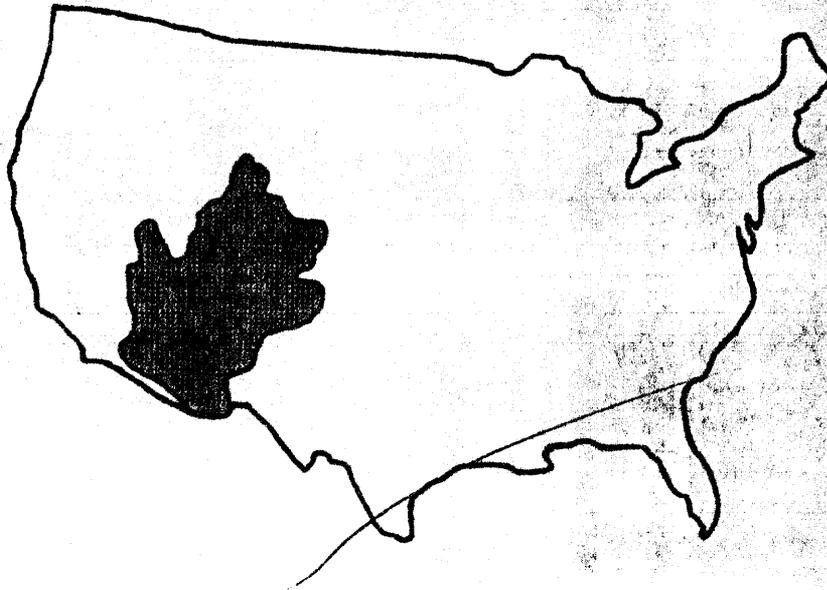


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# 1990 Joint Evaluation of the Salinity Control Program in the Colorado River Basin



United States Department of the Interior  
Bureau of Reclamation  
Bureau of Land Management  
United States Department of Agriculture  
Soil Conservation Service  
December 1990

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# 1990 Joint Evaluation of the Salinity Control Program in the Colorado River Basin

Prepared by the

United States Department of the Interior  
Bureau of Reclamation  
Bureau of Land Management

and the

United States Department of Agriculture  
Soil Conservation Service

in cooperation with the  
U.S. Geological Survey  
U.S. Fish and Wildlife Service  
Agricultural Stabilization and Conservation Service  
Cooperative Extension Service  
Environmental Protection Agency

December 1990

## Disclaimer

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057); the Upper Colorado River Basin Compact (63 Stat. 31); the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219); the United States/Mexico agreement in Minute No. 242 of August 30, 1973, (Treaty Series 7708; 24 UST 1968), the decree entered by the Supreme Court of the United States in *Arizona v. California*, et al.

(376 U.S. 340); the Boulder Canyon Project Act (45 Stat. 1057); the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a); the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620); the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501), the Colorado River Basin Salinity Control Act (88 Stat. 266; 43 U.S.C. 1951), or the Hoover Power Plant Act of 1984 (98 Stat. 1333).

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## Summary

The Department of the Interior and the United States Department of Agriculture, in cooperation with the Colorado River Basin Salinity Control Forum and its workgroup, reassessed the adequacy of the Colorado River salinity control program in meeting numeric criteria for salinity at three stations (Hoover, Parker, and Imperial Dams) along the river.

This joint evaluation report is a result of those efforts; it presents and integrates the respective salinity control programs authorized in the Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) and amendments in Public Law 98-569.

Salinity concentrations of the river have fluctuated significantly over the period 1941-1989, and generally decrease in periods of high flows and increase in periods of low flows. Although high flows in the period 1983 to 1987 temporarily lowered salinity levels in the system, salinity levels are currently rising.

The implementation plan identified during this evaluation satisfies salt load reduction objectives and program goals by maintaining average total dissolved solids at Imperial Dam at or below 879 milligrams per liter (mg/L), while the Basin States continue to develop their compact-apportioned waters. The implementation plan will remove about 1.464 million tons of salt per year by the year 2010, and the projected total remaining investment cost (capital and O&M) is approximately \$669 million.

Public Law 93-320 and its amendment requires that a percentage of the Federal cost be repaid from the Upper and Lower Basin water development funds with revenue generated from the sale of hydropower. Repayment analysis of the Lower Colorado River Basin Development (LCRBD) Fund prepared for this evaluation shows that sufficient funds are available to cover all costs (capital, operation and maintenance, and interest) of the implementation plan. The LCRBD Fund can repay its share of the costs with an inflation rate of 2.9 percent.

# Introduction

The Department of the Interior and the United States Department of Agriculture, in cooperation with the Colorado River Basin Salinity Control Forum (Forum) work group, reassessed the adequacy of the Colorado River salinity control program in meeting numeric criteria for salinity at three stations (Hoover, Parker, and Imperial Dams) along the river. The salinity control program was authorized in the Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) and amended by Public Law 98-569.

This joint evaluation report outlines the coordination efforts to effectively undertake the salinity control program, it describes the

assumptions and methods used to arrive at the current salinity control program—the 1990 implementation plan, and it summarizes the salinity control program and its effects.

The report also describes major program activities through fiscal year 1990. Salinity control units needed to achieve the objectives of Public Law 93-320 and Public Law 98-569 are shown in figure 1. This evaluation, updated annually, monitors the program implementation schedule, allowing inclusion of newly formulated, more cost-effective units and changes in technology.

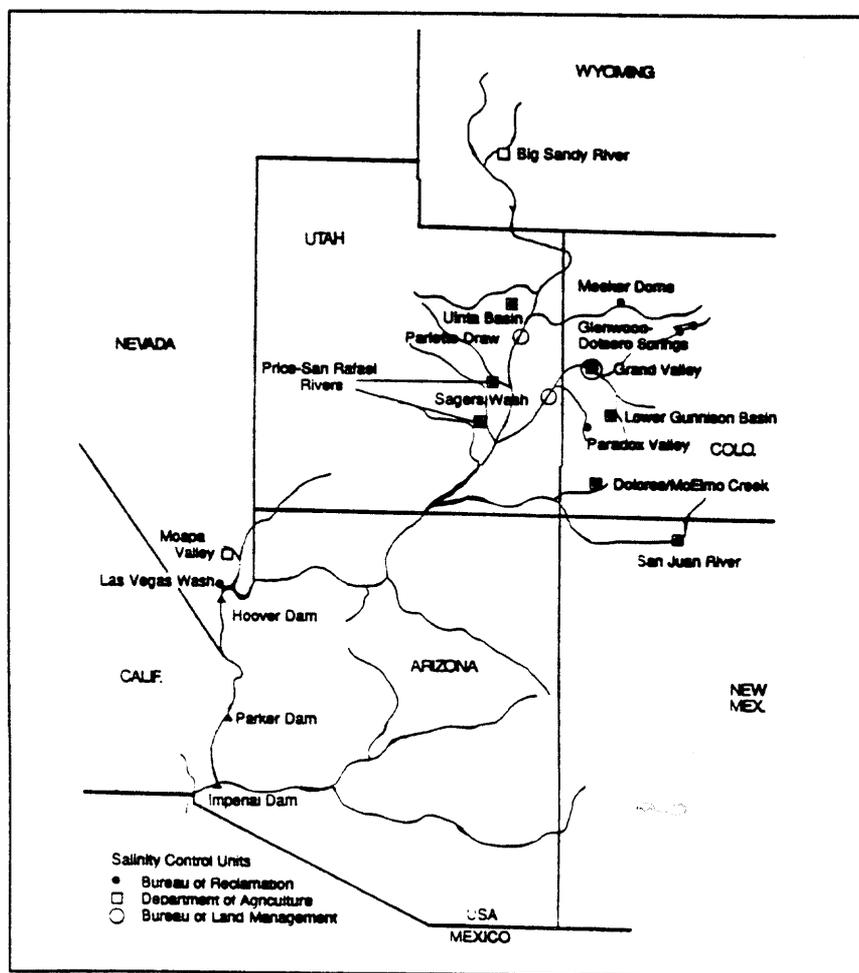


Figure 1.—Colorado River Basin salinity control program.

# Program Coordination

Federal and State coordination is critical for effective implementation of the salinity control program. Program coordination among the U.S. Department of Agriculture (USDA), the Bureau of Reclamation (Reclamation), and the Bureau of Land Management (BLM) is occurring by agency interaction at the field level and through the USDA, Reclamation, and BLM salinity control coordinators. The BLM established a program coordinator position in September 1990. Various committees are in place to coordinate actions among agencies. In addition, the agencies are represented on the Colorado River Basin Salinity Control Forum (Forum) Work Group and serve as advisors to the Forum.

## Interagency Salinity Control Coordinating Committee

During the year, the Interagency Salinity Control Coordinating Committee (ISCCC) was reinstated to address Federal interagency policy issues. The committee met three times during the year.

## Technical Policy Coordinating Committee

Technical coordination among agencies is accomplished through the Technical Policy Coordinating Committee (TPCC). In addition to Reclamation, BLM, and Soil Conservation Service (SCS), representatives from the Fish and Wildlife Service (FWS), Geological Survey (USGS), Environmental Protection Agency (EPA), and the Forum participate in TPCC meetings. During 1990, committee subgroups met several times to address specific issues.

SCS, EPA, and FWS held meetings and tours to address wetlands issues. Reclamation and SCS

met to address Office of the Inspector General (OIG) audit comments. Utah SCS and EPA met to discuss the Price-San Rafael Rivers Unit Environmental Impact Statement. Nevada SCS and EPA met to discuss the Moapa Valley USDA project. Various agencies also met to update the salinity detriments study.

## USDA Salinity Control Coordinating Committee

The USDA Salinity Control Coordinating Committee (SCCC) is responsible for the coordination of USDA program activities at the national level. This committee is comprised of representatives from the Agricultural Stabilization and Conservation Service (ASCS), Extension Service (ES), and the SCS. Unofficial members represent Reclamation, BLM, and EPA.

This committee met regularly and took action on various policies, procedures, and fund management issues. The committee reviewed all Project Implementation Plans and made program implementation recommendations for effective agency coordination.

## Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum was established in 1973 as a mechanism for interstate cooperation and to develop water quality standards for salinity. The Forum is comprised of up to three representatives from each of the seven Colorado River Basin States. Federal agencies serve on the Forum's work group to coordinate actions with the Forum.

# Program Evaluation

## Background and Assumptions

Salinity concentrations of the river have fluctuated widely over the period 1941-1989. Salinity concentrations generally decrease in periods of high flows and increase in periods of low flows. Figure 2 shows the annual flow of the Colorado River at Imperial Dam and the corresponding annual salinity concentrations.

Figure 3 provides a historical perspective, numeric criterion, and the projections at Imperial Dam without further salinity control actions. Without the recommended controls, the salinity at Imperial Dam is expected to increase significantly over the next 20 years. Current salinity projections show that an additional salt load reduction of about 1.280 million tons per year is needed to maintain total dissolved solids (TDS) levels at the numeric criterion of 879 mg/L at Imperial Dam. A total salt removal of 1.464 million tons per year is needed by the year 2010.

The 1990 evaluation was completed using modeling results from the Colorado River Simulation System (CRSS). The base condition on which the computer simulations were made include the following salinity control projects: Grand Valley, Meeker Dome, Uinta Basin, Las Vegas Wash, Lower Gunnison 1, Big Sandy River, and BLM well plugging. These projects, or portions thereof, are removing approximately 183,500 (Jan. 1990) tons of salt annually from the river system, as shown in table 1.

The 1990 base condition was modeled using the January 1, 1990, reservoir starting conditions. Projections of future salinity conditions on the Colorado River are derived from 15 sequences of historically based hydrology. Depletion projections as of January 1990 were developed jointly by Reclamation and the Forum.

Moderate variations in the salinity levels in impoundments like Lake Powell and Lake Mead and at Imperial Dam can be ascribed to several

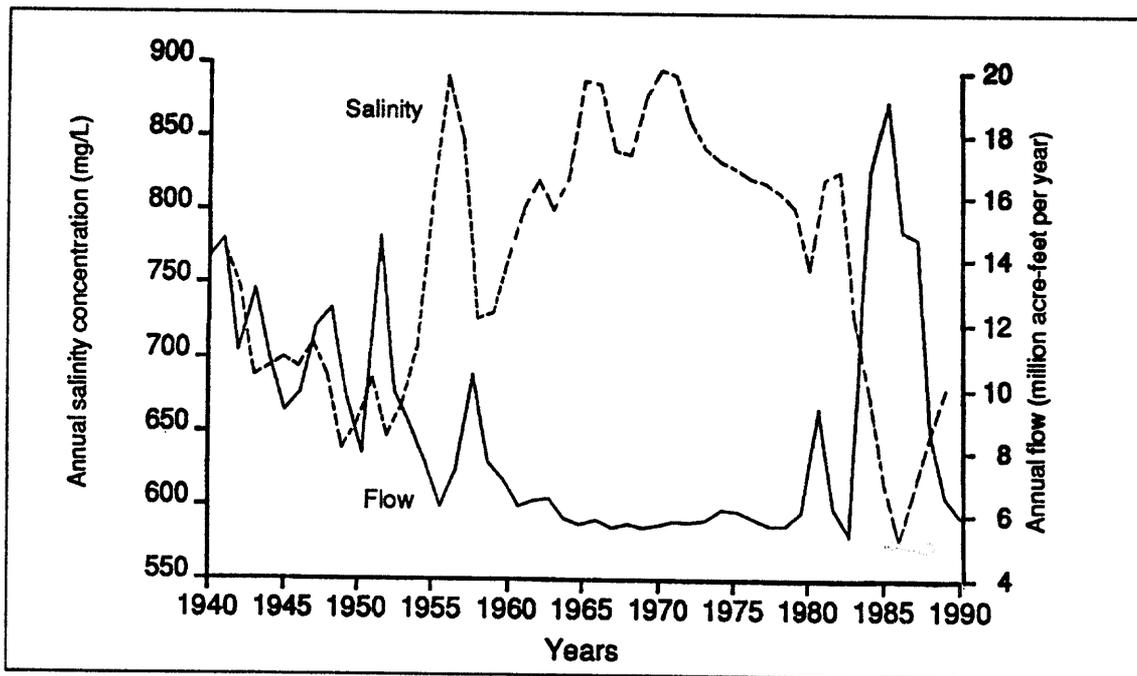


Figure 2.—Historical flows and salinity concentration at Imperial Dam.

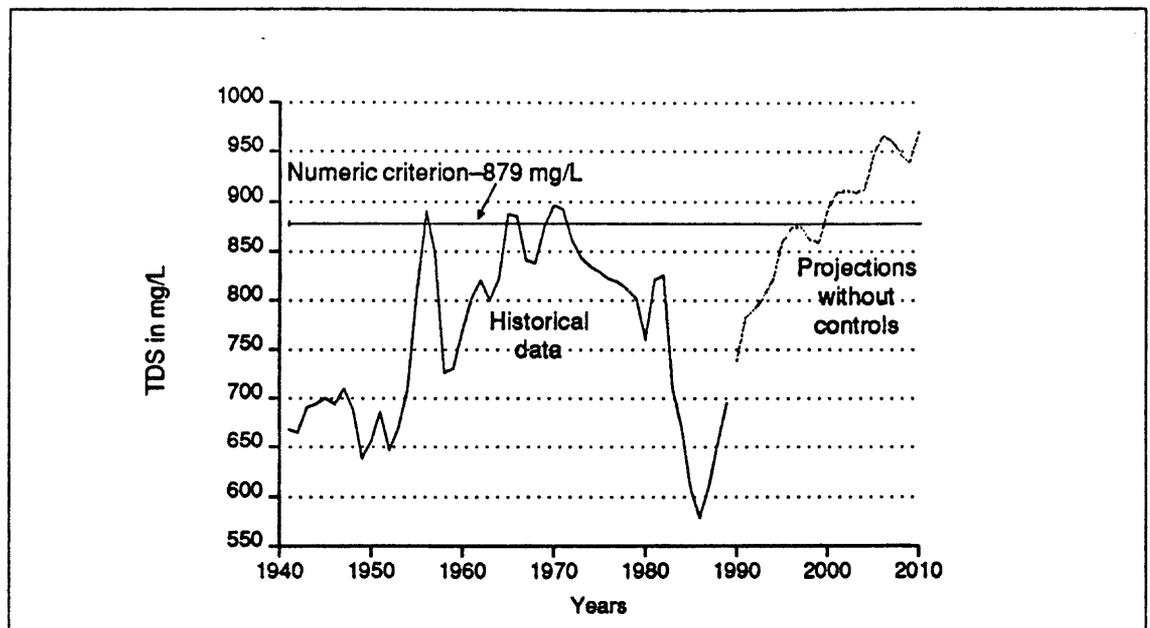


Figure 3.—Historical data and salinity projections without further controls at Imperial Dam.

Moderate variations in the salinity levels in impoundments like Lake Powell and Lake Mead and at Imperial Dam can be ascribed to several factors, such as water demands, weather, and salinity control activities. However, there are two factors for which the salinity levels at Hoover Dam and below are very sensitive.

- **Accumulated reservoir inflow and resulting high reservoir storage** — Whenever reservoir inflow is significantly greater than normal, dilution is generally occurring within the large reservoirs of Powell and Mead.
- **Reservoir discharges**—Whenever river flows are low, salinity concentrations are high; and the opposite occurs when river flows are high.

Very rapid changes in salinity concentration can be observed when both these conditions exist at the same time; i.e., (1) previous reservoir inflows have been high for several seasons and (2) above average reservoir discharge will produce very low salinity concentrations as observed in 1986 (less than 600 mg/L). Conversely, high concentrations can be expected when reservoir

inflow has been low for several seasons and the reservoir discharge has been at a minimum.

Because of the vast water storage behind Glen Canyon and Hoover Dams, Upper Basin salinity control projects implemented at any given year do not begin to reduce salinity levels at Imperial Dam until many years thereafter. This time lag needs to be recognized when scheduling project implementation to achieve desired results in some timely manner.

## The Program

The plan of implementation is designed to maintain the average salinity concentration of the river at or below the numeric criteria at the three stations on the river without impairing the development and use of compact-apportioned water in the Colorado River Basin. The Basin-wide salinity control plan is designed to offset salinity increases caused by man's development of the State's compact-apportioned waters. The plan makes no attempt to offset salinity increases which result from natural hydrologic variations of the river system. Salinity control is accomplished primarily by

Table 1.—1990 salinity control program

	Begin implemen- tation	Completion date	Salt removed (tons/year) <sup>1</sup>	Estimated salt removal (tons/year)	Cost <sup>2</sup> effectiveness (\$/ton)
Meeker Dome (USBR)	Complete	1983	48,000	48,000	14
Las Vegas Wash Pittman (USBR)	Complete	1985	3,800	3,800	44
Grand Valley Stage One (USBR)	Complete	1984	21,900	21,900	121
BLM well plugging	Complete	1986	8,000	8,000	
Grand Valley (USDA)	1979	2010	36,400	163,000	27
Uinta Basin (USDA)	1980	2010	36,400	98,200	80
Grand Valley Stage Two (USBR)	1985	1997	25,600	115,600	113
Big Sandy River (USDA)	1988	2006	2,700	52,900	27
Paradox Valley (USBR)	1988	1994		180,000	49
Lower Gunnison 1 (USDA)	1988	2010	700	82,100	64
McElmo Creek (USDA)	1990	2007		38,000	83
Dolores Project (USBR)	1990	1995		23,000	84
Nonpoint sources (BLM)	1991	2010		36,000	
Lower Gunnison Win Wtr (USBR)	1991	1995		74,000	38
Lower Gunnison 2, Mont (USDA)	1991	2010		81,700	68
Lower Gunnison 2, Delta (USDA)	1991	2010		104,700	41
Glenwood Springs (USBR)	1992	1993		73,000	92
Moapa Valley (USDA)	1992	2002		19,500	43
Lower Gunnison 3 (USDA)	1992	2006		12,000	74
San Juan-Hammond (USBR)	1994	1996		27,700	35
San Juan Hammond (USDA)	1994	2007		12,500	
Uinta Basin I (USBR)	1994	1999		25,500	88
Price-San Rafael (USBR/USDA)	1994	2010		162,900	55
<b>Totals</b>			<b>183,500</b>	<b><sup>3</sup>1,464,000</b>	

Units under consideration, but currently not in the program.

Units investigated, but no longer being considered.

Lower Virgin River (USBR)  
Sinbad Valley (USBR)  
Lower Gunnison Stage I Balance (USBR)  
Lower Gunnison North Fork (USBR)

Dirty Devil River (USBR)  
LaVerkin Springs (USBR)  
Palo Verde Irrigation District (USBR)  
Grand Valley II Balance (USBR)  
Mancos Valley (USDA)  
Virgin Valley (USDA)

<sup>1</sup> Salt-load reductions are as of January 1, 1990.

<sup>2</sup> Cost effectiveness numbers are based on 1988 analyses unless the unit was not in the program at that time. In that case, the best numbers available are shown. These costs will be reviewed and updated during the winter 1990-91 and should be complete by July 1, 1991.

<sup>3</sup> Reduction to maintain the numeric criterion through 2010.

reducing salt contributions to the river from existing upstream sources and by minimizing future increases in salt load caused by man's activities. Control measures are selected on the basis of cost-effectiveness, technical feasibility, social and political acceptability, and environmental considerations. Based on river modeling results, the current plan of implementation will achieve the goal of maintaining mean salinity levels at Imperial Dam at or below 879 mg/L. The implementation schedule for this plan is shown on table 1.

As evidenced by past program activities, long lead times are required for project planning and implementation. Failure to implement the plan will result in a revised plan with greater salt reduction in a shorter time to achieve the same goal.

Figure 4 shows the effect of the accumulated differences of the 1987 vs. 1990 salinity program. The 1987 implementation plan proposed removing a total of 1,210,800 tons of salt from the Colorado River by the year 2010 to meet the program goal of maintaining an average total dissolved solids at or below the

numeric criterion of 879 mg/L at Imperial Dam. The current 1990 implementation plan proposes to remove a total of 1,464,000 tons of salt annually from the Colorado River by 2010. Therefore, an additional 253,200 tons of salt are needed to be removed annually from the system to achieve the same results.

The 1990 salinity program's projected total remaining investment cost is approximately \$669 million. The construction costs differ from the 1987 program in the following manner:

- Four salinity control projects have been added to the 1987 program—Glenwood-Dotsero Springs Unit, the BLM program, San Juan (Hammond Project)—USDA, and San Juan (Hammond) Unit—Reclamation.
- Inflation has increased construction costs and operation and maintenance costs.
- Costs for some projects have increased because of technical problems and delays in project implementation.

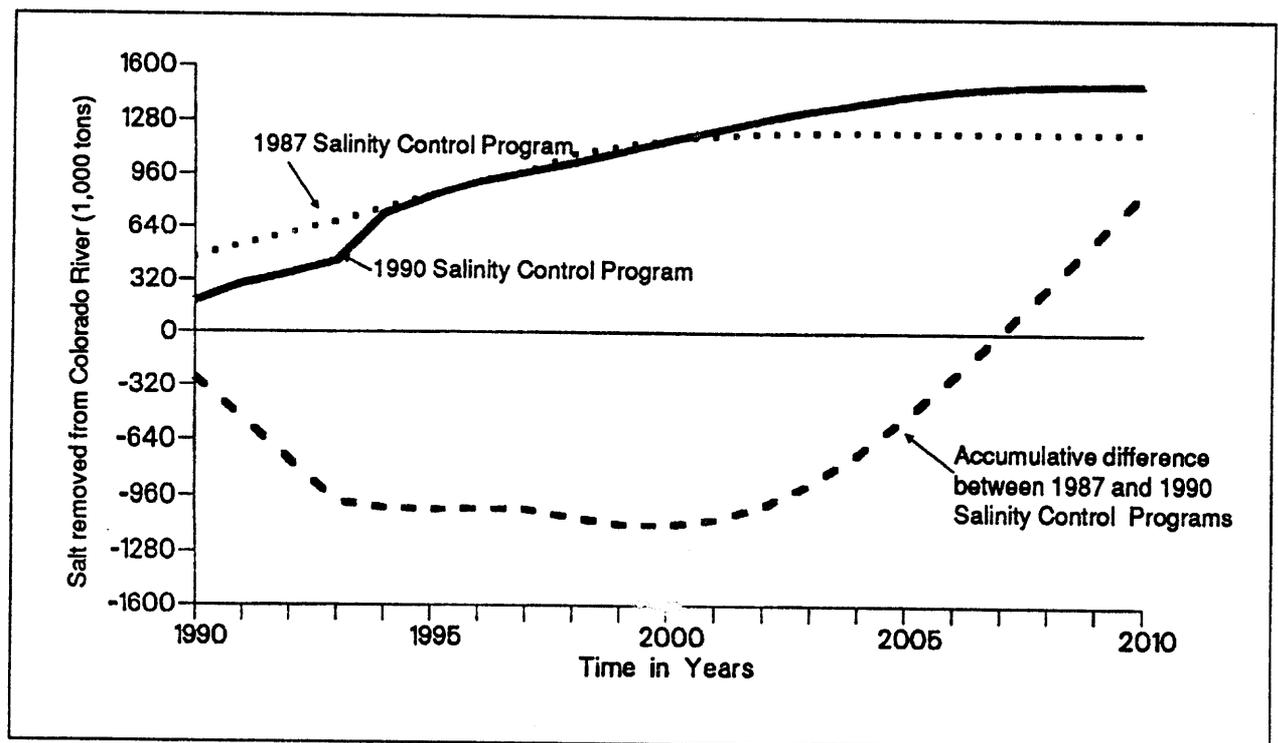


Figure 4.—Comparison of the 1990 salinity control program and 1987 salinity control program.

## Program Effects

The plan of implementation will fully satisfy salt load reduction objectives and program goals. It will maintain the average TDS at or below 879 mg/L at Imperial Dam based on long-term mean water supply and the projected demands. Figure 5 shows how the implementation plan meets the numeric criterion at Imperial Dam in 2010. It shows the projected salinity at Imperial Dam with and without further controls to the year 2010.

Public Law 93-320 and its amendment requires that a percentage of the Federal cost be repaid from the Upper and Lower Basin water development funds with revenue generated from the sale of hydropower. Repayment analysis of the Lower Colorado River Basin Fund prepared for the 1990 water quality standards review and this evaluation showed that sufficient funds are available to cover all costs (capital, operation and maintenance, and interest) of the implementation plan. The repayment analyses spreadsheets are included in appendix A.

## Conclusions

The 1990 plan of implementation will fully satisfy salt load reduction objectives and program goals, maintaining flow weighted average annual salinity levels at Imperial Dam at or below 879 mg/L. The plan will remove a total of 1.464 million tons of salt annually from the Colorado River system by 2010. The projected total remaining investment cost of the 1990 implementation plan will be approximately \$669 million.

Although high flows in the period 1983 to 1987 temporarily lowered salinity levels in the system, salinity levels are currently rising.

Repayment analysis of the Lower Colorado River Basin Fund prepared for this evaluation showed that sufficient funds are available to cover all costs (capital, O&M, and interest) of the implementation plan. The LCRBD Fund can repay its share of the costs with an inflation rate of only 2.9 percent, which further emphasizes the need to complete the implementation plan as early as possible.

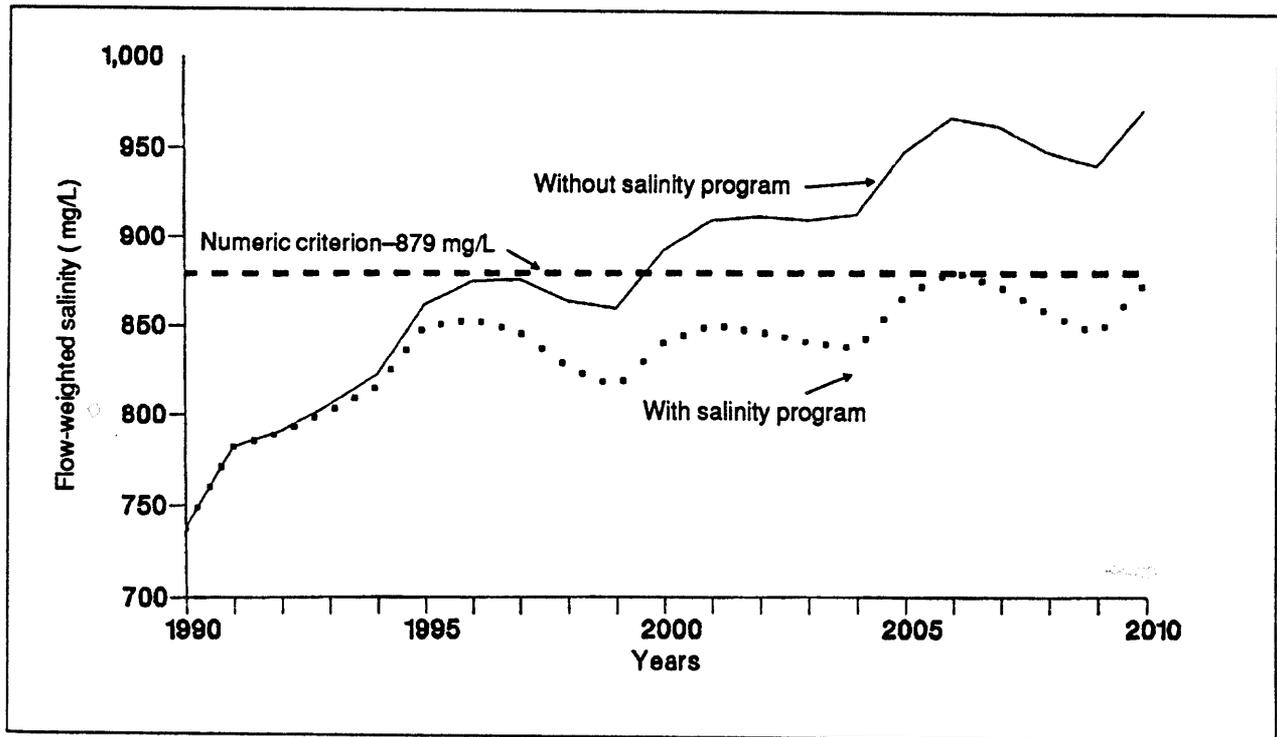


Figure 5.—Salinity projections at Imperial Dam.

# Program Status

This program status briefly describes salinity control activities over the last year for the geographic areas where actions are underway. This section also includes BLM activities not directed to specific areas.

## Big Sandy River, Wyoming—USDA

This was the third year of funding for salinity control contracts in the Big Sandy River USDA Project. To date, 13 salinity control contracts have been signed. Participants have installed 11 sprinkler irrigation systems and improved surface systems with underground pipelines and gated pipe. Technical assistance is being provided to each participant on irrigation management. As of September 30, 1990, a total salt load reduction of 4,900 tons per year has been achieved. Approximately 16 Colorado River Salinity Control (CRSC) applications are on file in the USDA office.

An SCS wildlife biologist is located in the Farson USDA office and provides full-time assistance for planning, installation, and tracking of wildlife habitat. Construction was completed in the fall of 1990 by FWS on an 11-surface acre wildlife pond. This is a voluntary cooperative wildlife project by the farmer with assistance from FWS and SCS.

The Wyoming Cooperative Extension Service (CES) assigned an Area Water Management Agent to the project in August 1989. Information and education activities are being carried out by means of consultations with participants, public presentations, and news articles. Research and demonstration activities include alfalfa variety trials and soil moisture monitoring. Assistance is being provided to secure adequate electrical power and State backed financing for CRSC participants. A locally sponsored public tour of the salinity control activities was held in August 1990.

## Dolores/McElmo Creek, Colorado

### Reclamation

The McElmo Creek Unit was authorized for construction by Public Law 98-596 in October 1984 as part of the Dolores Project. Construction of the Reach 1 Towaoc-Highline Canal was nearly complete in 1990. Construction of Reach 2 will begin in fiscal year 1991.

### USDA

USDA allocated first-year cost-share funds for salinity control contracts to this project in fiscal year 1990 and began implementation. In the first sign up, 125 applications were received. To date, 9 contracts have been signed with individuals. During the first year, 6 sprinkler systems and 4 miles of underground and gated pipe were installed to improve 8 irrigation systems. The annual salt load reduction achieved is 500 tons. Coordination of the planned onfarm salinity control actions with the Bureau of Reclamation canal and lateral construction program continue.

An experienced wildlife biologist was assigned to the Cortez SCS field office in November 1989. This biologist provides leadership for implementation of the voluntary wildlife habitat replacement program. To date, 60 percent of the applications include wildlife habitat practices.

The Cooperative Extension assigned a full-time irrigation engineer to the project in 1989 to carry out information and education activities.

## Glenwood-Dotsero Springs, Colorado—Reclamation

In 1989, Reclamation entered into a cooperative agreement to investigate and potentially participate with a private cogeneration developer. This developer would use waste

powerplant steam for desalination. The Glenwood Springs brine, once collected, would be concentrated by flash evaporators into salt blocks. The salt would then be marketed by the developer. The evaporated water would be condensed and either sold or returned to the river. Funding for the study is being shared between the developer and Reclamation, with each party paying their own expenses. The developer will submit a plan to Reclamation early in fiscal year 1991. Reclamation will then prepare an environmental assessment of the impacts of the cogeneration plant.

## **Grand Valley, Colorado**

### **Reclamation**

Construction of the Grand Valley west end laterals was well underway in 1990. A construction contract for 17 miles of piped laterals was awarded in the fall of 1988 and completed in 1989. Contracts for the installation of an additional 14.2 miles of piped laterals will continue into 1991.

Beginning in May 1988, Reclamation began purchasing land to replace habitat lost by the canal and lateral lining program. Reclamation purchased 545 acres of bottom lands along the Colorado River near Fruita, Colorado. This land and additional land from the BLM will be improved and managed for Reclamation by contract with the Colorado Division of Wildlife. In 1990, more than 1,000 acres of habitat are in development as wildlife habitat replacement.

### **USDA**

During the year, 31 CRSC contracts were signed with participants. As of September 30, 1990, a total of 149 CRSC contracts are in effect. All CRSC funds were obligated during the year with many plans prepared and awaiting funding in fiscal year 1991. Interest in the program among individuals remains strong, with many applications on file.

The installation of salinity reduction practices continues at an accelerated pace. During the year, 32 miles of pipeline and concrete-lined

ditches were installed. As of September 30, 1990, 367 miles of underground pipelines, gated pipe, and concrete ditch lining have been installed. In addition, 3,984 acres of land have been leveled and other salinity reduction practices installed, such as surge and cablegation systems to improve 102 surface irrigation systems. Technical assistance is being provided to participants on irrigation water management. The annual salt load reduction achieved as of September 30, 1990, is 39,100 tons.

Increased emphasis is being placed on the replacement of wildlife values. In fiscal year 1990, 20 percent of the new participants volunteered to include upland and wetland habitat improvement practices in their contracts. Practices include ponds, fencing, shallow water areas and habitat plantings. To further support the voluntary wildlife habitat program, SCS has a wildlife biologist assigned to the Grand Junction field office. This biologist provides full-time assistance on the wildlife habitat replacement program, including coordination with other agencies.

The Cooperative Extension assigned a second Irrigation Extension Agent to the Grand Valley project. During the year, a monthly newsletter (*The Waterline*) was sent to more than 2,000 recipients. The local salinity coordinating committee hosted a salinity tour in August 1990.

The Cooperative Extension entered into an Interagency Agreement with the Bureau of Reclamation for a surge irrigation demonstration project. Under this agreement, 35 surge systems were installed and evaluations initiated to determine the benefits over conventional systems. First year evaluations indicate that deep percolation and salt loading can be reduced up to 50 percent by surge systems.

## **Las Vegas Wash, Nevada—Reclamation**

Quarterly monitoring of salinity at 15 sites in the Wash continued during 1990. Reclamation also cooperated in a dye study to determine

time-of-travel for water in the Wash. Results of the salinity analyses indicated that total dissolved solids concentrations continue to decrease, but total salt volume is increasing due to increased water flow. Preliminary results of the dye study indicate that resident time for water in the Wash is continuing to decrease.

Reclamation requested the State of Nevada to withdraw an application for a permit to divert 20 ft<sup>3</sup>/s of water from the Wash. Approval was granted for this permit in April 1977 and an extension has been granted each year since then.

## Lower Gunnison Basin, Colorado

### Reclamation

The Lower Gunnison Basin Unit plan of development provides for replacing winter livestock water in the Uncompahgre Project system with delivery through rural domestic systems.

Construction of the first portion of the winter water system started in 1990 under a construction cooperative agreement with the Uncompahgre Valley Water Users Association. A 5-year construction period is anticipated for the completion of the entire winter water system.

### USDA

This was the third year of CRSC cost-share funding for USDA contracts with individuals and groups. During the year 17 CRSC contracts were signed. This makes a total of 40 contracts signed since the project started. All CRSC contract funds were obligated during the year, and 26 plans were prepared and are awaiting funding in fiscal year 1991.

Eighteen miles of pipeline and concrete-lined ditch have been installed along with other salinity reduction practices such as sprinkler systems, drip systems, surge irrigation, and structures for water control. Technical assistance on irrigation water management was also provided to all participants. As of September 30, 1990, a salt load reduction of 2,000 tons per year has been achieved.

An SCS wildlife biologist is located in the Delta field office and devotes full time to assisting with the planning, installation, and tracking of wildlife habitat practices. To date, 20 percent of the salinity control contracts include the voluntary application of wildlife habitat practices. During the year, an SCS wildlife biologist was placed in the Montrose field office to provide assistance on wildlife habitat replacement program in the Lower Gunnison #2 (Montrose County) project area.

The full-time Irrigation Extension Agent located in the Delta USDA Service Center provided information, education, and technical assistance for implementation of the salinity control program. During the year, a field day was held to acquaint the public with the salinity control activities. In addition, cablegation, surge, and subsurface demonstration sites were monitored.

## Moapa Valley, Nevada—USDA

Preparation of the Moapa Valley USDA salinity control project EIS continued during the year. The final EIS is scheduled for release in December 1991. During the year, engineering investigations were carried out on several alternatives for the irrigation water distribution system. Also, monitoring of shallow ground-water wells continued.

This salinity control project, located northeast of Las Vegas, Nevada, is for the installation of onfarm and off-farm irrigation systems. It is projected to reduce salt loading to the Colorado River by approximately 19,500 tons per year.

## Paradox Valley, Colorado—Reclamation

The Paradox Valley Unit facility will intercept salinity inflows to the river and dispose of the brine by deep well injection. The ongoing testing program consists of verification and refinement of controlling brine inflow to the river, design data collection for future facilities, and testing the injection well. The 2-year test will begin in fiscal year 1991.

## **Pariette Draw—BLM**

Installation of water quality monitoring stations and construction of improvements are in progress on Pariette Draw in Vernal District.

## **Price-San Rafael Rivers, Utah—Reclamation/USDA**

SCS and Reclamation continued preparation of a joint plan and EIS for the Price-San Rafael Rivers Unit. Under the joint plan, Reclamation will install salinity control features in the irrigation distribution system and USDA will assist individuals and groups apply onfarm salinity reduction practices. The plan will eliminate winter water from the canal system by installing a rural domestic water distribution system. A joint draft plan/EIS is scheduled to be filed with EPA in May 1991. The present schedule anticipates that a final EIS will be filed by December 1991.

Under the preferred plan, salt loading to the Colorado River system would be reduced by about 162,900 tons per year, with an annual cost of salt removal of \$55 per ton (January 1989 prices).

## **Sagers Wash—BLM**

A Comprehensive Watershed Management Plan and Economic Analysis will be completed for Sagers Wash in the Spring of 1991. Installation of water quality monitoring stations is underway in the Sagers Wash area.

The Sagers Wash area was the first priority watershed that was modeled (Phase II effort) by the interagency team for a nonpoint source management program, and the draft report is receiving review.

## **San Juan River, New Mexico**

### **Reclamation**

The Hammond Project, Navajo Indian Irrigation Project (NIIP), and the Hogback Irrigation Project (also a Navajo Indian project) are the principal irrigation-induced sources of salt

loading in the Basin. Preliminary canal seepage and drainage investigations were completed on the Hammond Project and justified development of a plan. Reclamation proposes to reduce seepage losses to the main canal system by lining the canal with either concrete or membrane linings. These improvements would eliminate seepage into the saline formations beneath the canals thus reducing salinity. Reclamation has focused its planning efforts in the San Juan River Unit by preparing a Draft Planning Report/Environmental Impact Statement for the Hammond Area. This report is scheduled for release in fiscal year 1991.

Preliminary review of data available in the Hogback Project Area show heavy salt loading but the mechanisms have not yet been explored. Ground water accruing to the San Juan alluvium in this vicinity have salinity concentrations of over 15,000 mg/L. Other salt sources may include abandoned oil or gas wells and wastewater from a petroleum refinery. Reclamation and the USGS are cooperatively investigating this area to identify sources of salt and potential salinity control opportunities.

Recent water quality data has shown the NIIP irrigated area groundwater return flows to be surfacing in Gallegos and Ojo Amarillo Washes, tributaries to the San Juan River. These return flows have salinities of about 3,000 mg/L and are typical of irrigation return flows. These washes are both wide and deep and the drainage water could be collected in them if disposal or industrial use alternatives appear feasible. These sources of salt will be evaluated for treatment in future studies.

### **USDA**

SCS continued with investigations during the year to determine the feasibility of an onfarm program in the San Juan River Basin. Priority has been given to the Hammond Irrigation District area because of Reclamation's planned improvements to the canal system. The USDA onfarm planning activities will continue in 1991.

## Uinta Basin, Utah

### Reclamation

The Reclamation Uinta Basin Unit Planning Report/Final Environmental Statement for Phase I was filed with the Environmental Protection Agency on June 25, 1987. This unit has not yet been authorized for construction, but is under consideration by the Administration.

### USDA

During the year, 75 CRSC contracts were signed, with participants. As of September 30, 1990, a total of 218 CRSC contracts have been signed with participants. Interest in participation by individuals and groups remains high, with a large number of applications on file awaiting planning and contract funding. Installation of salinity reduction and voluntary wildlife habitat practices continued at a rapid pace. As of September 30, 1990, 689 sprinkler systems and 487 miles of pipeline have been installed to reduce deep percolation from onfarm irrigation and seepage from earth ditches. Other salinity reduction practices were installed and technical assistance on irrigation water management provided to program participants. The annual salt load reduction achieved as of September 30, 1990, is 45,000 tons per year.

During the year, program participants installed a variety of wildlife habitat practices including ponds, shallow water areas, wildlife habitat plantings, and fencing.

A full-time Cooperative Extension Agent provides assistance to the Uinta Basin CRSC program and, during the year, completed various information/education activities, including demonstrations, tours, and publications.

A draft salinity control plan/EIS is being prepared for 20,000 acres of irrigated land that was not included in the original plan. The final plan/EIS is scheduled for completion in 1991.

## Monitoring and Evaluation

### Reclamation

Reclamation has a continuing monitoring program of the Las Vegas Wash Unit, Nevada. This consists of quarterly collection and analysis of water samples from selected locations in the Wash. Water quality data will be evaluated and reported annually to permit identification and tracking of any trends in water quality.

### USDA

USDA monitoring and evaluation activities are underway in the USDA Grand Valley, Uinta Basin, Big Sandy River, Lower Gunnison, McElmo Creek, and Moapa Valley Projects. In the Grand Valley and Uinta Basin, the M&E activities have been underway for more than 6 years. Annual reports have been prepared for the Uinta Basin, Grand Valley, and Big Sandy River projects. The M&E activities in the other projects are still in the early stages of implementation.

## Bureau of Land Management

The BLM Colorado River Basin State Directors in March of 1989 agreed to develop a strategy to reduce salinity discharges from public land. The elements of the strategy are:

- Prepare Comprehensive Watershed Management Planning and Economic Analysis Procedures. Apply them to a prototype/demonstration watershed and follow through with implementation actions.
- Demonstrate the feasibility of reducing salinity contributions through effective watershed management practices.
- Maintain a cooperative effort to implement State nonpoint source management programs.

- Establish a position to coordinate the BLM Colorado River Basin Salinity Control Program.
- Treat salinity control as a primary issue in land use planning process for areas within the Basin.
- Conduct 5-year needs assessment for salinity control in the Basin.

Progress achieved on each element is described below:

*Comprehensive Watershed Management Planning and Economic Analysis Procedures.*—A BLM workshop was held in Moab, Utah, in May 1990 and covered: (1) an interdisciplinary approach to comprehensive watershed planning; (2) projecting salt reduction from land treatment and management prescription practices; and (3) preparing a cost-effectiveness analysis of alternative practices.

The workshop resulted in development of an interagency approach to projecting salt and sediment reduction and evaluating the most cost-effective practices.

*Feasibility of Salinity Reduction.*—The Bureau of Reclamation and BLM have initiated an interagency agreement to investigate salinity control alternative improvements that may reduce the overall cost of the salinity control program. Some offices are monitoring the effectiveness of improvements outlined in the *1987 Report to Congress, Salinity Control on BLM-Administered Public Lands in the Colorado River Basin*, but limited funding has affected the capability to demonstrate salt reductions on BLM rangelands.

*Cooperative Effort on Nonpoint Source Management Areas.*—BLM has worked closely with Colorado River Basin States in preparing nonpoint source (NPS) management programs under Section 319 of the Clean Water Act. The BLM is supporting the State of Utah NPS program which focuses on priority projects in the

Utah portion of the Upper Colorado River Basin. Also, BLM is cooperating with other affected interests on a plan/action for Alkalai Creek in Colorado. An assessment is in progress that focuses on *Sediment and Salinity Problems in the Colorado River Basin Through Identification and Treatment of Excessively Eroding Lands*.

*CRBSC Coordination Position.*—A BLM salinity coordinator position was established this year to coordinate programs developed and jointly approved by the BLM. He will serve as the BLM lead coordinator for and between the seven BLM State Directors, Service Center Director, and Washington Directorate, and all entities involved with the salinity program.

*Salinity Control as a Primary Issue.*—BLM's primary concern is how to meet salinity objectives along with the other multiple-use objectives on public lands. The Comprehensive Watershed Management Plan will be the basis for deciding how to meet these objectives. The salinity program would dovetail nicely and would be consistent with multiple-use management of public lands. Proper livestock grazing and land treatment techniques in various combinations on saline soils appear to provide BLM the best opportunity to demonstrate that multiple use management and salinity control is cost-effective and accepted.

In addition, BLM is implementing the actions identified in the *1987 Report to Congress*.

*5-Year Needs Assessment.*—A funding needs assessment was conducted in 1990 based on the BLM projects currently planned. Additional funding is necessary to effectively implement a comprehensive approach to salinity control efforts on BLM rangelands. Approximately \$18.3 million will be needed over the next 5 years.

In addition, 48 positions are needed in the areas of soils, hydrology, range, natural resources, and engineering support for project design, implementation, and maintenance activities.

# Appendix A

## Repayment Analyses

The Lower Colorado River Basin repayment spreadsheet gives a comparison of estimates between the net revenues from the Lower Colorado River Basin Development (LCRBD) Fund and Lower Colorado River Basin States' (Arizona, California, and Nevada) share of the reimbursable costs for salinity control projects. The reimbursable costs to the States are based on capital and O&M costs from fiscal year 1990 budget costs and estimates from fiscal years 1991, 1992, and 1993 budget proposals. Projected cost estimates from 1994 to 2010 are estimated costs based on implementing this salinity program to meet the salinity target level in 2010. This is done on an annual basis from 1990 to 2010. This comparison assists program managers in developing a program of salinity projects that meet the salinity numeric criteria at the three stations on the river.

Projects in the implementation plan are either completed or are in various stages of planning and construction. Cost estimates for those projects being planned or constructed were indexed to October 1989 values using Reclamation's composite construction cost trends. Cost estimates for the projects were obtained from various sources, and are on record in Reclamation's offices.

The reimbursable portion of these projects by the Lower Colorado River Basin States are based on two repayment formulas determined by Public Law 93-320 and Public Law 98-569.

Projects authorized under Public Law 93-320 are Grand Valley Stage One and Stage Two, Las Vegas Wash, and Paradox Valley. The repayment formula that is applied after project construction is completed consists of 25 percent of the total investment cost as reimbursable by the States and 85 percent of this reimbursable share is to be paid by the Lower Colorado River Basin States over a 50-year time period. The formula applied in the spreadsheet is as follows:  $(\text{Total investment costs} \times 0.25 \times 0.85) / 50$  years.

Repayment of operation and maintenance (O&M) costs applies a similar formula—annual O&M costs  $\times 0.25 \times 0.85$ , and repayment is in the next fiscal year after the costs are incurred.

Projects authorized under Public Law 98-569 are Lower Gunnison Basin Unit (Winter Water) and the Dolores Project (salinity control portion). For purposes of the repayment analysis, the following projects are assumed to have the same repayment obligations: Price-San Rafael Rivers, San Juan River (Hammond portion), and Glenwood-Dotsero Springs Units. The repayment formula applied to these projects is as follows:  $(\text{Total investment costs} \times 0.30 \times 0.85) / 50$  and  $(\text{O\&M costs} \times 0.30 \times 0.85)$ , after the fiscal year in which the O&M costs are incurred.

The repayment spreadsheet contains the LCRBD Fund 1989 balance (\$16,983,000) and the estimated schedule of revenues up to the year 2010. Estimated annual repayment costs for the LCRB States are deducted from the LCRBD Fund from 1990 to 2010. For those years when the repayment costs are greater than the balance in the LCRBD Fund, interest on the deficit is calculated and that interest plus the deficit balance is added to the next year's repayment costs. The interest rate (8.125 percent) used is the most recent for fiscal year 1990 to be applied on repayment of projects under the Colorado River Basin Salinity Control Act.

A sensitivity analysis was performed by developing a spreadsheet that calculates the rate of inflation such that the balance of the LCRBD fund amounts to zero in 2010. A calculated inflation rate that appears reasonable based on recent history indicates the program can probably be repaid by 2010 with no adverse effects of inflation. The rate calculated for the 1990 Repayment Analysis is 2.9 percent which indicates that implementation must be expedited or there will probably still be some outstanding cost to be paid after 2010.

A1 Repayment based - Program used in CRSS Run # 2												
2 Draft Colorado River Salinity Program - Repayment Analysis			E F G H I J K L M N \$669 Million Alternative - Without Inflation									
3												
4 \$ in 1,000's												
5 Total Total												
6 Investment O&M thru												
7 P.L.93-320 Units Costs Costs 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998												
8 Grand Valley Stage I 29,205 168 29,205 8 8 8 8 8 8 8 8 8												
9 Grand Valley Stage II 154,701 3,168 40,317 7,783 14,732 17,927 15,366 15,000 15,000 15,000 9,000 4,576												
10 Las Vegas Wash-Pittman 1,632 1,050 1,632 50 50 50 50 50 50 50 50 50												
11 Paradox Valley Unit 72,490 7,392 53,177 2,623 3,380 4,410 4,400 4,500 462 462 462 462												
12												
13												
14 Subtotal P.L.93-320 Units: 258,028 11,778 124,331 10,464 18,170 22,395 19,824 19,558 15,520 15,520 9,520 5,096												
15 Cumulative Subtotal: 124,331 134,795 152,965 175,360 195,184 214,742 230,262 245,782 255,302 260,398												
16												
17 LCRB Fund Share												
18 Grand Valley Stage I 126 126 126 126 126 126 126												
19 Grand Valley Stage II												
20 Las Vegas Wash-Pittman 7 18 18 18 18 18 18												
21 Paradox Valley Unit 308 406 406 406												
22												
23 Subtotal-LCRB Fund Share 0 126 133 143 143 143 451 550 550 550												
24												
25 P.L.98-569 Units												
26												
27 Grand Valley USDA 40,300 0 14,260 1,092 1,500 2,000 2,000 2,000 2,000 2,000 2,000 2,000												
28 Uinta USDA 67,000 0 17,574 2,674 3,000 3,000 3,000 3,000 3,000 3,000 3,000 3,000												
29 Lower Gunnison-Wntr Mtr 30,224 5,792 228 2,513 4,726 7,372 9,908 5,477 362 362 362 362												
30 Lower Gunnison 1 USDA 34,500 0 695 1,042 1,200 2,000 2,000 2,000 2,000 2,000 2,000 2,000												
31 Lower Gunn-2-Montrose USDA 36,940 0 0 0 250 750 1,300 1,700 1,700 1,900 1,900 2,000												
32 Lower Gunn-2- Delta USDA 28,250 0 0 0 300 750 1,000 1,500 1,500 1,500 1,500 2,000												
33 Lower Gunnison 3 USDA 5,760 0 0 0 0 0 300 500 500 500 700 800												
34 Dolores-Salinity Contl-USBR 22,271 1,126 1,558 2,502 3,933 7,867 6,157 252 70 70 70 70												
35 McElme Creek USDA 15,500 0 0 397 750 1,500 2,000 2,000 2,000 2,000 1,500												
36 Big Sandy USDA 9,720 0 448 795 1,000 1,300 1,500 1,300 1,300 1,000 600 477												
37 Moapa Valley USDA 5,430 0 0 0 1,000 1,700 1,000 300 300 300 300 300												
38 Price-San Rafael USDA 23,360 0 0 0 0 0 0 1,000 1,700 1,800 2,200 2,200												
39 Price-San Rafael-USBR 35,182 0 0 0 0 0 0 2,056 2,305 5,654 4,482 2,955												
40 Glenwood Sprg-Dotzero 0 115,303 0 0 0 1,788 7,154 7,154 7,154 7,154 7,154												
41 Bur. of Land Management 40,417 0 0 417 833 1,250 1,667 2,083 2,500 2,917 3,333 3,750												
42 Hammond - USDA 2,170 0 0 0 0 0 0 100 200 300 300 300												
43 Hammond - USBR 9,174 280 0 0 0 0 0 3,058 3,058 3,058 20 20												
44 Uinta Stage I 27,917 1,958 0 0 0 0 0 4,082 2,735 3,705 4,304 6,108												
45												
46 Subtotal P.L.98-569 Units 434,115 124,459 34,763 11,432 18,493 31,277 38,986 39,562 34,385 39,220 36,225 36,996												
47 Cumulative Subtotal: 34,763 46,195 64,688 95,965 134,951 174,514 208,898 248,118 284,344 321,340												
48												
49 Subtotal - LCRB Fund Share 2,915 4,716 7,976 9,941 10,088 8,768 10,001 9,237 9,434												
50												
51 Other Units												
52												
53 Project A												
54 Project B												
55 Project C												
56 Project D												
57												
58 Subtotal Other Units 0 0 0 0 0 0 0 0 0 0 0 0												
59 Cumulative Subtotal: 0 0 0 0 0 0 0 0 0 0 0 0												
60 LCRB Fund Share												
61 - Other Units 0 0 0 0 0 0 0 0 0 0 0 0												
62												
63 TOTAL - ALL UNITS 692,143 136,237 159,094 21,896 36,663 53,672 58,810 59,120 49,905 54,740 45,745 42,082												
64 CUMULATIVE TOTAL: 159,094 180,990 217,653 271,325 330,135 389,256 439,160 493,900 539,646 581,738												
65 Est. remaining program (669,286) = (692,143 + 136,237) - 159,094												
66 TOTAL - LCRB Fund Share 0 3,041 4,848 8,119 10,085 10,232 9,220 10,551 9,787 9,984												
67												
68 LCRB Funds 0 9,290 9,050 8,115 8,285 8,565 8,500 8,470 8,150 8,050												
69 Balance 0 6,249 4,201 (4) (1,800) (1,667) (720) (2,081) (1,637) (1,934												
70 Previous Balance 0 16,963 23,212 27,413 27,408 25,608 23,941 23,221 21,140 19,503												
71												
72 Balance 0 23,212 27,413 27,408 25,608 23,941 23,221 21,140 19,503 17,569												
73 Interest Component 0 0 0 0 0 0 0 0 0 0 0 0												
74												
75 TOTAL - Balance 16,963 23,212 27,413 27,408 25,608 23,941 23,221 21,140 19,503 17,569												

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
8	8	8	8	8	8	6	8	8	8	8	8
264	264	264	264	264	264	264	264	264	264	264	264
50	50	50	50	50	50	50	50	50	50	50	50
462	462	462	462	462	462	462	462	462	462	462	462
784	784	784	784	784	784	784	784	784	784	784	784
261,182	261,966	262,750	263,534	264,318	265,102	265,886	266,670	267,454	268,238	269,022	269,806
126	126	126	126	126	126	126	126	126	126	126	126
657	714	714	714	714	714	714	714	714	714	714	714
18	18	18	18	18	18	18	18	18	18	18	18
406	406	406	406	406	406	406	406	406	406	406	406
1,207	1,263	1,263	1,263	1,263	1,263	1,263	1,263	1,263	1,263	1,263	1,263
2,000	2,000	2,000	1,000	1,000	800	648					
3,000	3,000	3,000	3,000	3,000	3,000	2,500	1,500	752			
362	362	362	362	362	362	362	362	362	362	362	362
2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	1,000	563		
2,000	3,000	3,000	3,000	3,000	3,000	3,000	2,500	1,500	1,000	440	
2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	1,500	700		
1,000	800	660									
70	70	70	70	70	70	70	70	70	70	70	70
1,000	353										
230											
2,970	2,730	2,800	2,500	2,000	900	460					
2,955	2,955	2,955	2,955	2,955	2,955						
7,154	7,154	7,154	7,154	6,205	6,205	6,205	6,205	6,205	3,650	3,650	3,650
4,167	5,000	4,500	4,000	2,500	1,000	500	0	0	0	0	0
300	300	200	170	0	0	0	0	0	0	0	0
20	20	20	20	20	20	20	20	20	20	20	20
6,983	178	178	178	178	178	178	178	178	178	178	178
38,211	32,022	30,899	28,409	25,290	22,491	17,943	14,835	11,587	6,543	4,720	4,280
359,551	391,574	422,473	450,882	476,173	498,664	516,607	531,442	543,030	549,573	554,294	558,574
9,744	8,166	7,879	7,244	6,449	5,735	4,576	3,783	2,955	1,669	1,204	1,092
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
38,995	32,806	31,683	29,193	26,074	23,275	18,727	15,619	12,371	7,327	5,504	5,064
620,733	653,540	685,223	714,416	740,491	763,766	782,493	798,112	810,484	817,811	823,316	828,380
10,951	9,429	9,143	8,508	7,712	6,998	5,839	5,046	4,218	2,932	2,467	2,355
8,040	8,075	8,100	8,025	7,800	7,640	9,079	12,250	11,908	11,810	11,810	12,080
(2,911)	(1,354)	(1,043)	(483)	87	641	3,240	7,203	7,690	8,878	9,343	9,725
17,569	14,657	13,303	12,260	11,777	11,865	12,506	15,746	22,949	30,639	39,517	48,859
14,657	13,303	12,260	11,777	11,865	12,506	15,746	22,949	30,639	39,517	48,859	58,584
0	0	0	0	0	0	0	0	0	0	0	0
14,657	13,303	12,260	11,777	11,865	12,506	15,746	22,949	30,639	39,517	48,859	58,584



1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
11	11	11	12	12	12	13	13	13	14	14	15
352	362	373	384	395	406	418	431	443	456	469	483
67	69	71	73	75	77	79	82	84	86	89	91
616	634	653	672	691	711	732	753	775	798	821	845
1,045	1,076	1,107	1,140	1,173	1,207	1,242	1,279	1,316	1,354	1,394	1,435
280,644	281,720	282,827	283,967	285,140	286,347	287,589	288,868	290,184	291,538	292,932	294,367
126	126	127	127	127	127	127	127	127	127	127	127
729	804	806	808	810	813	815	818	820	823	826	828
21	22	22	22	23	23	24	24	25	25	26	26
443	447	451	455	459	463	467	472	476	481	486	491
1,320	1,399	1,405	1,412	1,419	1,426	1,433	1,441	1,448	1,456	1,464	1,473
2,667	2,745	2,825	1,454	1,496	1,232	1,027					
4,000	4,117	4,237	4,361	4,488	4,619	3,961	2,446	1,262			
483	497	511	526	542	557	574	590	608	625	644	662
2,667	2,745	2,825	2,907	2,992	3,079	3,169	3,262	1,678	973		
2,667	4,117	4,237	4,361	4,488	4,619	4,754	4,077	2,518	1,727	782	
2,667	2,745	2,825	2,907	2,992	3,079	3,169	3,262	2,518	1,209		
1,333	1,098	932									
94	97	99	102	105	108	112	115	118	122	125	129
1,333	484										
307											
3,960	3,884	3,955	3,634	2,992	1,386	729					
3,940	4,055	4,173	4,295	4,421	4,550						
9,539	9,817	10,104	10,399	9,283	9,554	9,832	10,119	10,415	6,305	6,489	6,679
5,556	6,861	6,356	5,814	3,740	1,540	792	0	0	0	0	0
400	412	282	247	0	0	0	0	0	0	0	0
27	27	28	29	30	31	32	33	34	35	36	37
9,311	244	251	259	266	274	282	290	299	307	316	326
50,949	43,944	43,640	41,295	37,834	34,628	28,433	24,194	19,449	11,303	8,392	7,832
422,952	466,896	510,537	551,831	589,665	624,293	652,726	676,921	696,370	707,673	716,065	723,897
12,992	11,206	11,128	10,530	9,648	8,830	7,250	6,170	4,959	2,882	2,140	1,997
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
51,995	45,020	44,748	42,434	39,007	35,835	29,675	25,473	20,765	12,658	9,786	9,267
703,597	748,616	793,364	835,798	874,805	910,640	940,316	965,789	986,553	999,211	1,008,997	1,018,264
14,312	12,604	12,533	11,942	11,066	10,256	8,683	7,610	6,408	4,339	3,604	3,470
8,040	8,075	8,100	8,025	7,800	7,640	9,079	12,250	11,908	11,810	11,810	12,080
(6,272)	(4,530)	(4,434)	(3,917)	(3,267)	(2,616)	395	4,639	5,500	7,471	8,205	8,610
4,535	(1,878)	(6,929)	(12,286)	(17,519)	(22,475)	(27,130)	(28,907)	(26,239)	(22,424)	(16,168)	(8,610)
(1,737)	(6,408)	(11,362)	(16,203)	(20,786)	(25,091)	(26,735)	(24,267)	(20,739)	(14,953)	(7,963)	(0)
(141)	(521)	(923)	(1,316)	(1,689)	(2,039)	(2,172)	(1,972)	(1,685)	(1,215)	(647)	(0)
(1,878)	(6,929)	(12,286)	(17,519)	(22,475)	(27,130)	(28,907)	(26,239)	(22,424)	(16,168)	(8,610)	(0)

1990 Salinity Control Program  
Annual Expenditures (\$1,000)  
Bureau of Reclamation, Soil Conservation Service (construction costs only), and Bureau of Land Management

	Years																					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
USBR	15,479	26,829	39,422	43,043	41,637	31,205	35,523	25,912	21,765	18,328	11,523	11,523	11,523	10,574	10,575	7,619	7,619	7,619	7,619	5,064	5,064	5,064
USDA	6,000	9,000	13,000	14,100	15,400	16,200	16,300	16,500	16,577	16,500	16,283	15,660	13,670	13,000	11,700	10,608	8,000	8,000	4,752	2,263	440	0
BLM	417	833	1,250	1,667	2,083	2,500	2,917	3,333	3,750	4,167	5,000	4,500	4,000	2,500	1,000	500	0	0	0	0	0	0
TOTAL	21,896	36,663	53,672	58,810	59,120	49,905	54,740	45,745	42,092	38,995	32,806	31,683	29,193	26,074	23,275	18,727	15,619	12,371	7,327	5,504	5,064	5,064
CUMULATIVE TOTAL	21,896	58,559	112,231	171,041	230,161	280,066	334,806	380,552	422,644	461,639	494,445	526,129	555,322	581,396	604,671	623,399	639,018	651,389	658,717	664,221	669,286	669,286