Colorado River Basin Salinity Control Program

Trying Technology and Tools

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Colorado River Basin Salinity Control Forum

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CRWUA, Las Vegas, NV

Colorado River Basin SALINITY CONTROL FORUM

Improved Water Quality

100 mg/L less salt

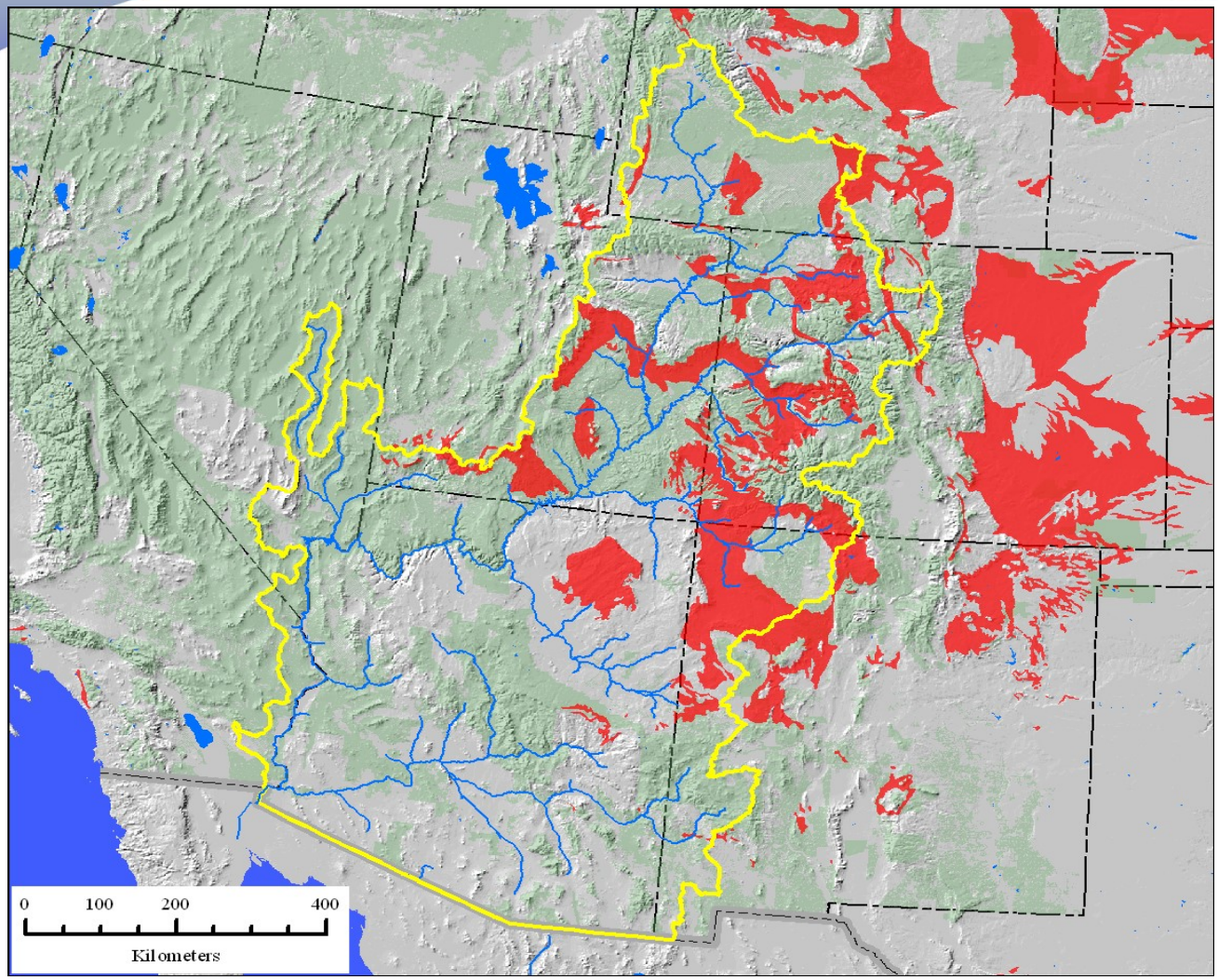
Total *quantified* damages averted: $300 M annually

Geology

100 mya

1000s ft of shale

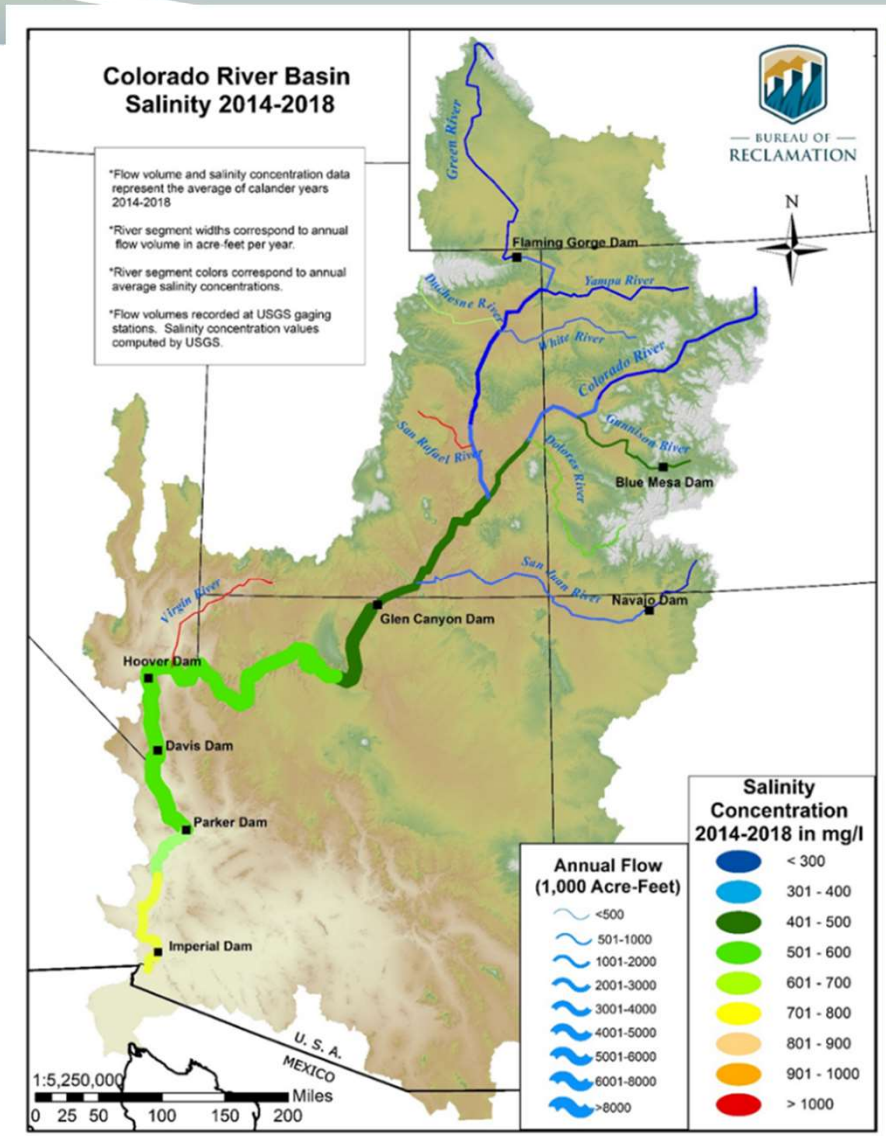
Mancos Shale

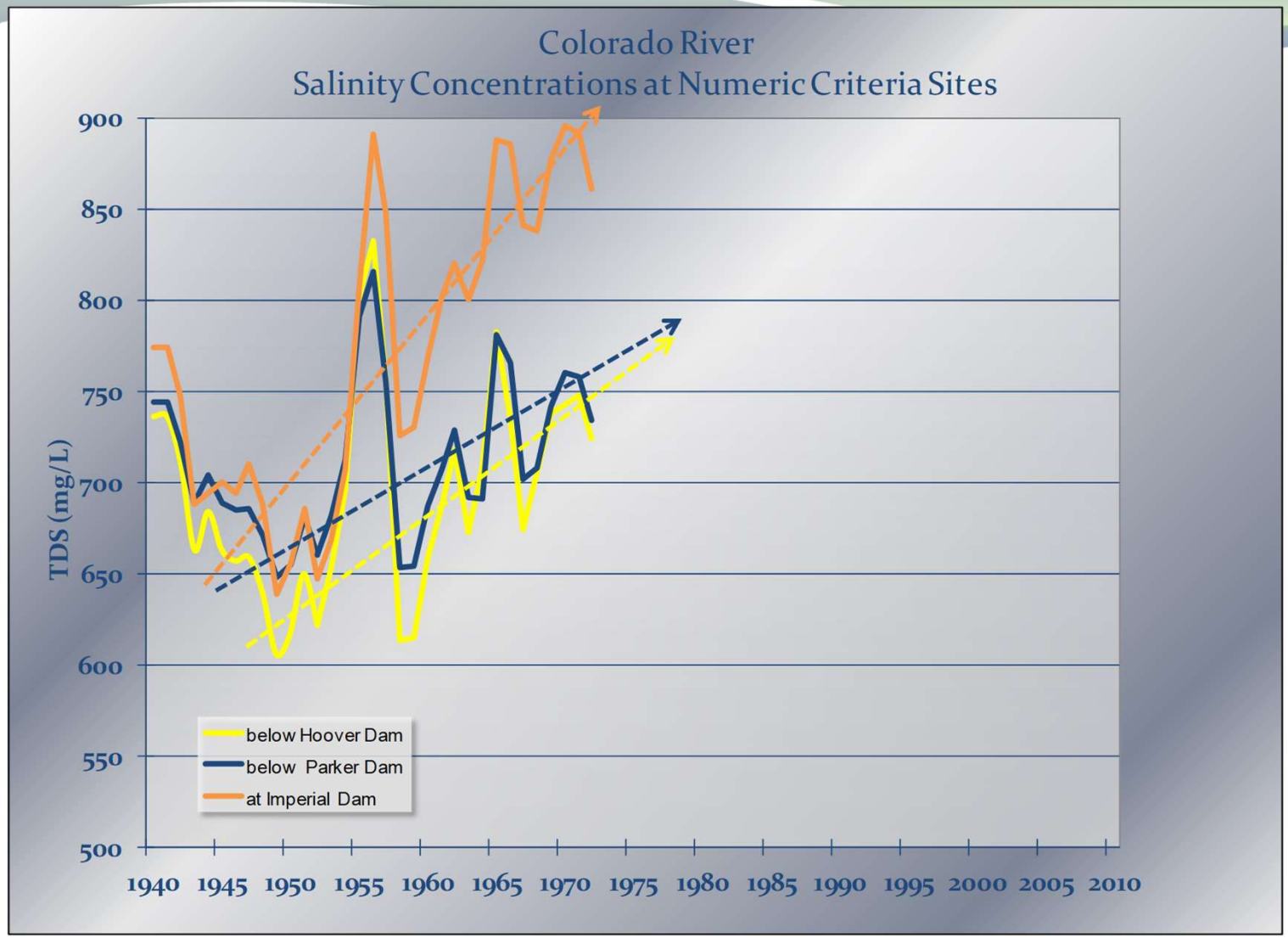


- Pervasive through Upper Basin
- Highly erodible
- Forms valleys
- Loaded with salt

Increases in salinity

50 mg/L – 800 mg/L



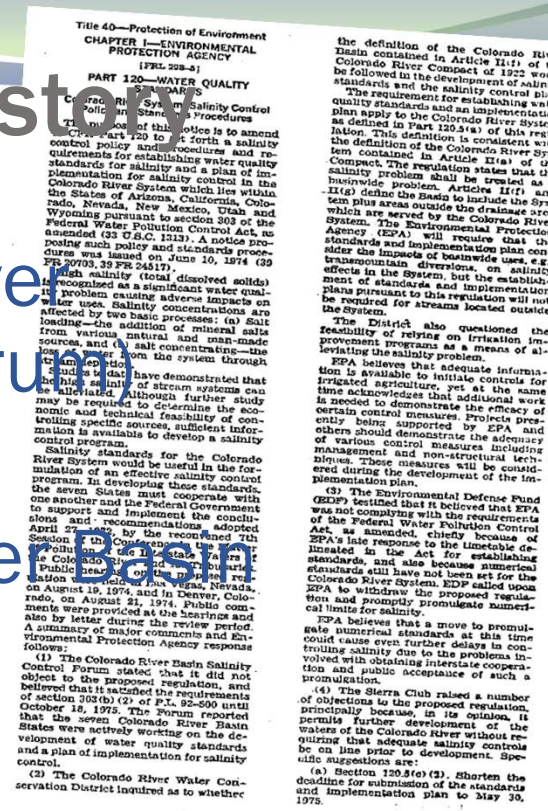

Colorado River
Salinity Concentrations at Numeric Criteria Sites
TDS (mg/L)
900
850
800
750
700
650
600
550
500
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
below Hoover Dam
below Parker Dam
at Imperial Dam

Salinity Control Program History

- Early 1970's
  - Salinity of the Colorado River was rising
  - Significant concerns by Mexico
  - 1972 Amendments: Federal Water Pollution Control Act

Salinity Control Program History

- 1973 – created the Colorado River Basin Salinity Control Forum (Forum)
- 1974 – passed the Colorado River Basin Salinity Control Act (Act)
  - Title I and Title II
- 1975 – adopted salinity standards for the Colorado River



Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 203-5]

PART 120—WATER QUALITY STANDARDS

Colorado River System Salinity Control Policy and Standards Procedures

This purpose of this notice is to amend Part 120 to set forth a salinity control policy and procedures and requirements for establishing water quality standards for salinity and a plan of implementation for salinity control in the Colorado River System which lies within the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming pursuant to section 303 of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1313). A notice proposing such policy and standards procedures was issued on June 10, 1974 (39 FR 20703, 39 FR 24517).

High salinity (total dissolved solids) is recognized as a significant water quality problem causing adverse impacts on water uses. Salinity concentrations are affected by two basic processes: (a) Salt loading—the addition of mineral salts from various natural and man-made sources, and (b) salt concentrating—the loss of water from the system through [illegible]. Studies to date have demonstrated that high salinity of stream systems can be alleviated. Although further study may be required to determine the economic and technical feasibility of controlling specific sources, sufficient information is available to develop a salinity control program.

Salinity standards for the Colorado River System would be useful in the formulation of an effective salinity control program. In developing these standards, the seven States must cooperate with one another and the Federal Government to support and implement the conclusions and recommendations adopted April 27, [illegible], by the reconvened 7th Session of the Conference [illegible] Pollution of the Colorado River Basin, and Public hearings [illegible] Las Vegas, Nevada, on August 19, 1974, and in Denver, Colorado, on August 21, 1974. Public comments were provided at the hearings and also by letter during the review period. A summary of major comments and Environmental Protection Agency response follows:

(1) The Colorado River Basin Salinity Control Forum stated that it did not object to the proposed regulation, and believed that it satisfied the requirements of section 303(b)(2) of P.L. 92-500 until October 18, 1975. The Forum reported that the seven Colorado River Basin States were actively working on the development of water quality standards and a plan of implementation for salinity control.

(2) The Colorado River Water Conservation District inquired as to whether the definition of the Colorado River Basin contained in Article II(f) of the Colorado River Compact of 1922 would be followed in the development of salinity standards and the salinity control plan.

The requirement for establishing water quality standards and an implementation plan apply to the Colorado River System as defined in Part 120.3(a) of this regulation. This definition is consistent with the definition of the Colorado River System contained in Article II(a) of the Compact. The regulation states that the salinity problem shall be treated as a basinwide problem. Articles II(f) and II(g) define the Basin to include the System plus areas outside the drainage area which are served by the Colorado River System. The Environmental Protection Agency (EPA) will require that the standards and implementation plan consider the impacts of basinwide uses, e.g., transmountain diversions, on salinity effects in the System, but the establishment of standards and implementation plans pursuant to this regulation will not be required for streams located outside the System.

The District also questioned the feasibility of relying on irrigation improvement programs as a means of alleviating the salinity problem.

EPA believes that adequate information is available to initiate controls for irrigated agriculture, yet at the same time acknowledges that additional work is needed to demonstrate the efficacy of certain control measures. Projects presently being supported by EPA and others should demonstrate the adequacy of various control measures including management and non-structural techniques. These measures will be considered during the development of the implementation plan.

(3) The Environmental Defense Fund (EDF) testified that it believed that EPA was not complying with the requirements of the Federal Water Pollution Control Act, as amended, chiefly because of EPA's late response to the timetable delineated in the Act for establishing standards, and also because numerical standards still have not been set for the Colorado River System. EDF called upon EPA to withdraw the proposed regulation and promptly promulgate numerical limits for salinity.

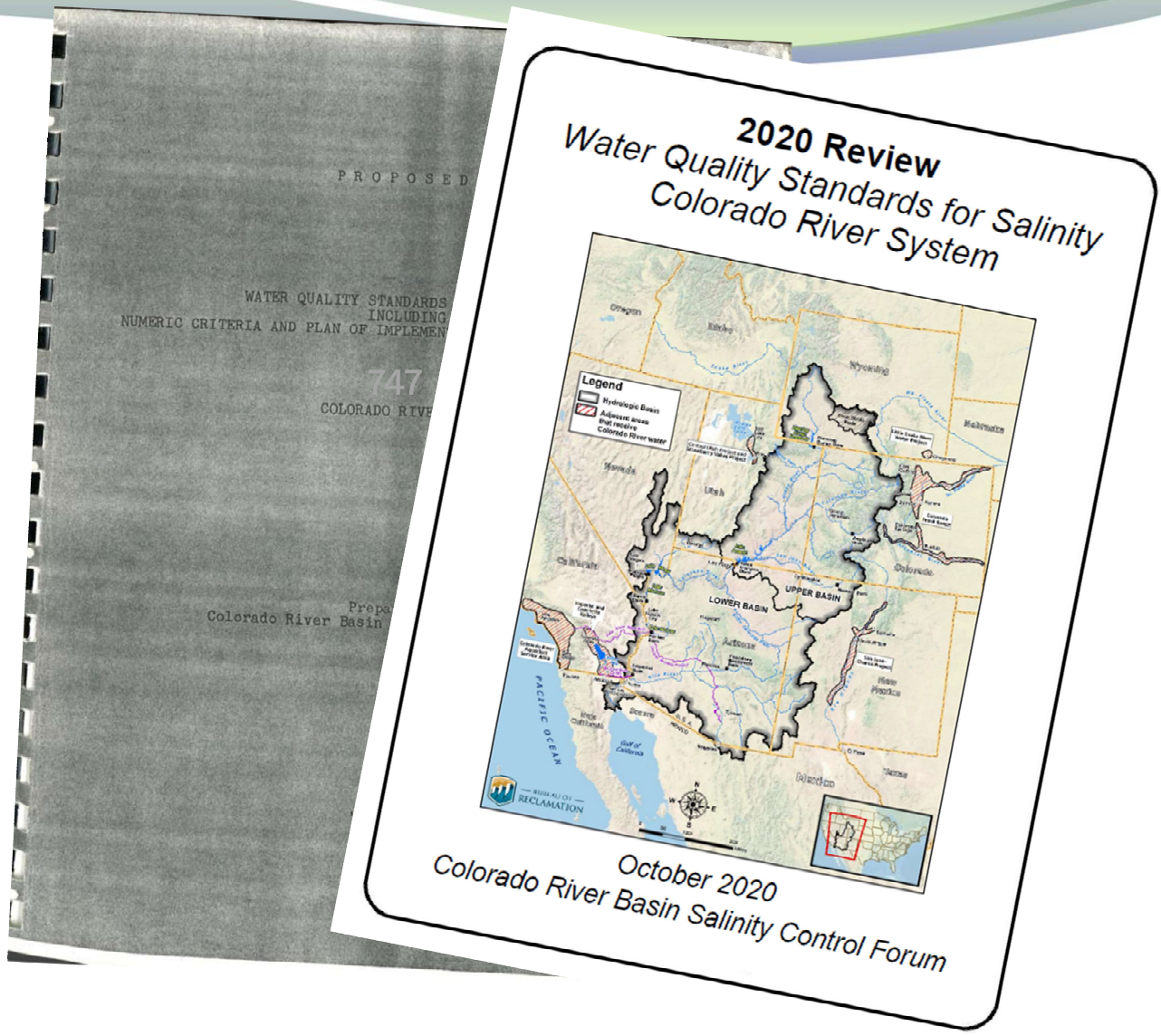
EPA believes that a move to promulgate numerical standards at this time could cause even further delays in controlling salinity due to the problems involved with obtaining interstate cooperation and public acceptance of such a promulgation.

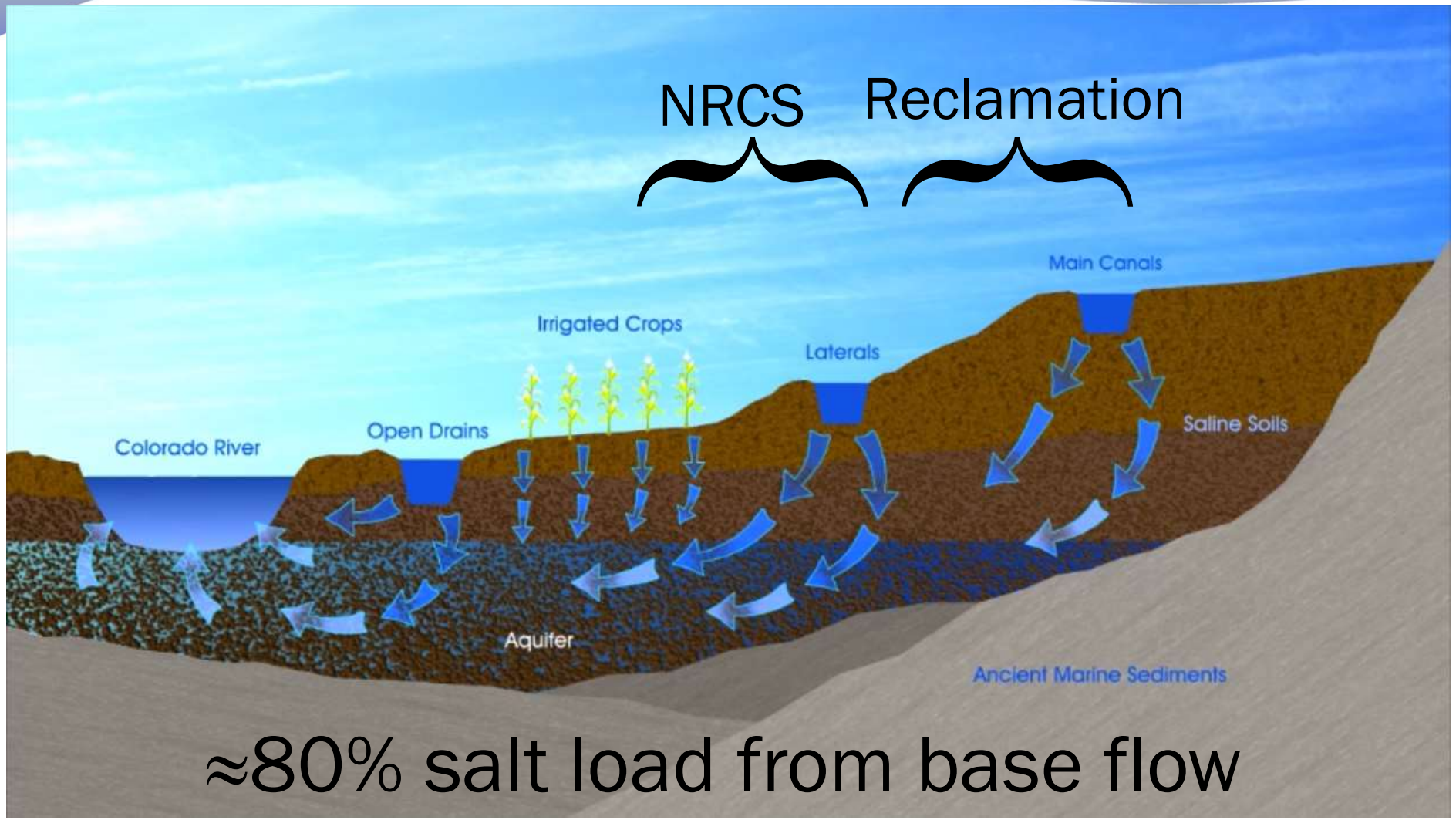
(4) The Sierra Club raised a number of objections to the proposed regulation, principally because, in its opinion, it permits further development of the waters of the Colorado River without requiring that adequate salinity controls be on line prior to development. Specific suggestions are:

(a) Section 120.3(e)(2). Shorten the deadline for submission of the standards and implementation plan to May 30, 1975.

Standard (1975)

- Established the numeric criteria.
- Initiated a Plan of Implementation.





≈80% salt load from base flow

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
  - NPDES permit requirements
  - Paradox Valley Unit (capture and deep well injection of brine)

EPA Study

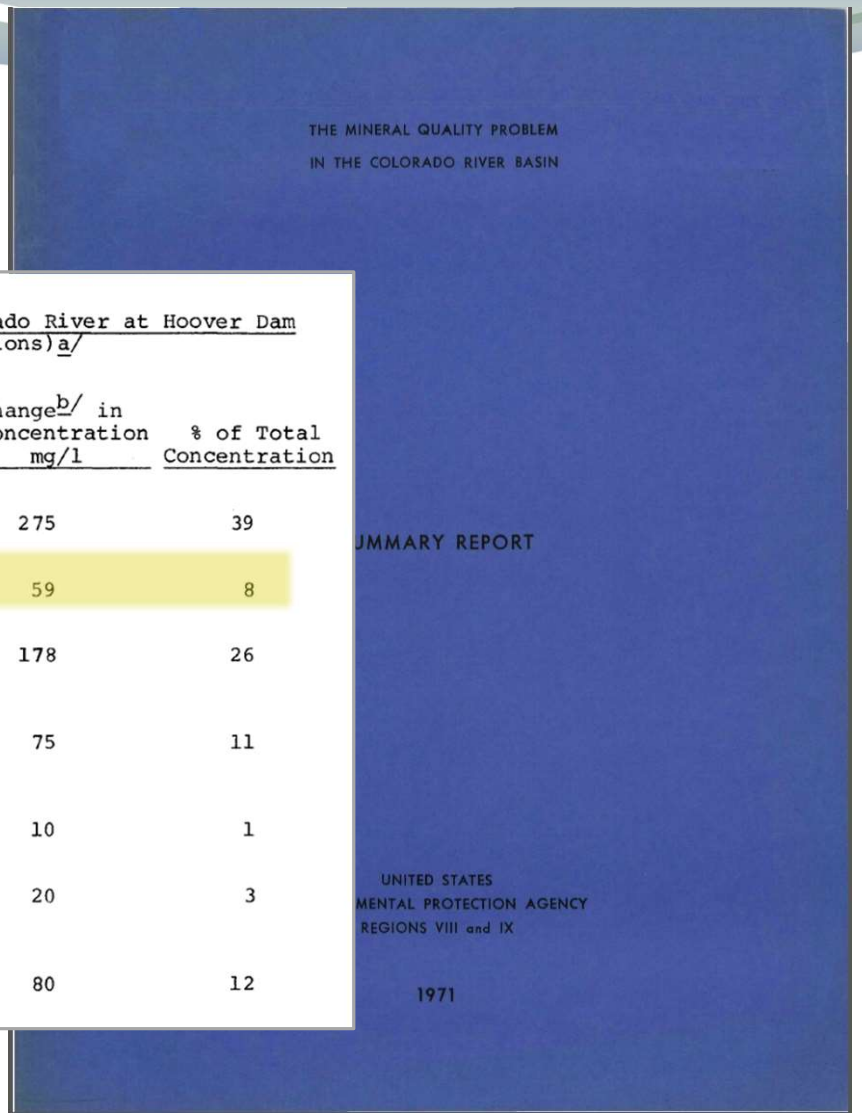


Table 1. Effect of Various Factors on Salt Concentration of Colorado River at Hoover Dam (1942-61 period of record adjusted to 1960 conditions)a/

Factor	Flow (1,000 AF/Yr)	Cumulative Flow (1,000 AF/Yr)	Salt Load (1,000 Tons/Yr)	Cumulative Salt Load (1,000 Tons/Yr	Cumulative Concentration Tons/AF	mg/l	Change b/ in Concentration mg/l	% of Total Concentration
Natural Diffuse Sources	14,471	14,471	5,408	5,408	0.374	275	275	39
Natural Point Sources	229	14,700	1,283	6,691	0.455	334	59	8
Irrigation (Salt Contribution)	0	14,700	3,536	10,227	0.696	512	178	26
Irrigation (Consumptive Use)	-1,883	12,817	0	10 227	0.798	587	75	11
Municipal & Industrial Sources	-42	12,775	146	10,373	0.812	597	10	1
Exports Out of Basin	-465	12,310	-37	10,336	0.840	617	20	3
Evaporation & Phreatophytes	-1,409	10,901	0	10,336	0.948	697	80	12

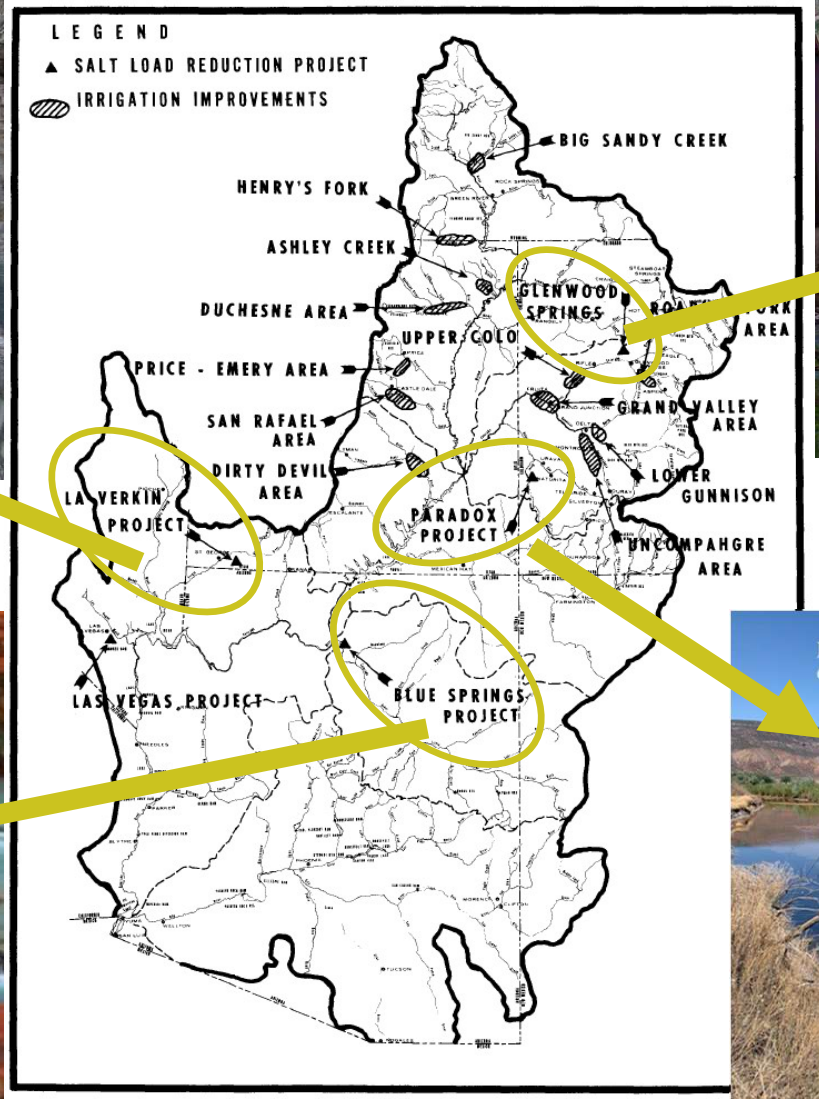
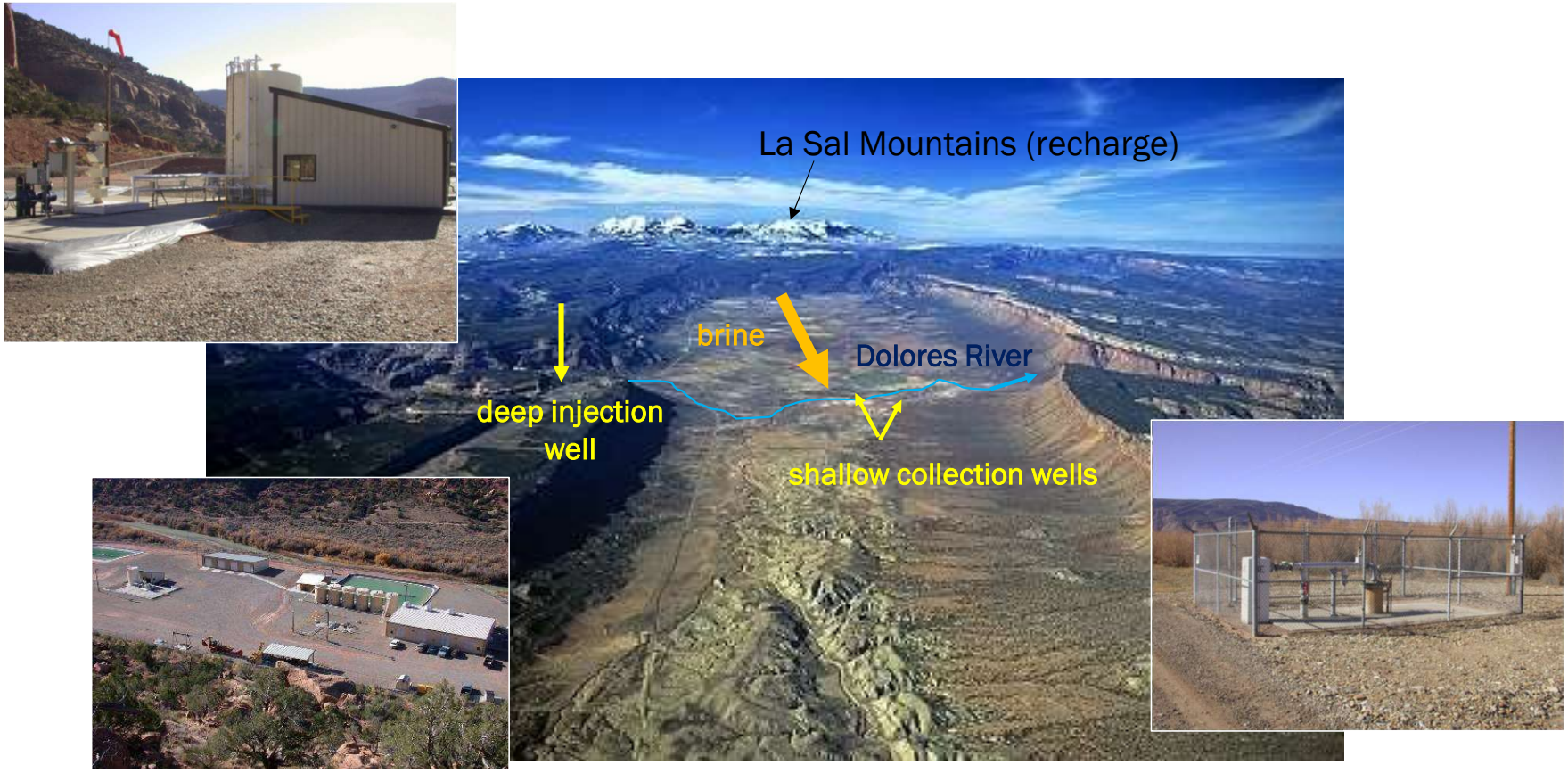
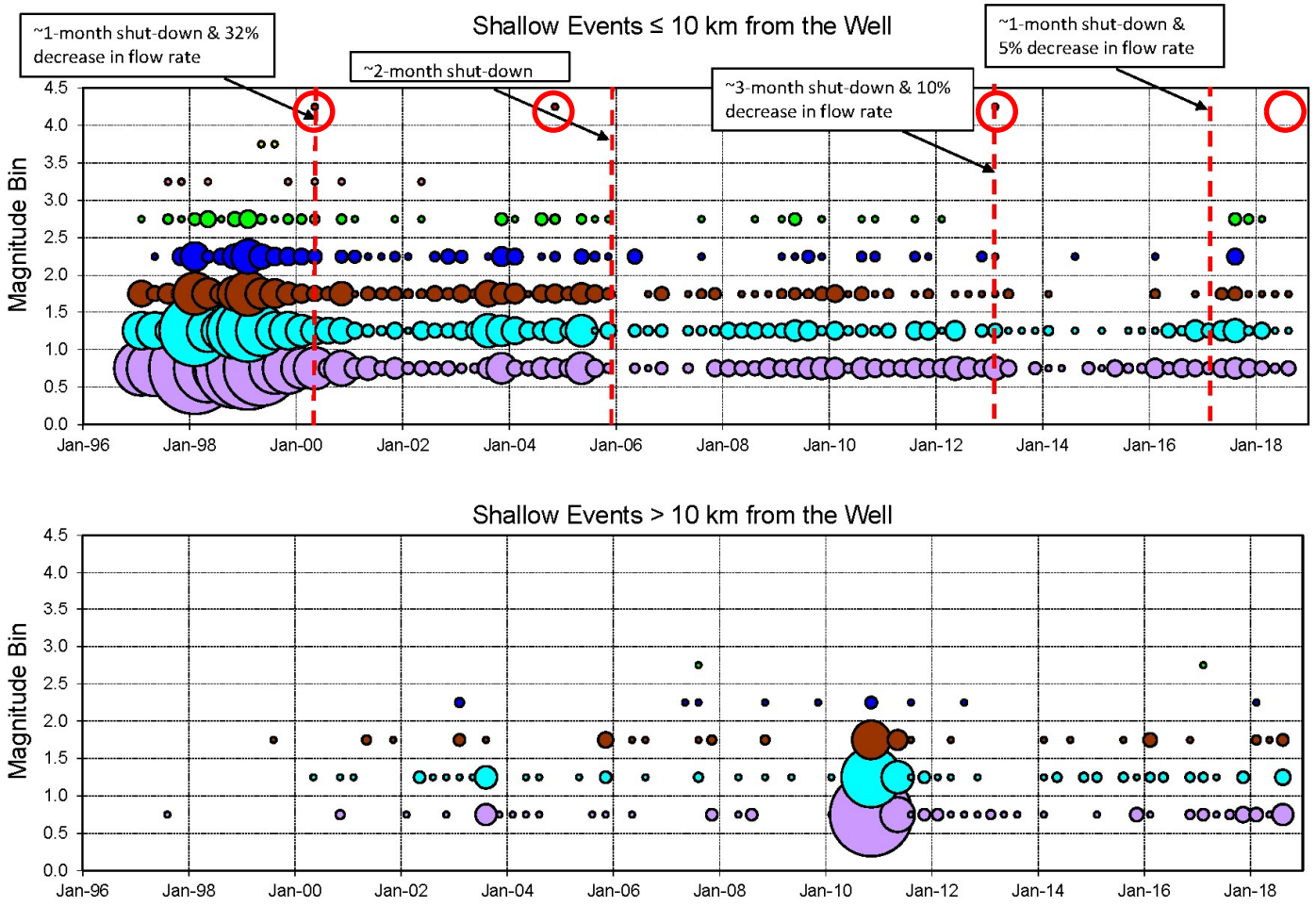


Figure 5. Location of Potential Salt Load Reduction Projects

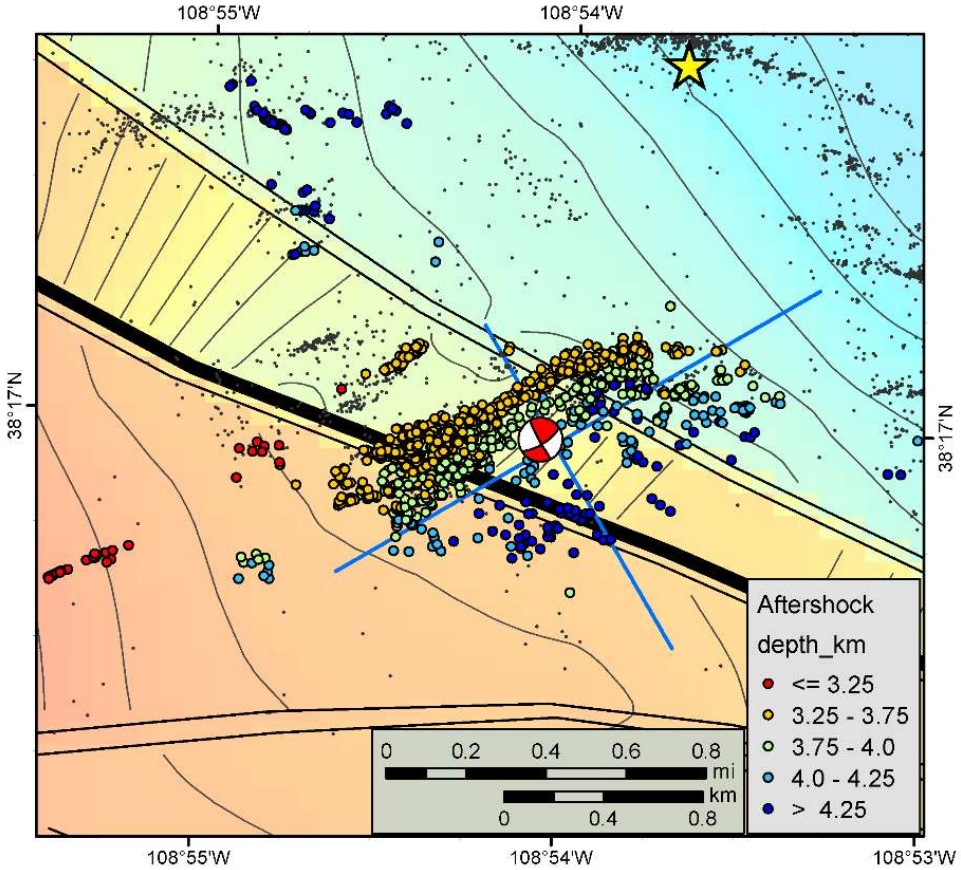
Paradox Valley Unit (PVU)



PVU Earthquakes

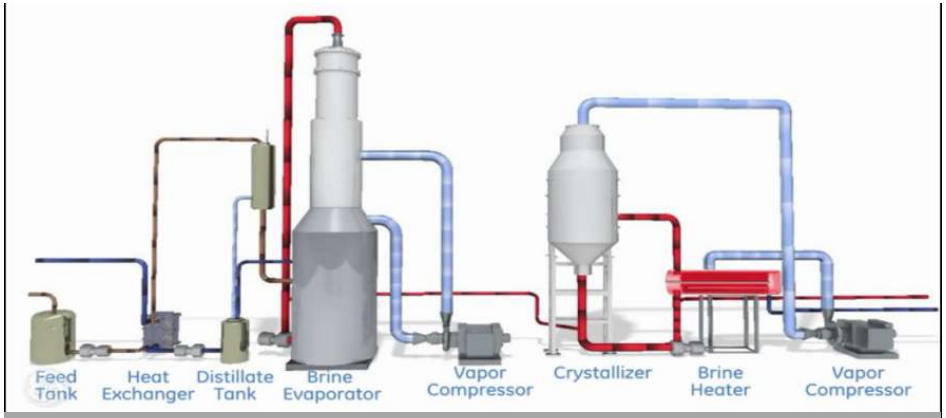


PVU March 4, 2019 4.5 M_L Earthquake



Paradox Valley Unit (PVU) EIS

2nd Injection Well



Brine Crystallization Technology

Evaporation Ponds

No Action

Brine Crystallization Technologies

RECLAMATION
Managing Water in the West

Paradox Valley Unit Brine Crystallization Technology Assessment

Western Colorado Area Office

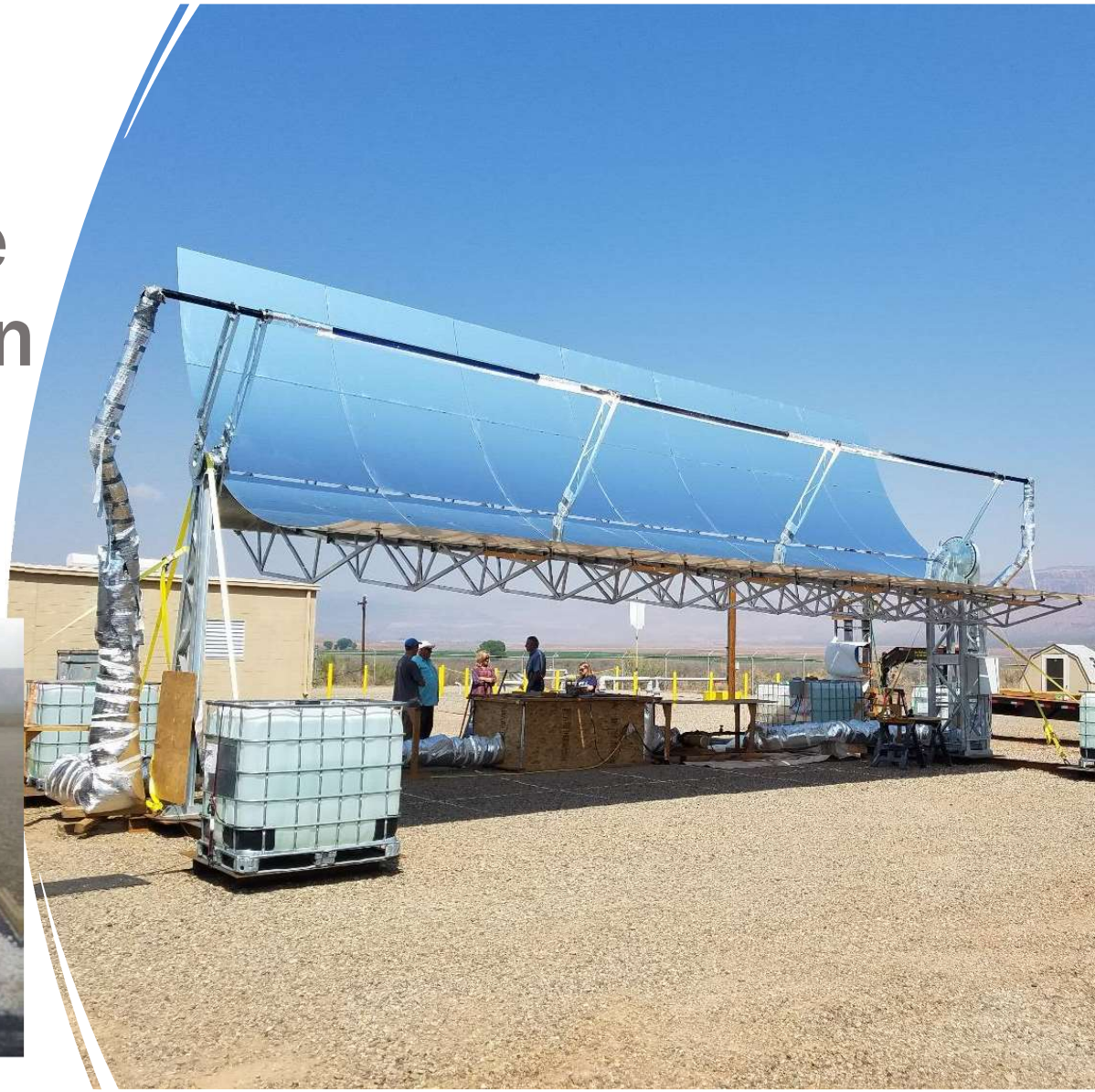
Paradox Valley Unit, Colorado

Upper Colorado Region

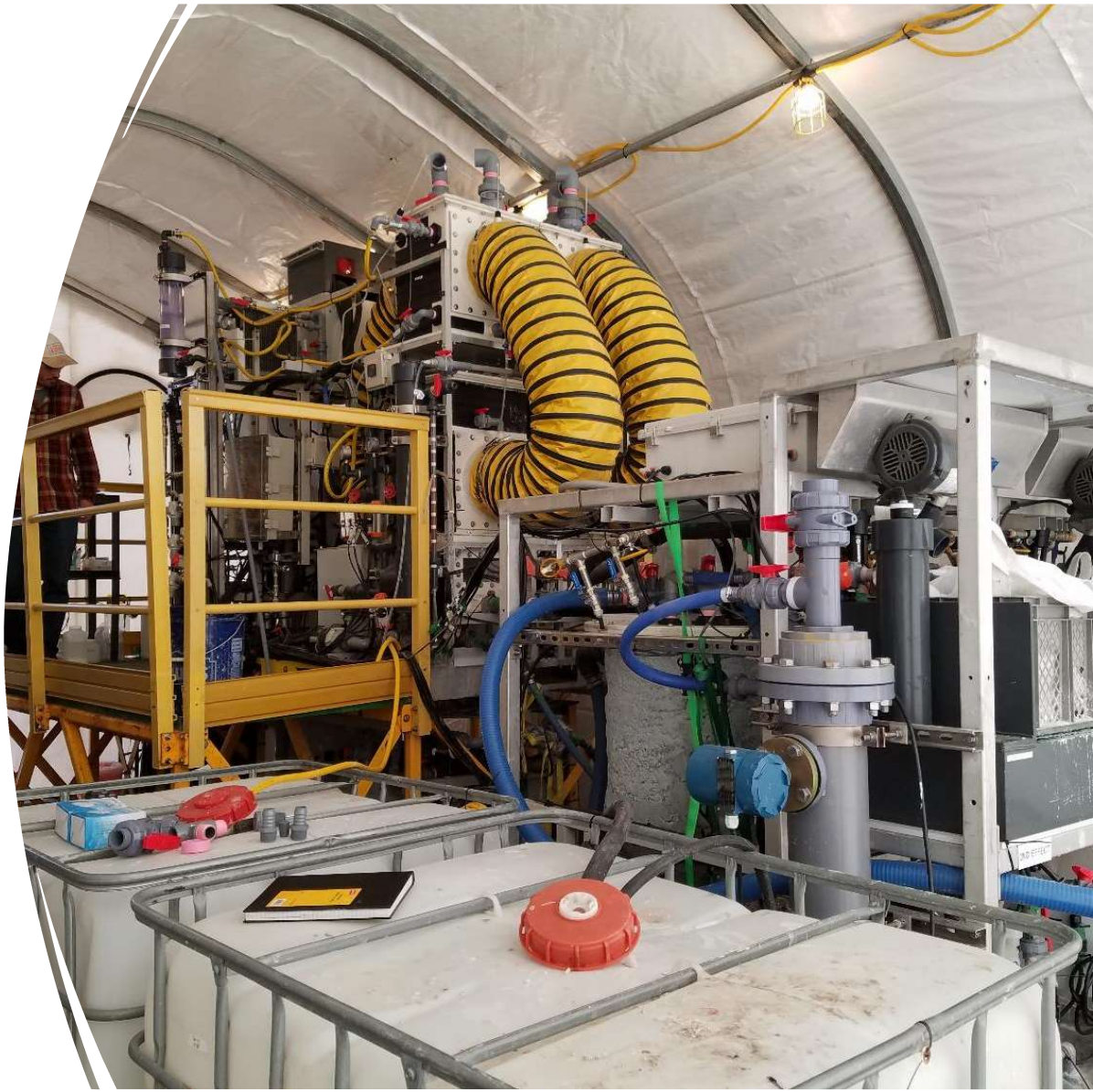
U.S. Department of the Interior
Bureau of Reclamation

September 2016

Solar Trough and Free Water Surface Brine Crystallization



Saltworks (ZLD)



Disposal of solid salt?

Salt Landfill

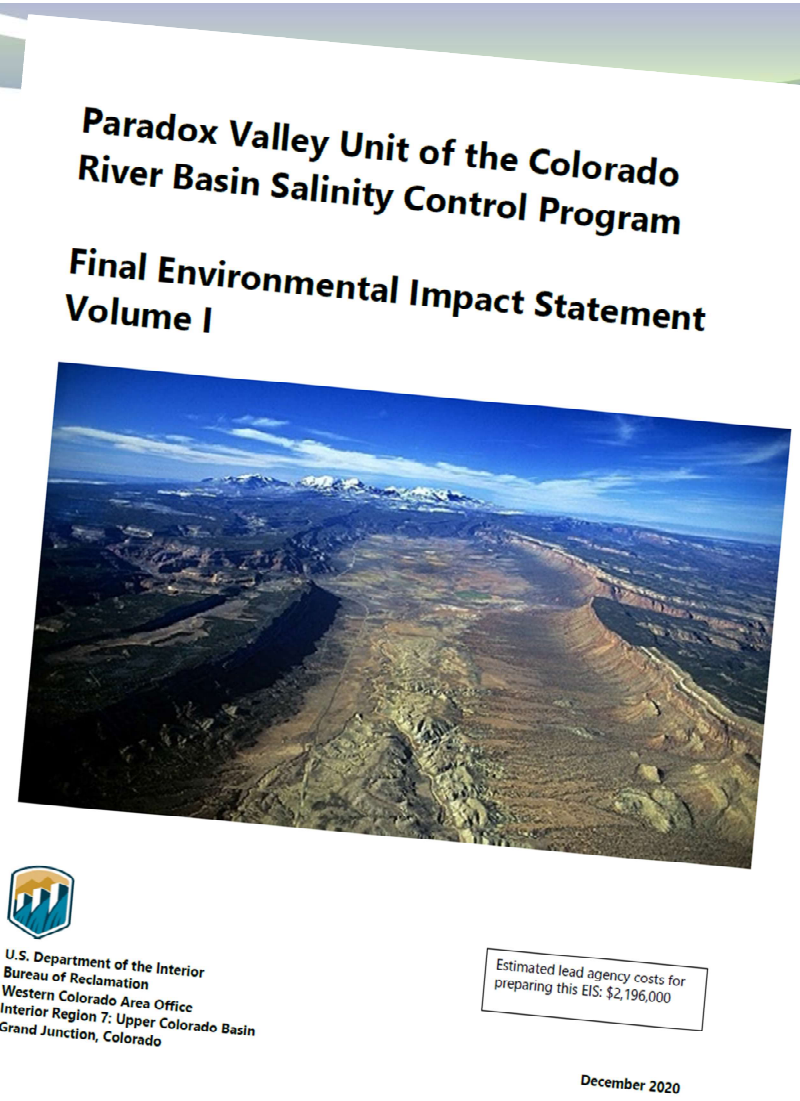
300 gpm for 50 years

- 470 tons of solid salt per day (8.6M tons)
- Six 10-acre cells
- 115’ high (100 feet above grade)
- New cell every 8 years

Note: 50% over need

PVU FEIS

- 8 plus years
- Final EIS December 2020
- 4 Volumes
- 180 pages, 1300 pages
- No Action Alternative
- No Record of Decision



Paradox Valley Unit Future/EIS?

Well Operations

- Review six-month test data and recommence brine injection at a reduced rate for an indefinite period

EIS/Project Future

- Reexamine the EIS assumptions, cast our net further and be more creative

Outside the Box Thinking

- Harvest for chemicals and products
- Replace existing road salt sources
- Provide to animal feed operations
- Salt bricks
- Solution mining replacement slurry
- Private landfill

- Ask the World
  - Develop a Statement of Objective (SOO)
  - Forum help develop
  - Parameters?
  - Send out soon – *let the world give us ideas*

"Seek different perspectives. As an [illegible] I already know the answers,
but when I engage others, I get a better answer, quicker."

Jim Watson, GM, Sites Project Authority

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Improved Water Quality

100 mg/L less salt