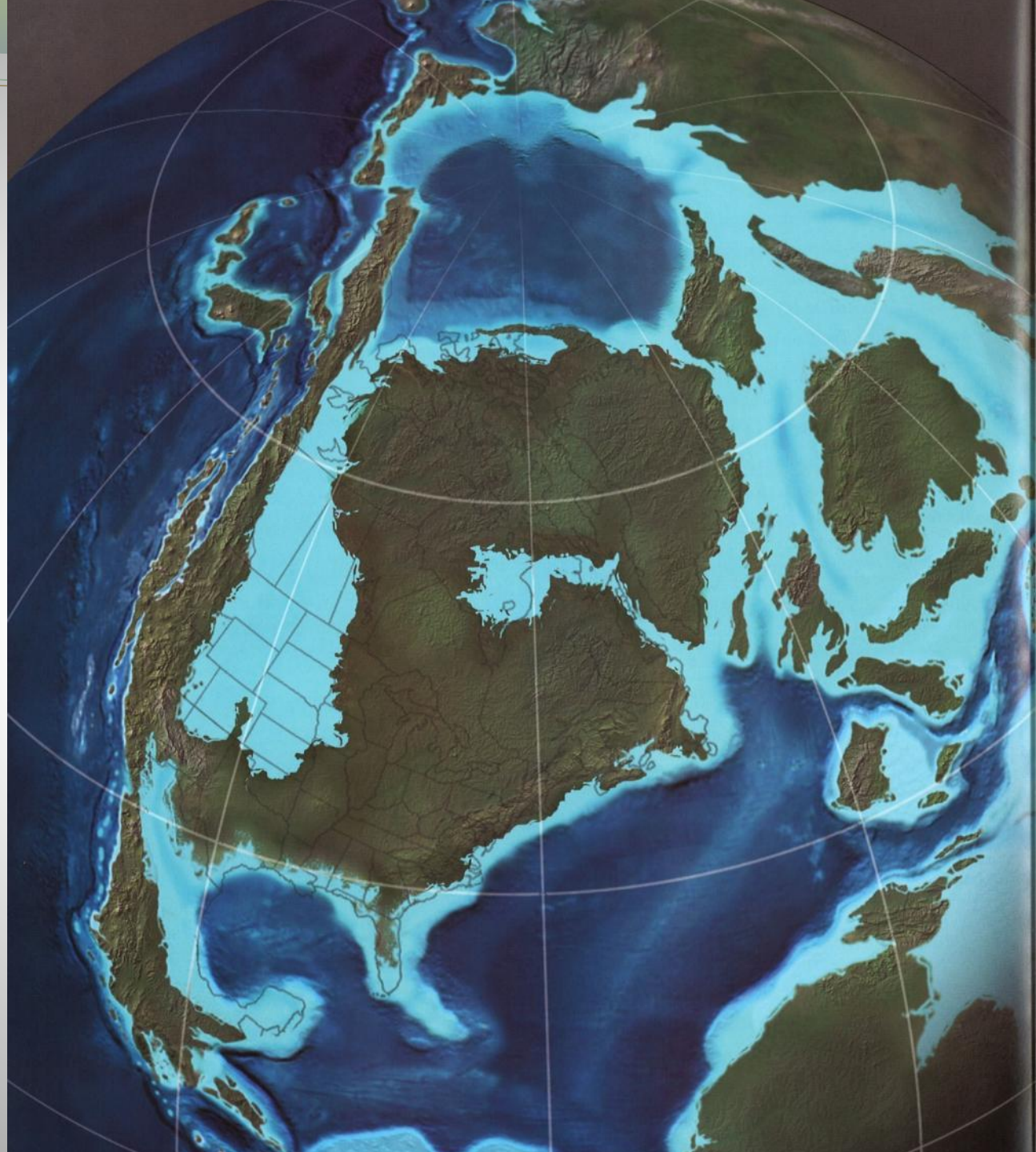






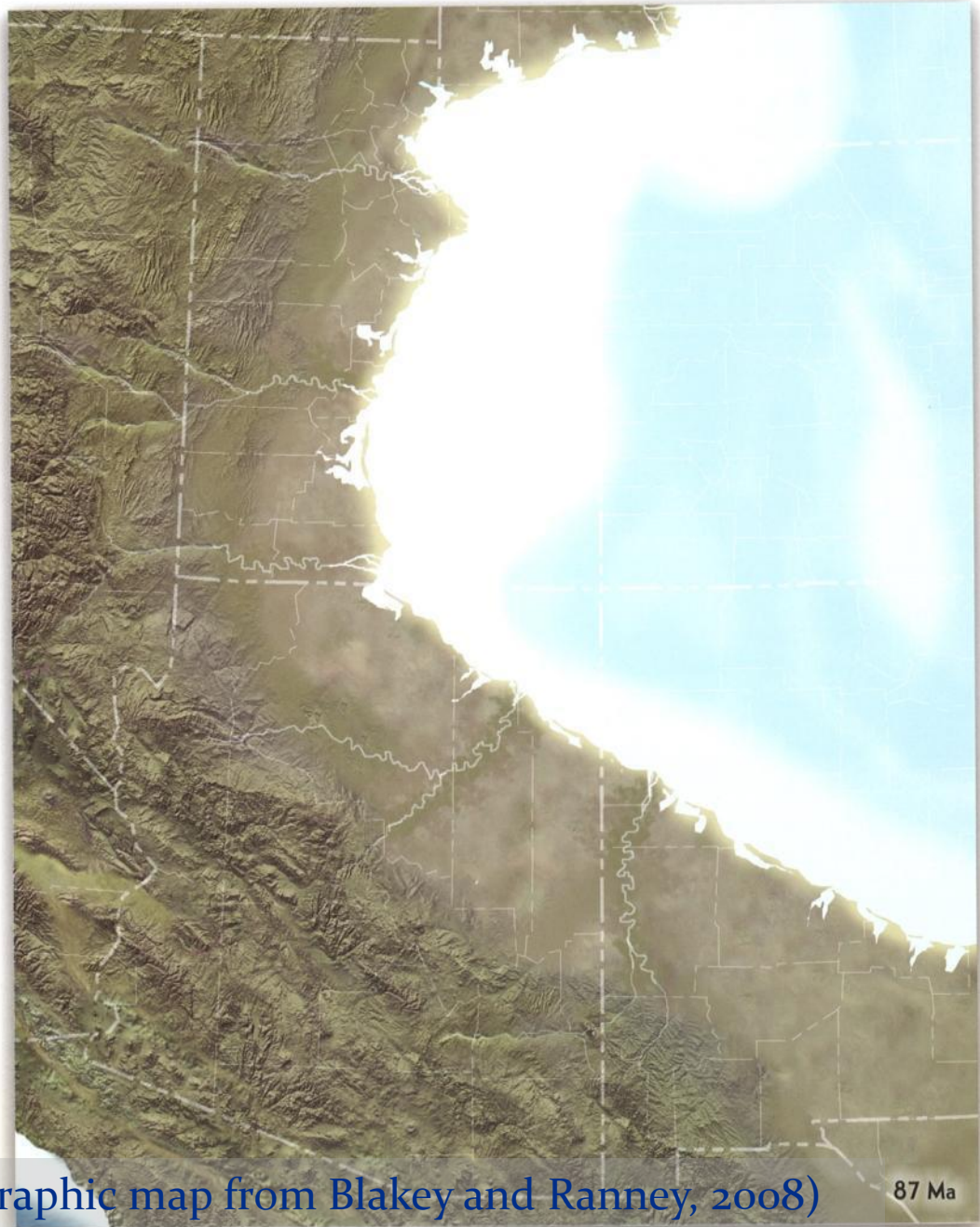
# About 100 mya – transgression of Western Interior Seaway

(paleogeographic map from  
Blakey and Ranney, 2008)





# Deposition of Cretaceous Mancos Shale during transgression of Great Western Interior Seaway



(Paleogeographic map from Blakey and Ranney, 2008)

87 Ma

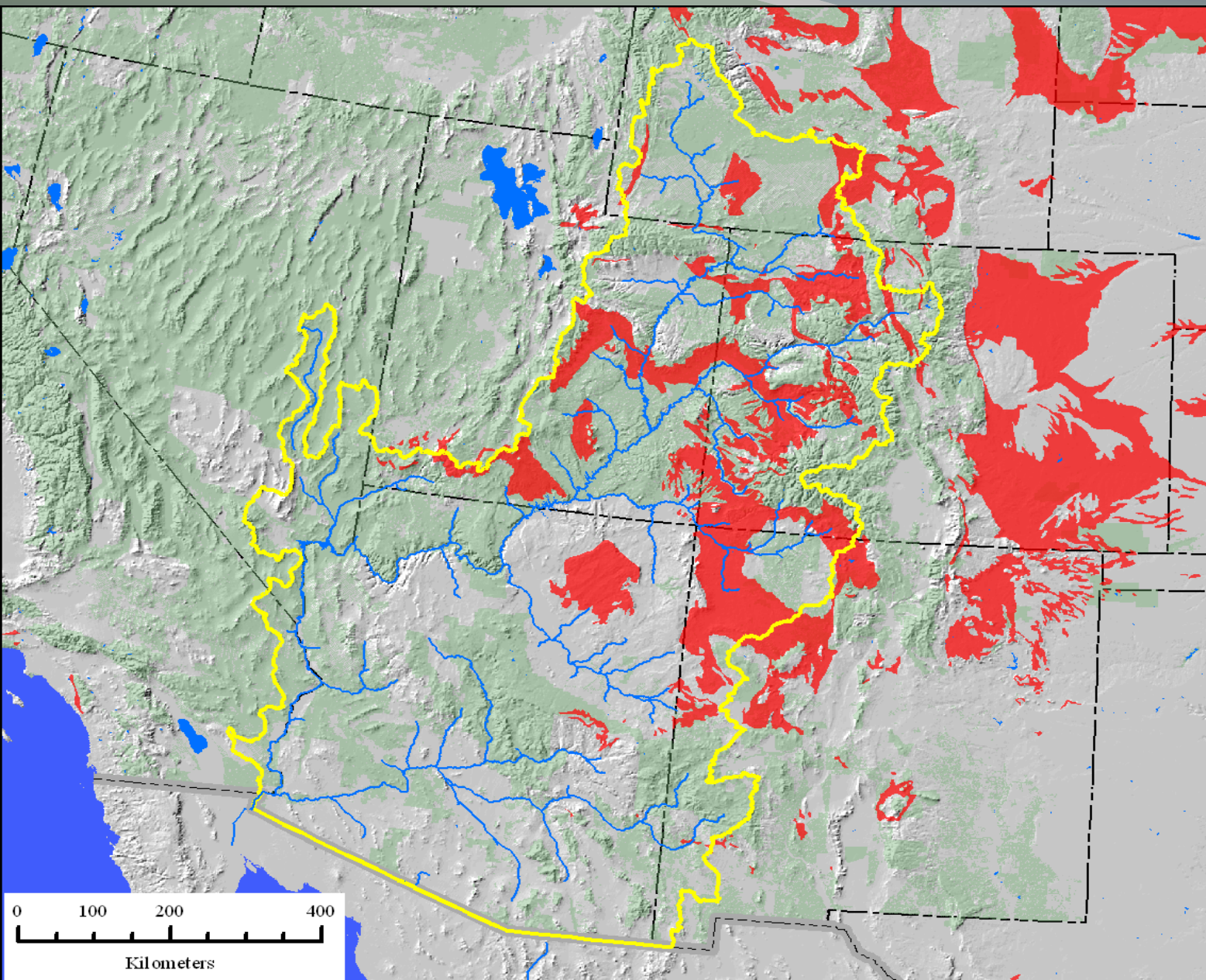


*Above: Late Cretaceous (Coniacian) paleogeography (87 Ma) during transgression of Mancos Shale*



# Mancos Shale

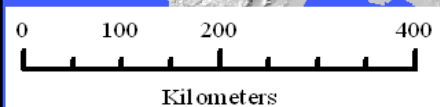




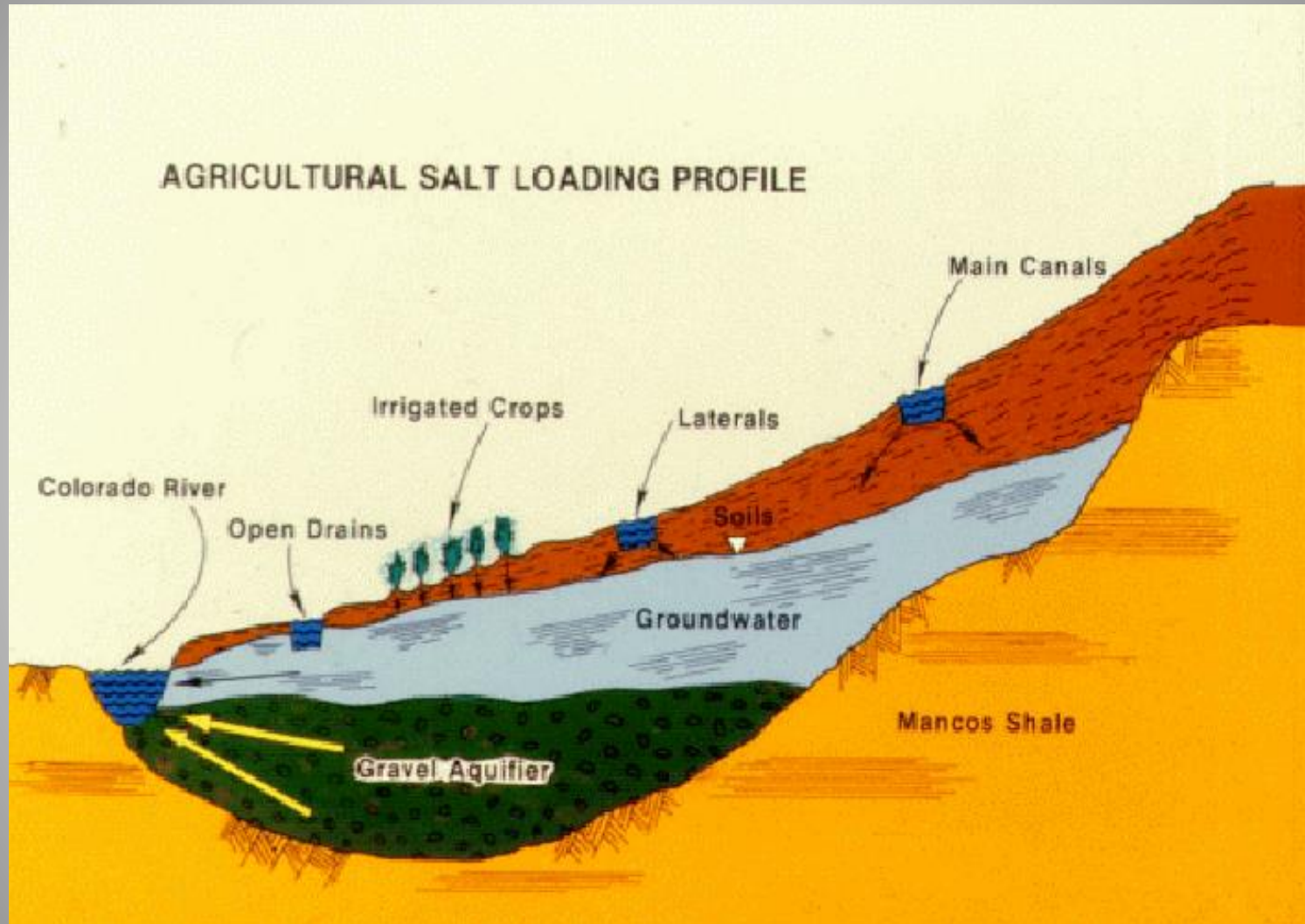
**Colorado  
River Basin**



**Mancos  
Shale**



# Irrigation Sources





# Salinity

- Non-

- Lin

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- Point

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- Sal

- Re

- Plugging of saline wells (BLM)

- Basinwide Program
- FOA
- \$8M Appropriation
- \$3.5M Cost Share



n)



- EQIP
- Applications by Producers
- \$12M Appropriation
- \$5.2M Cost Share





- BLM
- Soil Water and Air Program
- \$1M Appropriation
- \$0M Cost Share





# Salinity Control

- Non-Point Source Activities
  - Lining and piping of canals
  - On-farm irrigation efficiency
  - Rangeland improvement
- Point Source Activities
  - State NPDES administration pursuant to Forum's policies (7 States and EPA)
  - Saline spring disposal (Paradox Valley Unit, Reclamation)
  - Plugging of saline wells (BLM)





# Salinity Control Program Efforts

- Non-Point Source Activities
  - Lining and piping of canals and ditches (Reclamation)
  - On-farm irrigation efficiency improvements (NRCS)
  - Rangeland improvements (BLM)
- Point Source Activities
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# Paradox Valley Unit (PVU)



La Sal Mountains (recharge)

brine

Dolores River

deep  
injection well

shallow collection wells





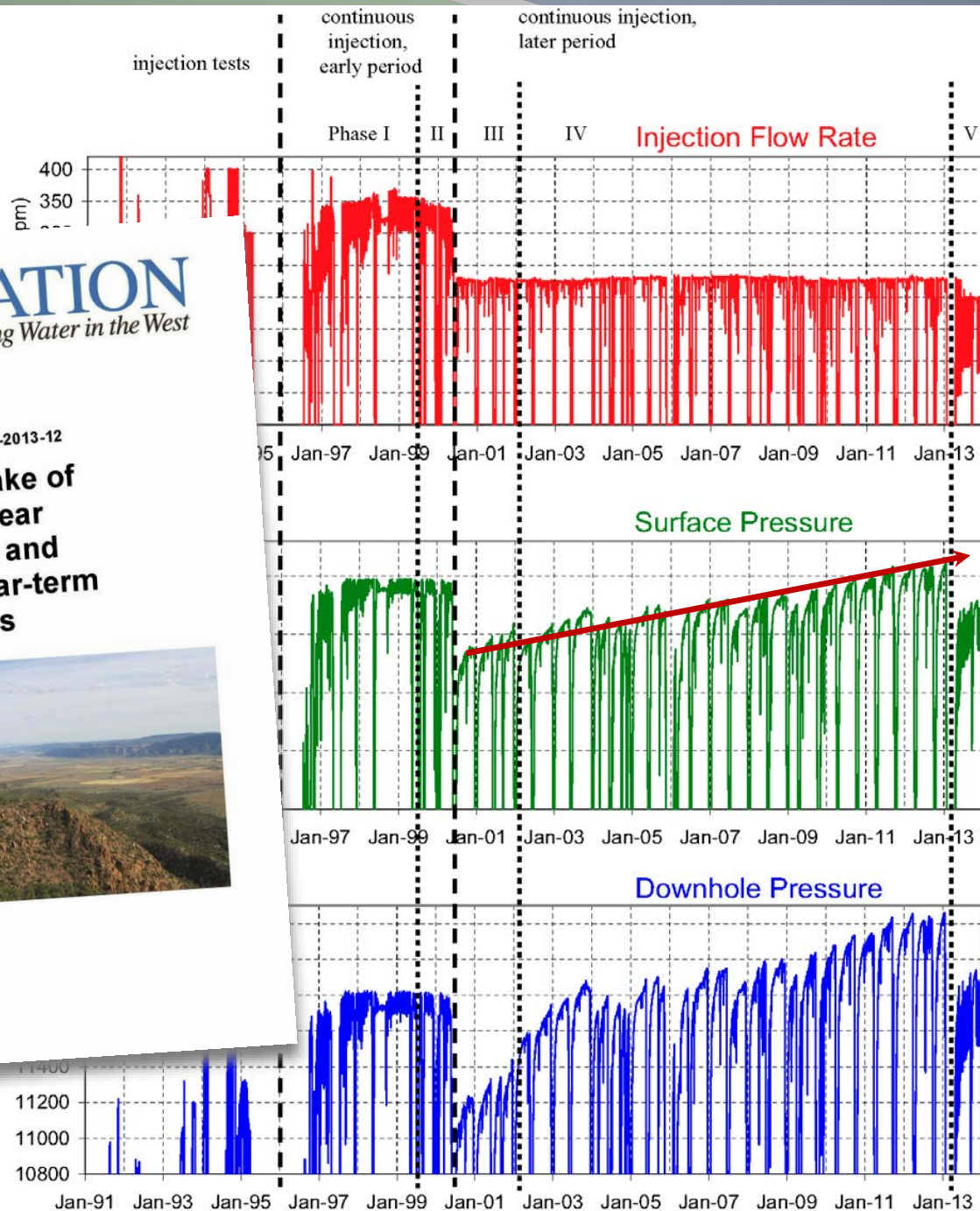
# RECLAMATION

Managing Water in the West

Technical Memorandum TM-86-68330-2013-12

## The $M_L$ 4.4 Earthquake of January 24, 2013, Near Paradox, Colorado, and Implications for Near-term Injection Operations

Colorado Basin  
Salinity Control  
Project,  
Paradox Valley  
Unit, Colorado  
Upper Colorado  
Region



# Salinity Control Program Efforts

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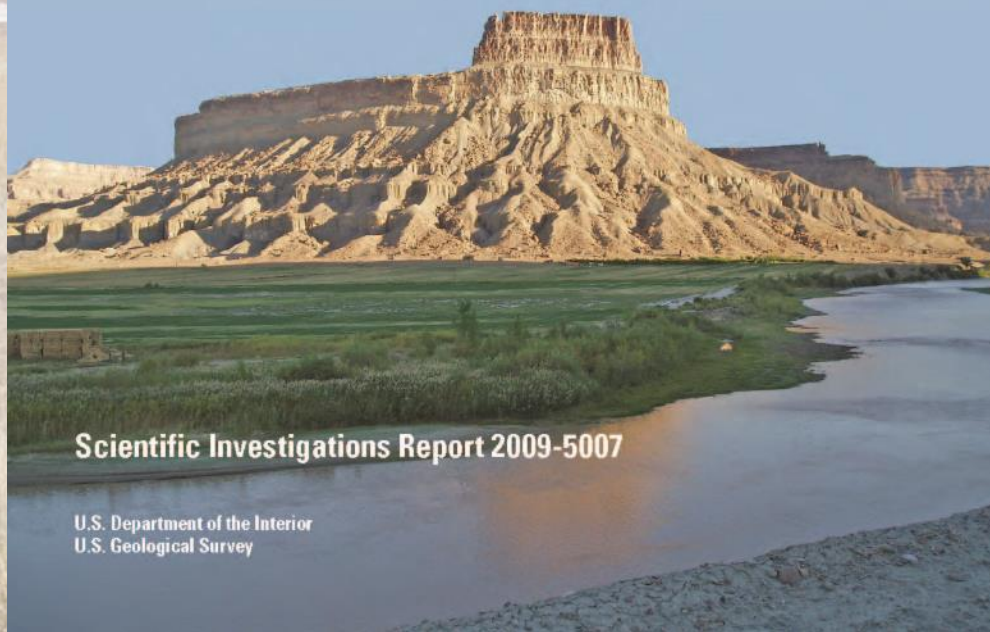


# Science Support (USGS)



Prepared in cooperation with the U.S. Department of the Interior Bureau of Reclamation and Bureau of Land Management

## Spatially Referenced Statistical Assessment of Dissolved-Solids Load Sources and Transport in Streams of the Upper Colorado River Basin



Scientific Investigations Report 2009-5007

U.S. Department of the Interior  
U.S. Geological Survey



# How is the Program Funded

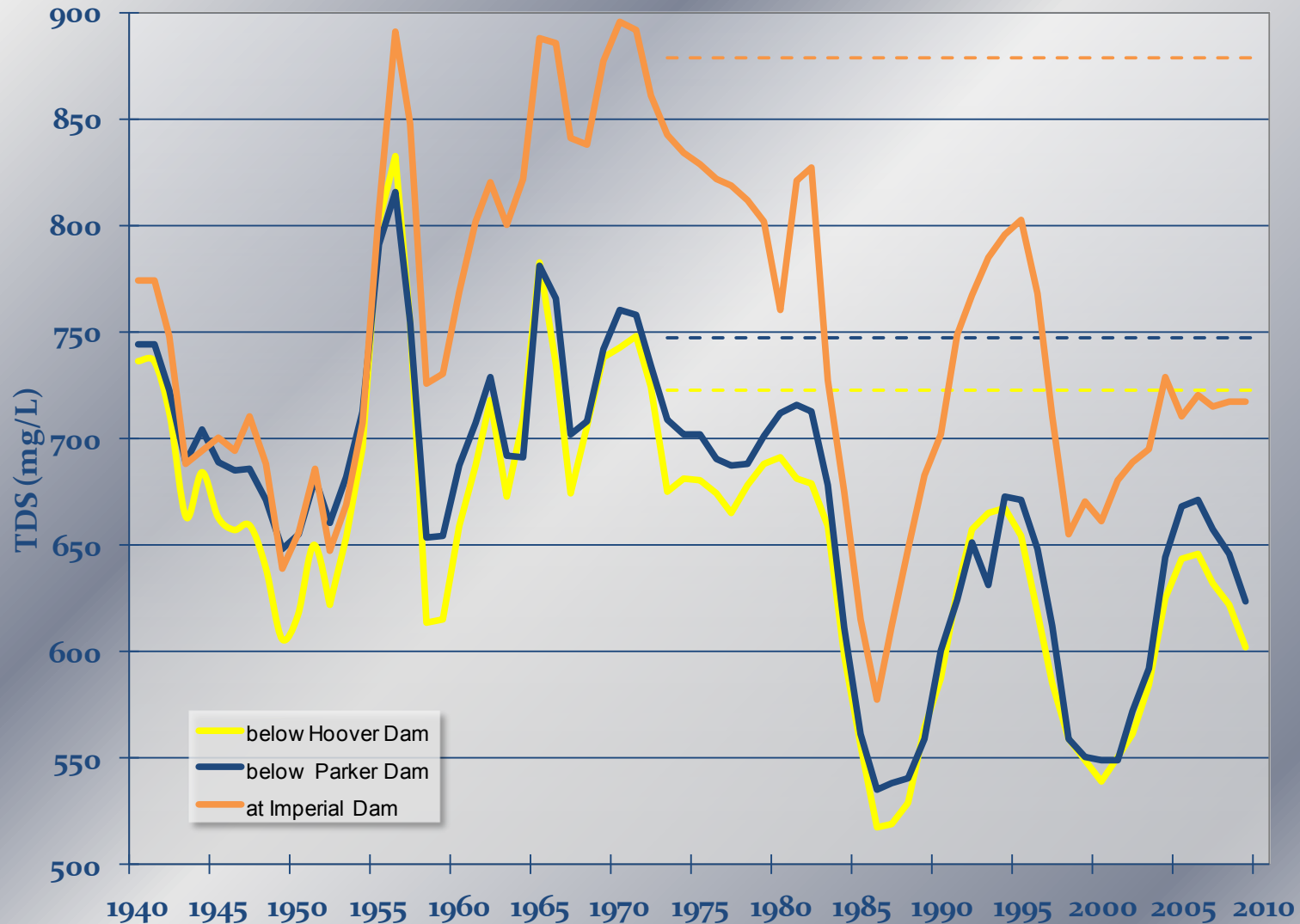
- Act provides that because “most” of the salt comes from federally administered lands:
  - 70% paid by federal government
  - 30% paid as cost-share by basin states through the Basin Funds (generated from a mill levy on power sales)
  - However, Program participants also cost-share in their projects



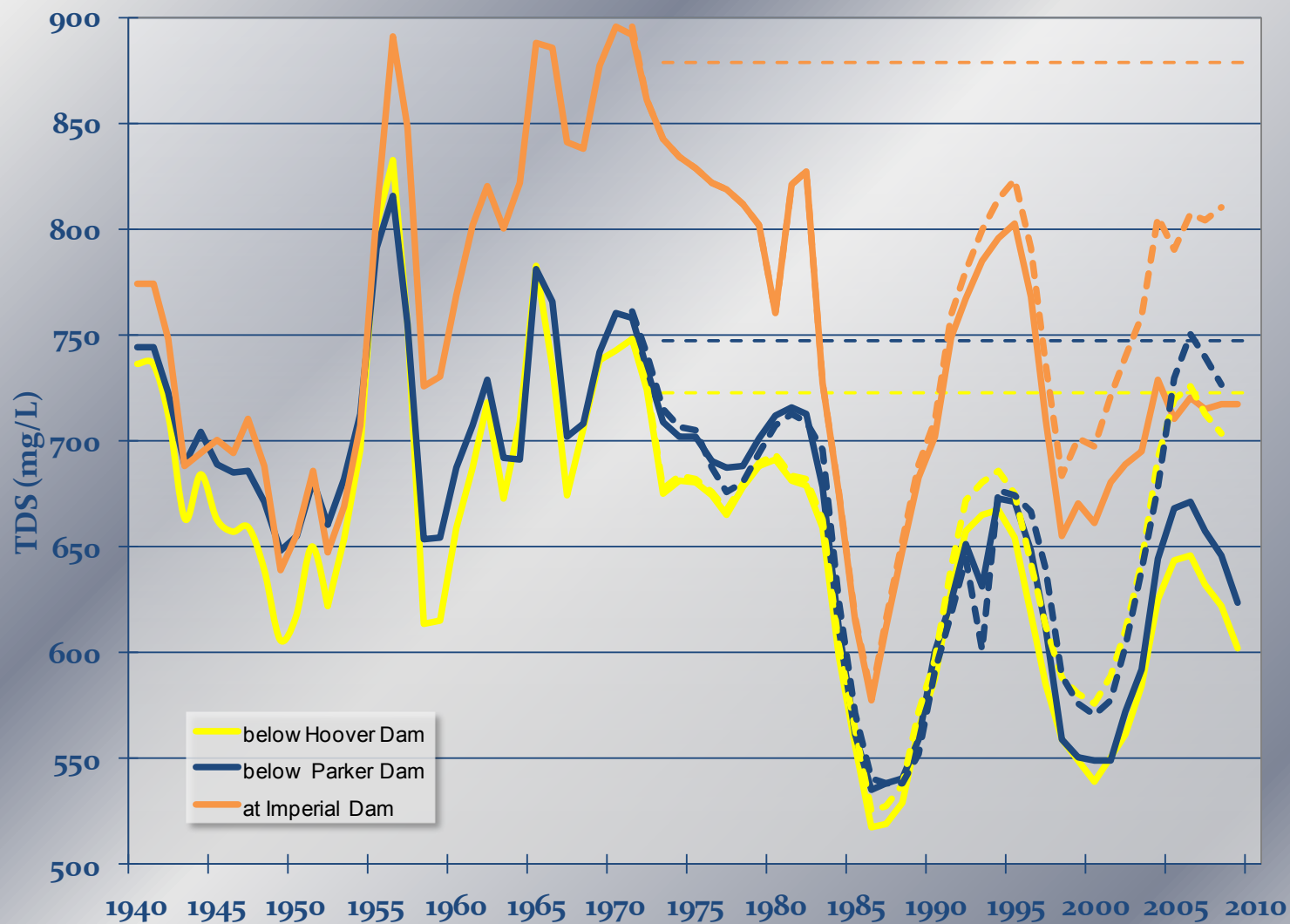


# How Have We Done?

Colorado River  
Salinity Concentrations at Numeric Criteria Sites



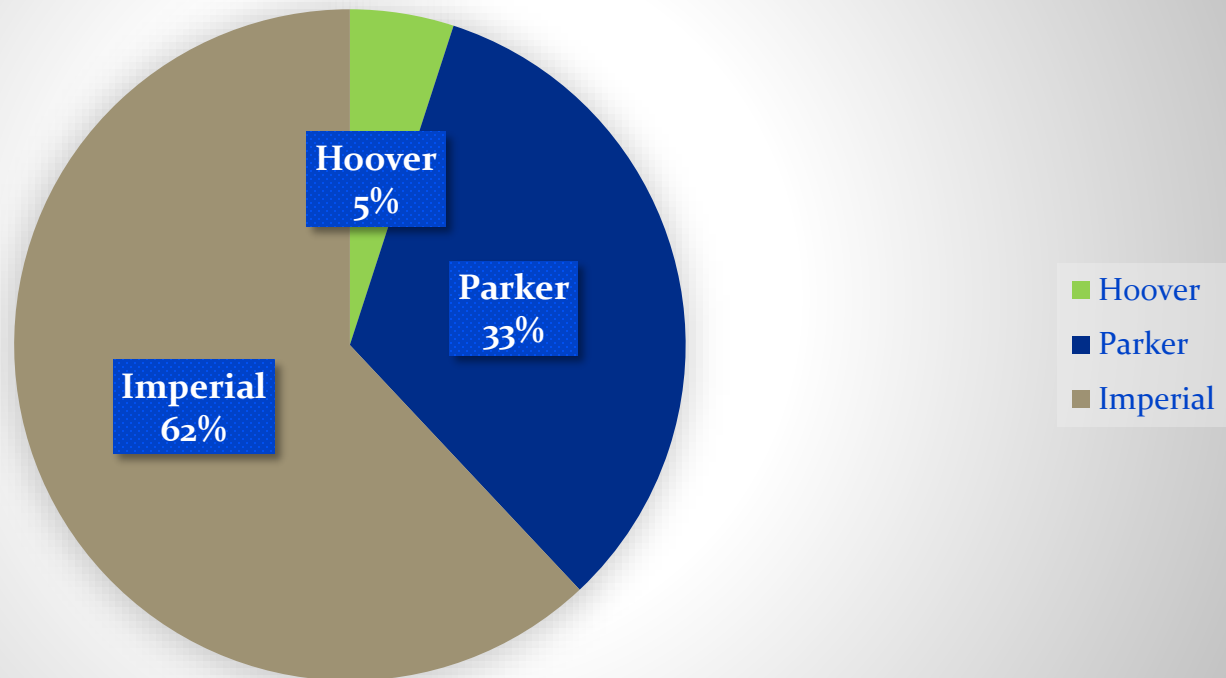
## Colorado River Salinity Concentrations at Numeric Criteria Sites



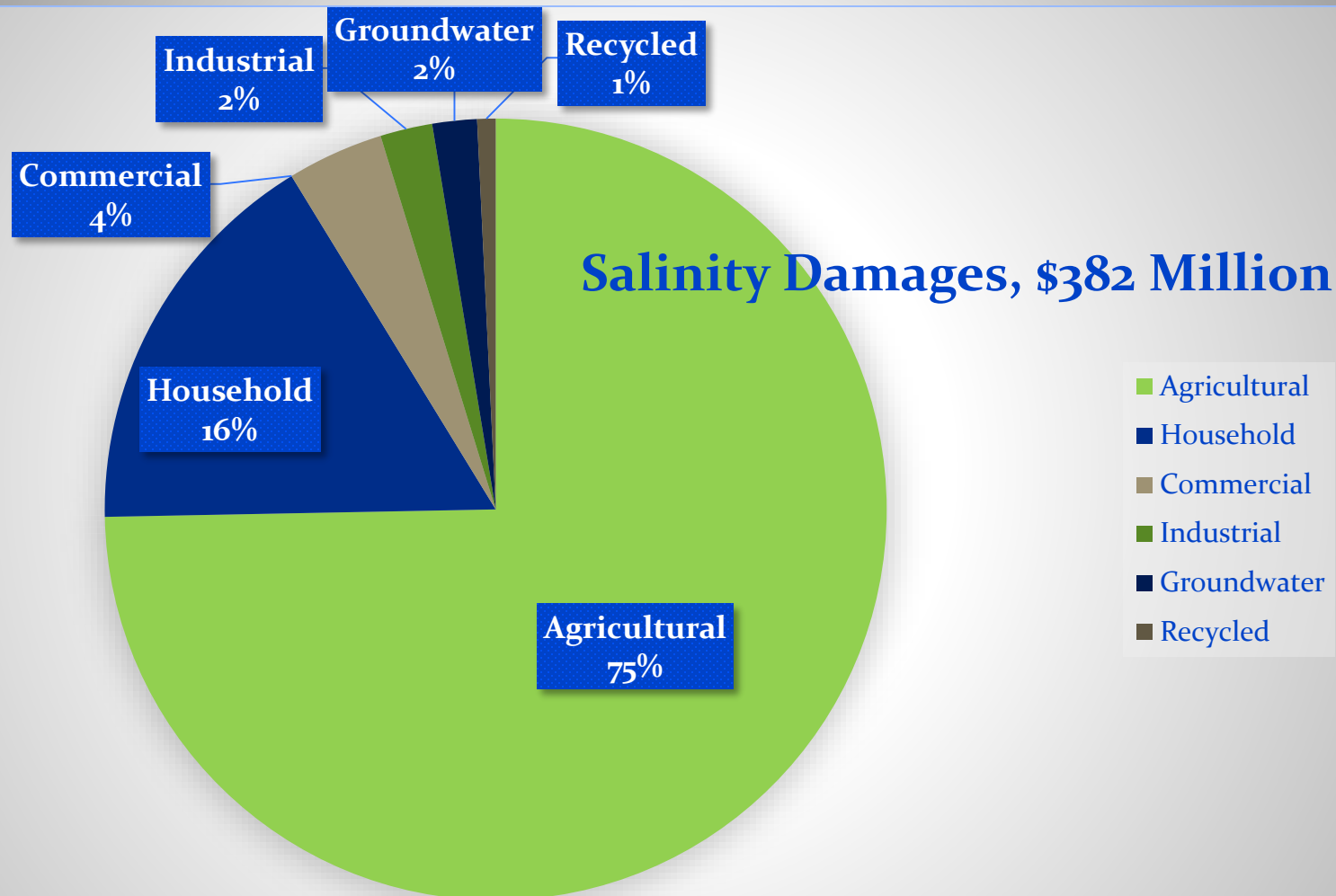


# Damages by Diversion

Salinity Damages, \$382 Million



# Damages by Sector





# Summary

- Very unique and successful state/federal/water users partnership - voluntary
- More than half a billion dollars thus far expended
- 1.3 million tons of annual salt load reduction
- Downstream concentration is 90-100 mg/L better
- Several hundred million dollars in reduced annual damages





## Colorado River Basin SALINITY CONTROL FORUM



### News and Announcements

On May 27, Agriculture Secretary Vilsack announced that he has designated the Colorado River Basin as a Critical Conservation Area under the newly created [Regional Conservation Partnership Program](#) under the 2014 Farm Bill.

Reclamation has just released [Final Findings and Strategies, Lower Gunnison Basin, Colorado](#) and [Final Report on Findings and Strategies, Uinta Basin, Utah](#), which represent the conclusion of an 18-month study regarding program implementation in the Lower Gunnison and Uinta Basin salinity areas respectively.

The new 2014 Farm Bill (known as the ["Agricultural Act of 2014"](#)) passed both the House and the Senate and was signed into law by President Obama on February 7, 2014.

### Welcome to the Colorado River Basin Salinity Control Forum Website

Recognizing the rapidly increasing salinity concentration in the Lower Colorado River and its impact on water users, the Colorado River Basin States came together in 1973 and organized the Colorado River Basin Salinity Control Forum (Forum). In 1974, in coordination with the Department of the Interior and the U.S. State Department, the Forum worked with Congress in the passage of the Colorado River Basin Salinity Control Act (Act). Title I of the Act deals with the United States' salinity commitments to Mexico. Title II of the Act creates the Colorado River Basin Salinity Control Program (Program) which focuses on improving the water quality of the Colorado River to U.S. users above Imperial Dam.

Since implementation of the Program, measures have been put in place which now control more than 1.2 million tons of salt annually. The salinity concentration at Imperial Dam has been reduced by about 90 mg/L. However, *quantifiable* damages to U.S. users presently are approximately \$376 million per year. Damages are projected to increase to \$577 million per year if the Program does not continue to be aggressively implemented.





## Colorado River Basin SALINITY CONTROL FORUM



### Membership

#### ARIZONA

Thomas Buschatzke  
Larry R. Dozier, Chairman  
Linda Taunt

#### CALIFORNIA

Pete Silva  
Gerald R. Zimmerman

#### COLORADO

Jennifer L. Gimbel  
Steven H. Gunderson  
David W. Robbins

#### NEVADA

Leo M. Drozdoff  
John J. Entsminger  
McClain Peterson

#### NEW MEXICO

Estevan López, Vice Chairman  
Scott A. Verhines

#### UTAH

### Organization

#### Colorado River Basin Salinity Control Forum

Created in 1973, the Colorado River Basin Salinity Control Forum (Forum) is an organization of the seven Colorado River Basin states of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming. The purposes of the Forum are to coordinate salinity control efforts among the states, coordinate with federal agencies on the implementation of the Colorado River Basin Salinity Control Program (Program), work with Congress on the authorization and funding of the Program, act to disseminate information on salinity control and otherwise promote efforts to reduce the salt loading to the Colorado River.

The Governors of each state appoint up to three representatives (though each state has one vote). Current Forum membership is shown on the left. Generally, Forum membership is made up of individuals from state water quantity and water quality agencies as well as major water user agencies. Forum members elect a Chair and Vice Chair. There are no specific terms for Forum members as they serve at the pleasure of their respective Governors.

The Forum generally meets twice each year; usually a spring meeting in one of the Upper Basin states and a fall meeting in one of the Lower Basin states. Forum meetings are open to the public and notice of meetings can be found on the "Meetings" tab.

The Forum has created a Work Group made up of technical representatives from the states with the Chair as the lead. The Work Group is responsible for the implementation of the Program.



## Colorado River Basin SALINITY CONTROL FORUM



### Additional Information

#### **HOTEL ACCOMMODATIONS**

Jackson Lake Lodge in Wyoming

Members can make reservations under the name "Colorado River Basin Group" by calling 800-628-9988.

### Meeting Notices

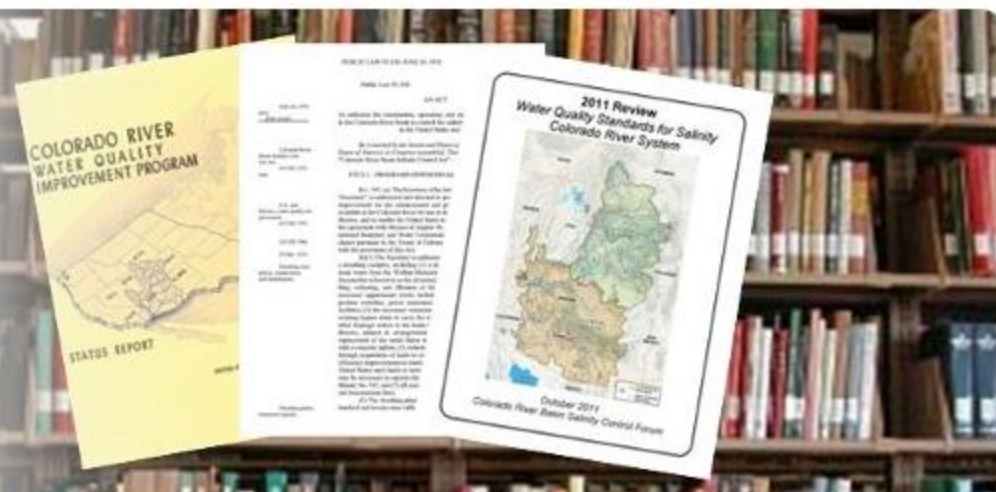
#### **COLORADO RIVER BASIN SALINITY CONTROL FORUM AND COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL**

The spring 2014 meetings for the Forum and Advisory Council have been set for June 12th and 13th, 2014, at Jackson Lake Lodge in Wyoming. The Work Group meetings will take place at the same location on June 10th and 11th.





## Colorado River Basin SALINITY CONTROL FORUM



### Document Categories

#### Search documents

- [Reviews](#)
- [Legislation](#)
- [Documents](#)
- [Miscellaneous](#)

### Reviews

13 documents on file:

- [2011 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [2008 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [2005 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [2002 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1999 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1996 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1993 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1990 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1987 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1984 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1981 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1978 Review. Water Quality Standards for Salinity. Colorado River System](#)
- [1975 Review. Water Quality Standards for Salinity. Colorado River System](#)

# Colorado River Basin Salinity Control Program

Questions?