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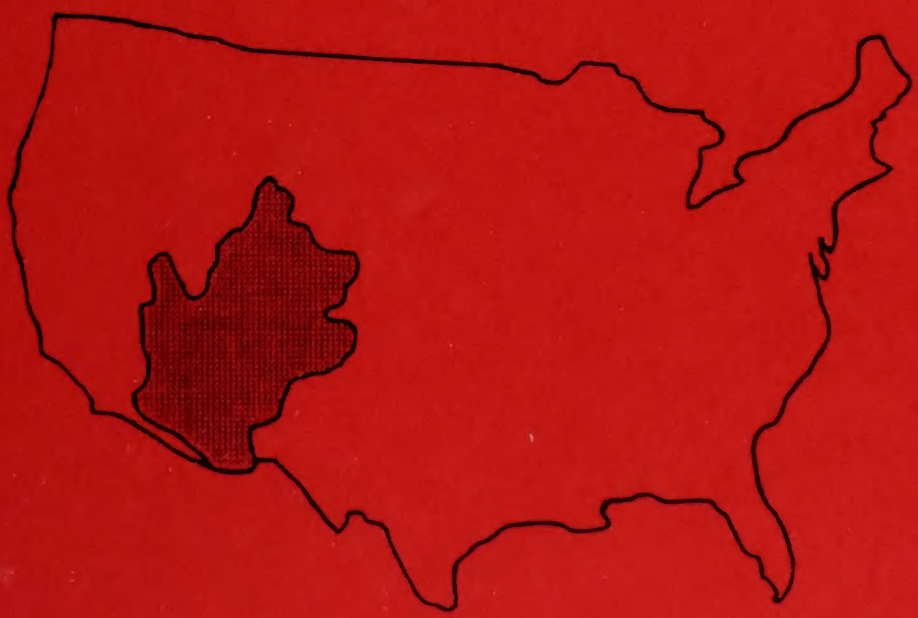
1991 Joint Evaluation of the Salinity Control Program in the Colorado River Basin



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

January 1992

1991 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

January 1992

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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Overview

The salinity control program in the Colorado River Basin was authorized by the Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320), as amended by Public Law 98-569.

As required by the Clean Water Act (Public Law 92-500), existing numeric salinity criteria and the plan for implementing the salinity control program must be reviewed every 3 years. The last review was documented in *Report on the 1990 Review, Water Quality Standards for Salinity, Colorado River System*, May 1990. The salinity control plan identified in that review satisfies salt load reduction objectives and program goals by maintaining average total dissolved solids (TDS) at Imperial Dam at or below 879 milligrams per liter (mg/L), while the Basin States continue to develop their compact-apportioned waters. The 1990 salinity control plan is the officially adopted plan.

This 1991 joint evaluation report, prepared by the U.S. Department of the Interior and the U.S. Department of Agriculture, describes adjustments to the salinity control plan identified in the 1990 review. The adjustments consist of (1) removing Bureau of Land Management projects from the repayment analysis; (2) analyzing the transfer of $10 million from the Lower Colorado River Basin Development (LCRBD) Fund; (3) making various changes in costs; (4) modifying implementation schedules to reflect delays, etc., in projects such as Glenwood-Dotsero Springs Unit and Uinta Basin Stage 1; and (5) updating salt removal accomplishments through 1991.

This report also outlines the coordination efforts needed to effectively implement the salinity control program and describes major program activities through fiscal year 1991. Figure 1 shows the locations of the Department of the Interior and Department of Agriculture salinity control units. Table 1 shows the salinity control plan.

The salinity control plan will remove about 1.5 million tons of salt annually from the Colorado River system by the year 2010 at a remaining cost of approximately $604 million.

Public Law 93-320 and its amendment require that a percentage of the Federal cost of the salinity control program be repaid from the Upper and Lower Basin water development funds with revenue generated from the sale of hydropower. Repayment analysis of the LCRBD Fund prepared for this evaluation shows that sufficient funds are available to cover all costs of the salinity control plan. The LCRBD Fund can repay its share of the costs with an inflation rate of 3.4 percent.

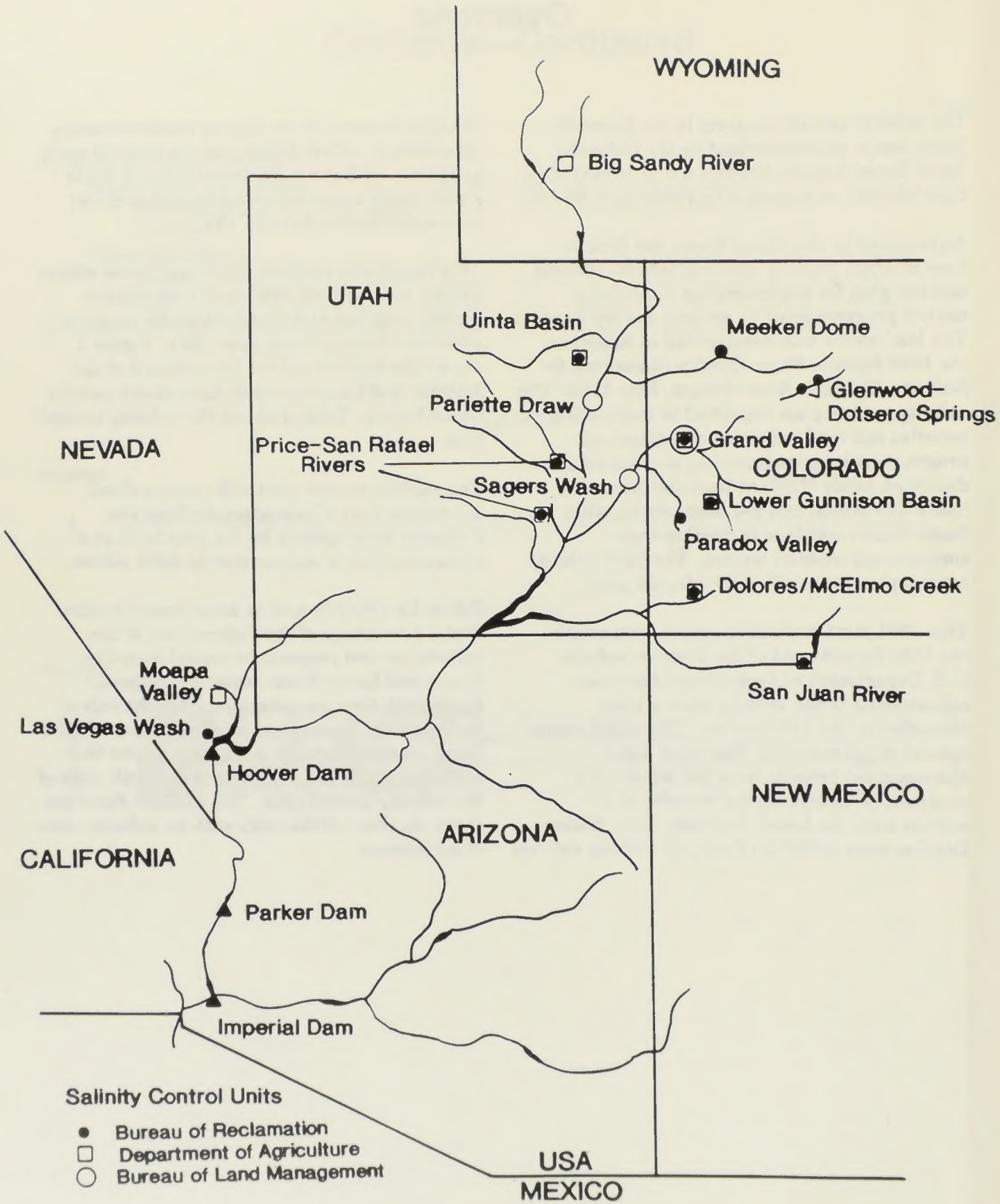

Figure 1.—Colorado River Basin salinity control units.

Table 1.—Salinity control plan

	Begin implementation	Completion date	Salt removed (tons/year)	Estimated salt removal (tons/year)	Cost effectiveness ($/ton)
Meeker Dome (Reclamation)	Complete	1983	48,000	48,000	14
Las Vegas Wash Pittman (Reclamation)	Complete	1985	3,800	3,800	44
Grand Valley Stage One (Reclamation)	Complete	1984	21,900	21,900	121
Grand Valley (USDA)	1979	2010	50,200	163,000	27
Uinta Basin (USDA)	1980	2010	50,000	106,800	80
Grand Valley Stage Two (Reclamation)	1985	1997	25,600	131,400	113
Well plugging (BLM)	1985	2010	8,000	9,000	
Big Sandy River (USDA)	1988	2006	9,000	52,900	27
Paradox Valley (Reclamation)	1988	1994		180,000	49
Lower Gunnison 1 and Lower Gunnison 2, Delta (USDA)[1]	1988	2010	10,800	186,800	51
McElmo Creek (USDA)	1990	2007	2,300	38,000	83
Dolores Project (Reclamation)	1990	1995		23,000	84
Lower Gunnison winter water (Reclamation)	1991	1995		74,000	38
Lower Gunnison 2, Montrose (USDA)	1991	2010	200	81,700	68
Muddy Creek (BLM)	1992	1997		[2]4,000	
Grand Valley (BLM)	1992	1996		[3]3,000	
Glenwood Springs (Reclamation)	1992	1993		73,000	92
Moapa Valley (USDA)	1993	2002		13,600	57
Lower Gunnison 3 (USDA)	1992	2006		12,000	74
Sagers Wash (BLM)	1993	1998		[3]2,000	
San Juan-Hammond (Reclamation)	1994	1996		27,700	35
San Juan (USDA)	1994	2007		[3]12,500	
Other (BLM)	1994	2010		32,000	
Uinta Basin I (Reclamation)	1994	1999		25,500	88
Price-San Rafael (Reclamation/USDA)	1994	2010		161,000	39
Totals			229,800	1,486,600	

Units under consideration but not currently in program:

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

Units investigated but no longer being considered:

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

[1] Lower Gunnison 1 and Lower Gunnison 2, Delta combined.
[2] Early analysis by BLM conservatively indicates at least the tons indicated.
[3] Estimated. Investigations under way.

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) occurs through agency interaction at the field level and through the USDA, Reclamation, and BLM salinity control coordinators. Several committees coordinate actions among participating Federal and State interests.

Interagency Salinity Control Coordinating Committee

The Interagency Salinity Control Coordinating Committee (ISCCC) facilitates communication about salinity control program issues among Federal agencies. The ISCCC met twice in 1991 to address Federal interagency policy issues.

Technical Policy Coordinating Committee

Technical coordination among agencies is accomplished through the Technical Policy Coordinating Committee (TPCC). The TPCC was formed to improve the coordination of salinity control investigations and the construction of salinity control units. In addition to Reclamation, BLM, and the USDA 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. The TPCC met in 1991; several committee subgroups also met several times to address specific issues.

SCS, EPA, and FWS held several meetings to address wetlands issues. Utah SCS and EPA met to discuss the Price-San Rafael Rivers Unit and Uinta Basin Expansion Environmental Impact Statements (EIS). Various agencies also met to discuss updating the salinity detriments study.

USDA Salinity Control Coordinating Committee

The USDA Salinity Control Coordinating Committee is responsible for coordinating USDA program activities at the national level. This committee is comprised of representatives from the Agricultural Stabilization and Conservation Service, the Extension Service (ES), and the SCS. Reclamation, BLM, and EPA also participate in committee meetings.

This committee met regularly in 1991 and took action on a number of policies, procedures, and fund management issues to ensure effective coordination of USDA agency activities.

Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum was established in 1973 to foster 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 are represented on the Colorado River Basin Salinity Control Forum Work Group and serve as advisors to the Forum.

The Forum met in Salt Lake City, Utah, on May 15, 1991, and in Yuma, Arizona, on November 8, 1991. The Forum Work Group met five times in 1991.

Program Evaluation

Background

Colorado River salinity concentrations fluctuated widely over the period 1941 to 1991. Generally, salinity concentrations 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, levels currently are rising. Figure 2 shows the annual flows of the Colorado River at Imperial Dam and the corresponding annual salinity concentrations.

Figure 3 provides a historical perspective, the numeric criterion, and the projections of salinity at Imperial Dam without further salinity control measures. Without the recommended controls, the salinity at Imperial Dam is expected to increase significantly over the next 20 years. About 1.5 million tons of salt per year must be removed from the Colorado River system by the year 2010 to maintain TDS levels at the numeric criterion of 879 mg/L at Imperial Dam. Projects that control about 230,000 tons per year have been completed. Therefore, an additional 1.3 million tons per year needs to be controlled.

The following salinity control projects, or portions of them, are removing the approximately 230,000 tons of salt annually from the river system: Meeker Dome, Las Vegas Wash, Grand Valley, Uinta Basin, Big Sandy River, Lower Gunnison, and McElmo Creek Units and BLM well plugging. (See table 1.)

Projections of future salinity levels in the Colorado River (shown in figure 3) were 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 attributed to several factors, including water demands, weather, and salinity control measures. However, salinity levels at Hoover Dam and below are very sensitive to the following two factors:

- Accumulated reservoir inflow and resulting high reservoir storage—Whenever reservoir inflow is significantly greater than normal, dilution generally occurs within the large reservoirs of Lakes Powell and Mead.

- Reservoir discharges—Whenever riverflows are low, salinity concentrations are high; whenever riverflows are high, salinity concentrations are low.

Very rapid changes in salinity levels can be observed when these two conditions exist at the same time. For example, when (1) previous reservoir inflows have been high for several seasons and (2) reservoir discharge has been above average, very low salinity levels can be expected, as in 1986 (less than 600 mg/L). Conversely, high salinity levels 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 in any given year do not begin to reduce salinity levels at Imperial Dam until many years later. This time lag is recognized when scheduling project implementation to achieve desired results.

The Program

The salinity control plan is designed to maintain the average salinity concentration of the Colorado River at or below the numeric criteria at the three stations (Hoover, Parker, and Imperial Dams) without impairing the development and use of compact-apportioned waters in the Colorado River Basin. The Basin-wide salinity control program is designed to offset salinity increases caused by man's development of the States compact-apportioned

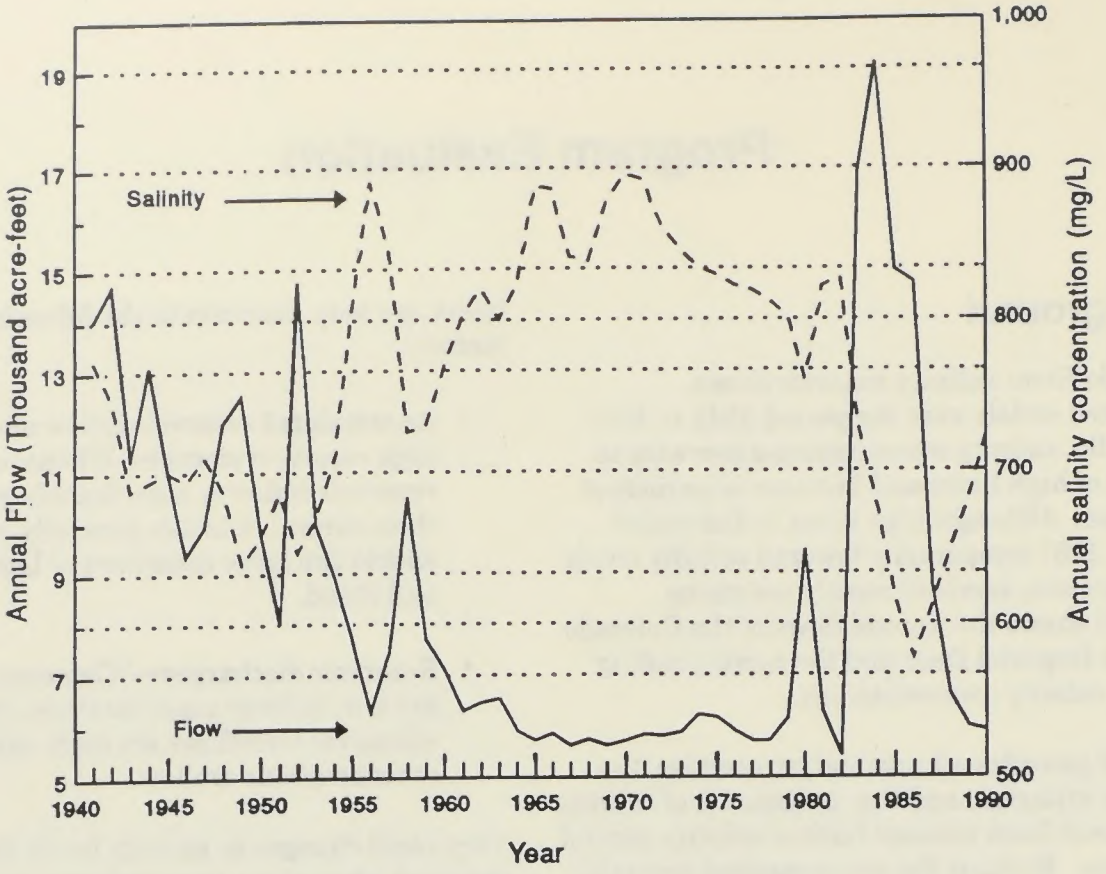

Figure 2.—Historical flows and salinity concentration at Imperial Dam.

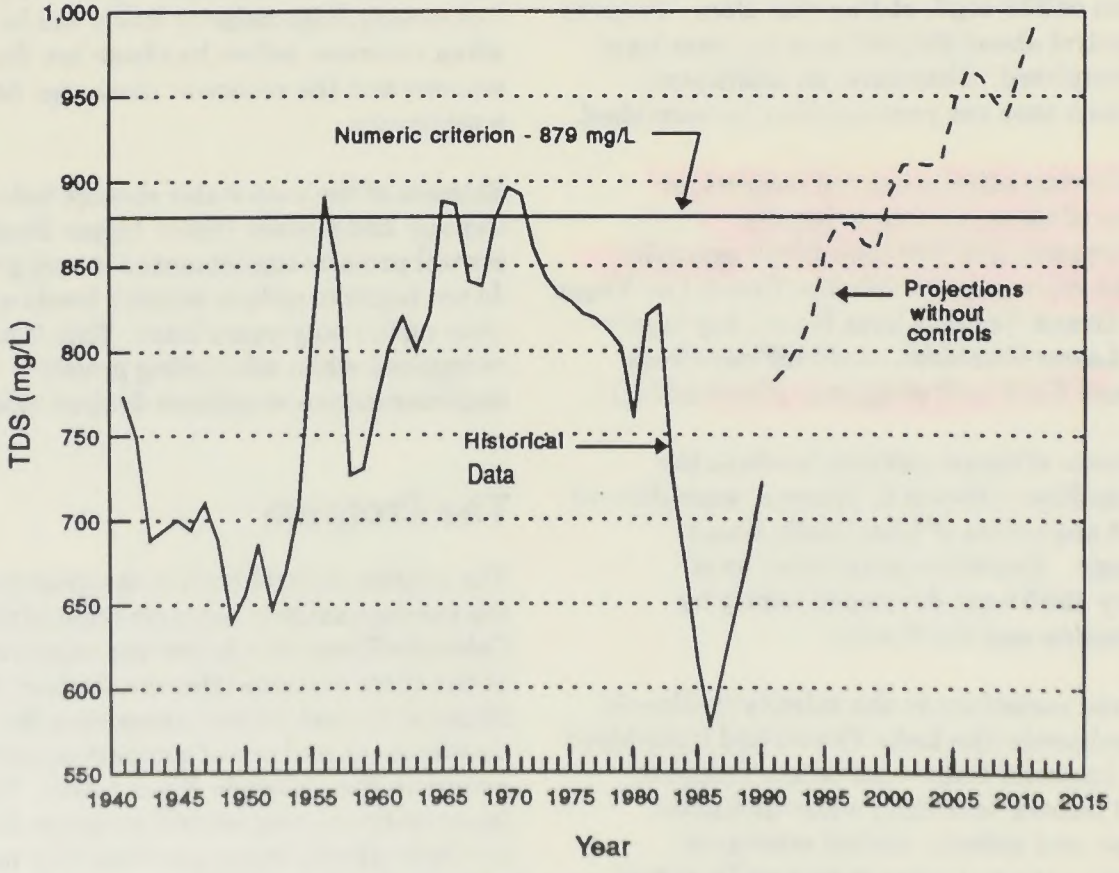

Figure 3.—Historical data and salinity projections without further controls at Imperial Dam.

waters and makes no attempt to offset salinity increases resulting from natural hydrologic variations of the river system. Salinity control is accomplished primarily by 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.

The salinity control plan will remove about 1.5 million tons of salt annually from the Colorado River system by the year 2010 at a remaining cost of the approximately $604 million.

Figure 4 shows how the salinity control plan identified in 1990 meets the numeric criterion at Imperial Dam in 2010. Figure 4 also shows the projected salinity at Imperial Dam with and without further controls to the year 2010.

Funding

Public Law 93-320 and its amendment require that a percentage of the Federal cost for the salinity control program 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 the 1990 water quality standards review and this evaluation shows that sufficient funds are available to cover all costs of the salinity control plan. The 1991 repayment analysis spreadsheets are included in the appendix.

USDA

The current funding of $14.786 million for the USDA portion of the plan greatly restricts implementation of existing projects and hinders bringing new projects into the program. More

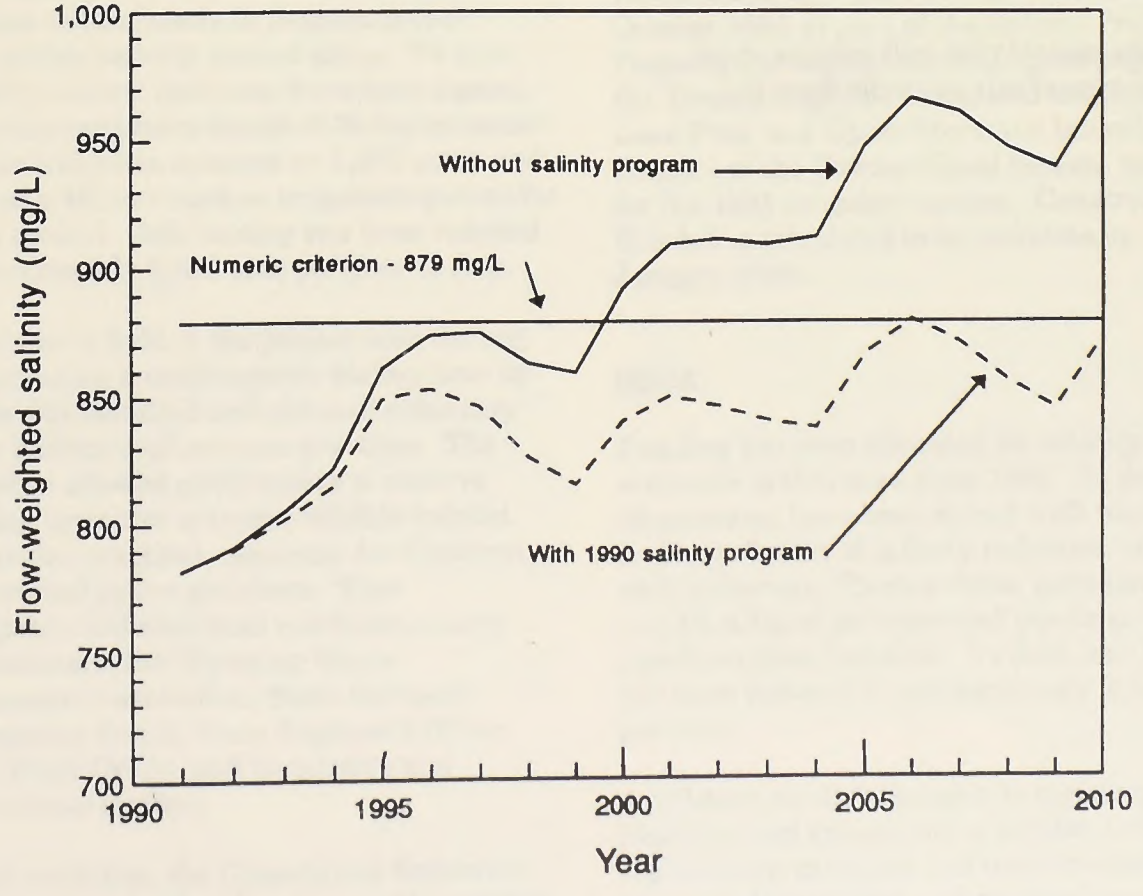

Figure 4.—Salinity projections at Imperial Dam.

than 500 farmers are currently waiting to participate in the program. Annual funding of $25 million is needed to achieve the USDA implementation schedule.

BLM

In the BLM program, six Basin States expended $863,000 on salinity efforts from a salinity budget of $679,000 in 1991. The difference was funded by other BLM sources. Of the funds expended, 30 percent was spent on inventories; 32 percent on planning, 26 percent on implementation; and 12 percent on maintenance and monitoring.

Additional funding is necessary to effectively implement the salinity control efforts envisioned on BLM rangelands. Approximately $39 million will be needed over the next 5 years: 3 percent will be expended for inventories; 20 percent for planning; 68 percent for implementation; and 9 percent for maintenance and monitoring.

Conclusions

The salinity control plan will remove about 1.5 million tons of salt annually from the Colorado River system by the year 2010 at a remaining cost of approximately $604 million.

Repayment analysis of the LCRBD Fund prepared for this evaluation shows that sufficient funds are available to cover all costs of the salinity control plan. The LCRBD Fund can repay its share of the costs with an inflation rate of 3.4 percent.

Implementing the salinity control plan on the schedule shown in table 1 assumes adequate annual funding. Should the cost effectiveness of any unit change, or should a measure fail to remove the expected amount of salt from the river system, one or more of the deferred units may again be examined.

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 and with increased costs to achieve the same goal.

Program Status

This section briefly describes 1991 salinity control activities.

Big Sandy River Unit, Wyoming

The Big Sandy River Unit is located in southwestern Wyoming. USDA identified a cost-effective onfarm program to remove 52,900 tons of salt from the Colorado River system that primarily focuses on converting surface flood irrigation to low-pressure sprinkler systems. Reclamation did not identify a cost-effective off-farm salinity control program.

USDA

Funding has been allocated for salinity control contracts in the Big Sandy River Unit since 1988. USDA provides technical and financial assistance to land users in preparing and implementing salinity control plans. To date, 28 salinity control contracts have been signed, and participants have installed 26 low-pressure sprinkler irrigation systems on 2,227 acres and improved a 40-acre surface irrigation system for salinity control. Salt loading has been reduced by approximately 9,000 tons per year to date.

Six tours were held in the project area during 1991, including a multi-agency biology tour to evaluate the installed and planned voluntary wildlife habitat replacement practices. The other tours allowed participants to observe operating sprinkler systems, wildlife habitat replacement practices, economic development, and electrical power problems. Tour participants included local residents, county commissioners, the Wyoming Water Development Association, State Economic Development Board, State Engineers Office, Forum Work Group, and legislative and congressional staffers.

In other activities, the Cooperative Extension Service installed a data logging weather station that will be used to demonstrate to irrigators the utility of using evapo-transpiration equation data for irrigation scheduling.

McElmo Creek Unit—Dolores Project, Colorado

The McElmo Creek Basin is located in southwestern Colorado and covers about 720 square miles. Early studies in the area showed that salt loading results from irrigation and diffuse sources, with irrigation as the main contributor. Reclamation and USDA have identified cost-effective programs to reduce salt-loading from the area by 61,000 tons per year.

Reclamation

The McElmo Creek Unit was authorized for construction by Public Law 98-596 in October 1984 as part of the Dolores Project. Project goals include controlling seepage from the Towaoc-Highline Canal and the Rocky Ford, Lone Pine, and Upper Hermana laterals. Reach 1 of the Towaoc Canal became operational for the 1991 irrigation season. Construction of Reach 2 is scheduled to be complete by January 1993.

USDA

Funding has been allocated for salinity control contracts in this area since 1990. To date, 38 contracts have been signed with participants, and installation of salinity reduction practices is well underway. Twenty-three sprinkler systems and 15 miles of underground pipelines and gated pipe have been installed. To date, salt loading has been reduced by approximately 2,300 tons per year.

A full-time wildlife biologist is assisting with planning and application of wildlife habitat replacement practices and implementation of the associated evaluation and monitoring systems.

Information and education activities included field days at the Southwestern Colorado Research and Extension Service and tours of the project area. Booths were set up at the Four Corners Agricultural Exposition and the Montezuma County Fair, and a series of irrigation water management workshops were held in the area as well. Irrigation water management for sprinkler systems is being enhanced through use of (1) crop water-use reports from an automatic weather station, (2) information from sprinkler-can tests, and (3) portable flow/pressure meters and automatic shut-off valves.

Glenwood-Dotsero Springs Unit, Colorado

This unit is located along the Colorado River in Eagle, Garfield, and Mesa Counties in west-central Colorado. The unit constitutes the second largest point source of salinity to the Colorado River. About half the salt comes from 20 surface saline springs; the remainder enters as seeps and underwater springs within the river channel.

Reclamation

As an alternative to federally developed projects in the Glenwood Springs area, Reclamation entered into a cooperative agreement in 1989 to investigate and possibly participate with a private cogeneration developer. The facility would collect and remove up to 73,000 tons of salt per year from the surface springs that contribute approximately 174,000 tons of salt annually to the Colorado River. The developer would use waste powerplant steam for desalination. The brine, once collected, would be concentrated by flash evaporators into salt blocks, and the evaporated water would be condensed and either sold or returned to the river. The developers are investigating alternative sites outside the city limits of Glenwood Springs.

Grand Valley Unit, Colorado

The Grand Valley Unit is located in west-central Colorado along the reach of the Colorado River near Grand Junction. The purpose of the unit is to remove the estimated 316,300 tons of salt added to the Colorado River annually as a result of conveyance system seepage and deep percolation from irrigated farmland.

Reclamation

Reclamation is improving the conveyance systems as a cost-effective method of reducing off-farm seepage and salt loading. Work is progressing in two stages, with Stage One work essentially complete. Stage Two work provides for installing pipe laterals in the private and Federal systems within the Stage Two area and lining portions of the Government Highline Canal. Reclamation has developed a lining plan that minimizes the need for right-of-way acquisitions without significantly increasing project costs. Construction on the Price and Stubb Ditches (part of Stage Two work) began in fiscal year 1991; construction will take approximately 3 years to complete.

Plans are also underway to continue with USDA a successful surge irrigation research and demonstration program. The purpose of the program is to determine the effectiveness of surge irrigation as an alternative method of irrigation for controlling salinity.

USDA

USDA is helping farmers make onfarm improvements to reduce salt loading from farm operations. At the end of fiscal year 1991, 205 salinity control contracts had been signed. Participants are applying salinity control and wildlife habitat replacement practices. To date, 387 miles of underground pipelines, gated pipe, and concrete-lined ditches have been installed and 4,200 acres of land have been leveled. Drip and surge irrigation systems and other practices have been installed as well. Salt loading has been reduced by 50,200 tons per year.

This was the second year for implementation of the Grand Valley surge irrigation research and demonstration project. Under this Reclamation-funded project, farmers, with assistance from the Cooperative Extension and SCS, installed 77 surge irrigation systems. The new systems are being evaluated to determine

the salinity reduction benefits over conventional systems. Also, liquid fertilizer has been added through the surge valves. As a result, increased yields and less deep percolation losses of nitrate nitrogen have been observed.

In other activities, the popular and informative monthly newsletter, *The Waterline*, continues to be published in the Grand Valley. USDA agencies in the Grand Valley hosted a total of 11 tours and public field days.

BLM

Efforts are underway to complete similar work already undertaken at Indian Wash drainage for those drainages west to the Utah State line. Objectives include improving grazing management practices, increasing vegetative cover, decreasing soil losses, and installing structures, where needed, to control flows and stop soil erosion.

Las Vegas Wash Unit, Nevada

Las Vegas Wash is a natural drainage channel that provides the only surface water outlet for the 2,000-square-mile Las Vegas Valley. A drainage area of 1,586 square miles directly contributes to the wash, which conveys storm runoff and wastewater to Las Vegas Bay, an arm of Lake Mead.

Reclamation

Reclamation continued quarterly monitoring of salinity at 15 sites in the Wash in 1991. Results of the salinity analyses indicated that TDS concentrations continue to decrease, but total salt volume is increasing due to increased water flow. The unit prevents 3,800 tons of salt per year from reaching the Colorado River.

Lower Gunnison Basin Unit, Colorado

The Lower Gunnison Basin Unit is located in west-central Colorado in Delta and Montrose Counties. The objective of the unit is to reduce salt loading by 354,500 tons per year in the Uncompahgre, Gunnison, and Colorado Rivers.

Reclamation

Part of Reclamation's plan of development provides for replacing winter livestock water in the Uncompahgre Project system with delivery through rural domestic systems. Construction of this portion of the unit is proceeding ahead of schedule and under budget. Phase 1 of 5 has been completed, and work on Phase 2 is well underway.

Another part of the plan provides for lining canals and laterals on the east side of the Uncompahgre Valley. Studies continue on ways to reduce the cost of the lining program through construction cooperative agreements, cost-sharing, and redesign of the delivery system to reduce canal and lateral lengths.

USDA

Program implementation in the Lower Gunnison Basin subarea 1 began in 1988. Since then, funds have been allocated to the other subareas, and implementation is now underway in the entire Lower Gunnison Basin.

At the end of fiscal year 1991, 94 salinity control contracts had been signed and 34 miles of underground pipelines, ditch lining, and gated pipe had been installed. Land leveling is continuing, and sprinkler and surge irrigation systems are being installed. Salt loading has been reduced by 11,000 tons per year. All 13 new contracts in Montrose County contain wildlife habitat replacement practices.

Two public field days were held during the year. Demonstration sites have been established to collect data on the suitability and performance of surge irrigation systems, micro-sprinklers, and subsurface irrigation. These sites are also used for educational purposes with small groups.

An agreement has been signed with Reclamation authorizing the Cooperative Extension to initiate a surge irrigation demonstration project in the Lower Gunnison project area. Reclamation is funding this 2-year agreement.

Moapa Valley Unit, Nevada

This salinity control unit is located on the Muddy River in Nevada immediately upstream from Lake Mead. Approximately 5,000 acres of land are irrigated in this area. The Muddy River contributes more than 50,000 tons of salt to Lake Mead annually.

USDA

The proposed USDA salinity reduction plan includes installing an underground pipeline irrigation water distribution system and improving onfarm irrigation systems. Salt loading will be reduced by approximately 13,600 tons per year at an estimated cost effectiveness of $57 per ton. These estimates will be finalized upon completion of the EIS discussed below.

Work on the Moapa Valley USDA salinity control project EIS continued during the year. Public scoping meetings were held, engineering investigations were carried out, and baseline monitoring activities continued. The EIS is scheduled to be published in 1992.

Paradox Valley Unit, Colorado

Reclamation

The Paradox Valley Unit facility, located in southwestern Colorado, will intercept saline inflows to the Colorado River and dispose of the brine through deep well injection, controlling about 180,000 tons of salt per year when in full operation. The ongoing testing program consists of verifying and refining the process of controlling brine inflow to the river, collecting design data for future facilities, and testing the injection well. The 2-year injection test began in July 1991.

Pariette Draw

BLM

Water quality monitoring stations are beginning to yield data on salt and flows in Pariette Draw, located in eastern Utah. Improvements have been made in the upper branch to reduce sedimentation into Pariette Draw in the Vernal District.

Price-San Rafael Rivers Unit, Utah

East-central Utah's Price and San Rafael Rivers basins contribute an estimated 430,000 tons of salt to the Colorado River annually. Approximately 60 percent of this load is attributable to agriculture.

Reclamation/USDA

SCS and Reclamation continued work on a joint plan and draft EIS for the Price-San Rafael Rivers Unit. The report was distributed to the public in September 1991. Under the joint SCS-Reclamation plan, Reclamation would install salinity control features in the irrigation distribution system and a rural domestic water distribution system to eliminate winter water from the canal system. USDA would assist individuals and groups in applying onfarm salinity reduction practices. The unit would reduce salt loading by an estimated 161,000 tons per year.

Sagers Wash

BLM

A comprehensive management plan (Phase III) is scheduled to be completed for Sagers Wash, located in eastern Utah, in winter 1992. The purpose of the study is to evaluate the salinity control potential of various erosion control structures, watershed improvements, and management techniques for use in planning projects in similar areas in the Colorado River Basin.

Water quality monitoring stations on paired watersheds are now yielding data. One watershed has treatment; the other does not. Therefore, quantifiable data will be available on the effectiveness of the treatments. Sagers Wash area was the first priority watershed that was modeled (Phase II) by the interagency team for a nonpoint source management program. Implementation of the comprehensive plan will

begin in 1993 after review of the plan, public involvement and support, and environmental assessments are completed. The goal is to prevent 2,000 tons of salt per year from leaving the watershed.

San Juan River Unit, New Mexico

The study area includes the entire 23,000-square-mile San Juan River watershed from the river's headwaters in south-central Colorado to its mouth at Lake Powell. The drainage contributes approximately 1 million tons of salt annually to the Colorado River system. The Hammond Project (Navajo Indian Irrigation Project) and the Hogback Irrigation Project (also a Navajo Indian project) are the principal irrigation-induced sources of salt loading in the basin.

Reclamation

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 is preparing an environmental assessment for the Hammond Area; a draft is scheduled for completion in April 1992. The unit, one of the most cost-effective units in the program, would reduce salt-loading by an estimated 27,700 tons per year.

Reclamation has received reports of and observed saline inflows to the San Juan River in the "Hogback" area. Hundreds of oil and gas exploration wells have been drilled in this area, raising concerns over mobilization of saline aquifers. Reclamation is investigating the apparent salt gains along the San Juan River.

USDA

USDA is continuing investigations in the San Juan River basin to determine the feasibility of an onfarm program. Preliminary investigations of the irrigated areas upstream from the Hogback near Farmington, New Mexico, will be completed in 1992. Also, investigations will begin in 1992 on the irrigated areas downstream from the Hogback along the San Juan River.

BLM

BLM is inventorying leaking oil and gas wells in the San Juan River basin.

Uinta Basin Unit, Utah

This unit is located in northeastern Utah. Seepage from conveyance systems and deep percolation, resulting from irrigation, dissolve salts from the soils and shales and convey the salts through the ground-water system to natural drainages and ultimately to the Colorado River. The Uinta Basin contributes an estimated 450,000 tons of salt to the Colorado River annually.

Reclamation

Reclamation has proposed this unit for construction, and the proposal has been sent to the Department of the Interior for review. Under the preferred plan, canals and laterals would be lined to reduce seepage losses and the associated salt pickup. The Department has asked the Office of Management and Budget to comment on the budgetary impacts of the unit. The Secretary of Agriculture and the Administrator of EPA have also been asked to comment on the plan. Some investigations continue into managing land to control salinity.

USDA

Salinity control contracts continue to be prepared at a record pace in the Uinta Basin. At the end of fiscal year 1991, 323 salinity control contracts were in effect and many applications were on file.

Salinity reduction practices continue to be installed at an increasing rate. At the end of fiscal year 1991, 855 sprinkler irrigation systems had been installed on 62,700 acres. In addition, more than 547 miles of underground pipelines and gated pipe have been installed. To date, the practices have reduced salt loading by 50,000 tons per year.

Replacement of wildlife habitat values continues to receive high priority. To date, wetlands have been developed by constructing shallow ponds and potholes. Grass, trees, and shrubs have been planted for wildlife habitat; fences have been installed; and management plans have been implemented for wildlife habitat management.

Many information and education activities are underway. Salinity tours were held, and information bulletins were prepared on the salinity control program. In addition, irrigation pumps are being tested and recommendations are being made for increasing efficiencies.

USDA prepared the Uinta Basin Unit Expansion draft plan and EIS in 1991. The plan adds treatment of an estimated 8,900 acres of the 20,800 acres of irrigated land not covered in the existing unit. The EIS is scheduled to be published in 1992.

Other Activities

USDA

USDA Agricultural Research Service continues to provide valuable salinity research. Research is conducted at the Snake River Conservation Center in Kimberly, Idaho; the U.S. Salinity Laboratory in Riverside, California; and in Fort Collins, Colorado.

A significant technological breakthrough was made in 1991 at the U.S. Salinity Laboratory. The laboratory has developed and successfully tested mobilized/automated systems for measuring, inventorying, and monitoring soil salinity in irrigated lands. Also, conceptual/modeling studies have been made to evaluate various irrigation/drainage strategies to reduce water pollution. This research shows that intercepting, isolating, and reusing drainage waters for irrigation will maximize the usability of the total water supply and minimize drainage disposal and water pollution problems.

In Utah, USDA agencies continue to cooperate with BLM and other agencies to identify salt-contributing rangelands and prepare plans for implementation. In Colorado, SCS is cooperating with various State and Federal agencies in developing a similar process.

USDA monitoring and evaluation (M&E) activities are underway in the Grand Valley, Uinta Basin, Big Sandy River, Lower Gunnison Basin, McElmo Creek, and Moapa Valley Units. As part of these activities, USDA is monitoring the effects of the salinity control program on salt load reductions, tracking the effects on wildlife habitat, and monitoring the economic effects. M&E activities have been conducted for about 7 years in the Grand Valley and Uinta Basin. Annual reports were prepared for all units except the Moapa Valley Unit, which is not yet operational. These reports contain detailed information obtained from field monitoring specific sites to determine the effects on salt loading and wildlife habitat. An interim "Framework Plan for Monitoring and Evaluating the Colorado River Salinity Control Program" was released in 1991. This plan provides guidance to achieve more uniformity in monitoring and evaluating activities and preparing annual reports.

BLM

The BLM Colorado River Basin States Assistant Director, salinity manager, other agency coordinators, and the Forum's Executive Director met in April 1991 to discuss accomplishments and future activities. The parties developed a strategy to reduce salinity discharges from public land. The elements of the strategy include the following:

- Watersheds in the Colorado River Basin will be ranked using an interagency team (Phase I).

- To determine the watersheds with the best potential for treatment, an interagency multidisciplinary team will use Pacific Southwest Interagency Committee procedures to determine soil loss, sediment, and potential treatments for salinity control (Phase II).

- Comprehensive plans (Phase III) will be developed using the Revised Universal Soil Loss Equation to estimate soil erosion. The plan will involve users and private and State landowners to ensure coordination and implementation. Accomplishments will be tracked.

- Economic analysis in Phase III plans will be based on cost effectiveness and will be comparable to Reclamation and USDA procedures.

- Results of watershed efforts in Indian Wash (Mount Garfield area in Colorado) will be used to estimate treatments in similar areas.

Appendix - Repayment Analysis

The Lower Colorado River Basin repayment spreadsheets provide 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 reimbursable costs for salinity control projects. The reimbursable costs to the States are based on capital and operation and maintenance (O&M) costs spent as of 1990, budgeted costs (capital and O&M) for 1991 and 1992, and projected costs from 1993 to 2010. Projected cost estimates from 1993 to 2010 are based on the full implementation of the salinity program to meet the salinity target level in 2010. The repayment spreadsheets assist program managers in developing an implementation plan of salinity projects that meet the salinity numeric criteria at the three stations on the Colorado River (Hoover Dam, Parker Dam, and Imperial Dam).

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 are in "1990" dollars. Cost estimates for the projects were obtained from various sources and are on record in the Bureau of Reclamation (Reclamation) and the Soil Conservation Service offices.

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

Reclamation projects authorized under Public Law 93-320 are Grand Valley Stage One, Grand Valley 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 States and 85 percent of the reimbursable portions to be paid by the Lower Colorado River Basin States over a 50-year period. The formula applied in the spreadsheet is (total investment costs x 0.25 x 0.85)/50 years. Repayment of O&M costs applies a similar formula (annual O&M costs x 0.25 x 0.85), and repayment is in the next year after the costs are incurred.

The repayment formula authorized under Public Law 98-569 is annual projects costs (capital and O&M) x 0.30 x 0.85. Reclamation projects covered by this repayment formula are Lower Gunnison Basin Unit (winter water), Dolores Project (salinity control portion), Price-San Rafael, San Juan River-Hammond portion, and Glenwood-Dotsero Springs.

Major adjustments to the 1990 Joint Evaluation Report (JER) repayment analysis are as follows:

1. Project costs (approximately $40.4 million) for the Bureau of Land Management program have been eliminated from this analysis. These costs are not covered under Public Laws 93-320 and 98-569.

2. A transfer of approximately $11.5 million in 1991 was made from the LCRBD fund to Reclamation's Upper Colorado Region. This transfer represents an advanced payment for Hoover Dam power deficiency. From 1992 to 1998, Hoover Dam deficiency payments are approximately $1.5 million, and a final payment of approximately $730,000 would be made in 1999.

3. Changes in total investment costs were made from the 1990 JER repayment spreadsheet for the following projects:

   a. Grand Valley Stage Two - $1.22 million decrease

   b. Paradox Valley - $722,000 decrease

   c. Lower Gunnison (winter water) - $10.2 million decrease

   d. Dolores (salinity control) - $10.0 million increase

   e. Moapa Valley - $820,000 increase

f. Price-San Rafael (USDA) - $1.4 million decrease

g. Price-San Rafael (Reclamation) - $318,000 increase

h. San Juan-Hammond (Reclamation) - $2.3 million increase

i. Uinta Stage I - $83,000 increase.

Based on these project changes, the net change in costs is an increase of approximately $7,000.

4. Changes in O&M costs result primarily from the Glenwood-Dotsero Springs Unit, which shows a $10 million decrease due to delays in implementing the project. Other changes in O&M costs are due to delays in implementation of some projects (Hammond [Reclamation] and Uinta Basin Stage I) and the effect of inflation on O&M cost estimates. The net change in O&M costs is approximately a $12.2 million decrease in costs.

5. Costs for projects currently under construction were incurred in 1990. This is accounted for under the column titled "Total thru 1990." The costs in this column are deducted from Total investment costs to estimate the remaining costs to complete the salinity control program. Comparing the total under this column to the column titled "Total thru 1989" in the 1990 JER repayment spreadsheet indicates a net increase of $12.78 million.

The effect of these changes (expressed in thousands of dollars) to the 1990 JER repayment spreadsheet are listed below:

Estimated remaining costs in 1990 JER repayment spreadsheet	$669,286
1. Elimination of BLM program from repayment spreadsheet	-40,417
2. Net change salinity projects planned for or currently under construction	+7
3. Net change in O&M costs	-12,239
4. Net change in project costs incurred in 1990. Difference between "Total thru 1989" and "Total thru 1990"	-12,777
Estimated remaining costs in 1991 JER repayment spreadsheet	$603,860

The repayment spreadsheet contains the 1990 LCRBD fund balance ($21,820,000) and the estimated schedule of revenues up to the year 2010. Estimated annual repayment costs for the Lower Colorado River Basin States are deducted from the LCRBD fund from 1991 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 is included to the deficit amount. The deficit balance is then added to the next year's repayment costs. The 9.0 percent interest rate used is the most recent for fiscal year 1991 and is to be applied on repayment of projects under the Colorado River Basin Salinity Control Act. The projected balance in the LCRBD fund for the year 2010 is $55.8 million.

The second repayment spreadsheet is based on an inflation rate applied to the project costs in the first spreadsheet. This spreadsheet is to determine at what inflation rate the 2010 LCRBD fund balance is equal to zero. After a series of calculations using different inflation rates, a zero balance in the fund is reached by using an annual inflation rate of approximately 3.4 percent. Based on this annual inflation rate, the estimated remaining salinity control program cost is $813 million.

A1	Repayment Analysis for 1991 Joint Evaluation Report			F	G	H	I	J	K	L	M	N	O	P
2	Colorado River Salinity Program				$604 Million Alternative			- Without Inflation					Repayment Interest R	
3														
4	$ in 1,000's	Total												
5		Investment	O&M	Total thru										
6	P.L.93-320 Units	Costs	Costs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
7															
8	Grand Valley Stage I	29,205	160	29,213	8	8	8	8	8	8	8	8	8	8	8
9	Grand Valley Stage II	153,482	2,915	38,348	12,880	15,881	15,830	13,974	13,974	13,974	13,974	12,970	1,877	265	265
10	Las Vegas Wash-Pittman	1,632	1,000	1,682	50	50	50	50	50	50	50	50	50	50	50
11	Paradox Valley Unit	71,768	6,975	56,012	2,962	4,410	3,448	2,795	2,141	485	485	485	485	485	485
12															
13	Subtotal P.L.93-320 Units:	256,087	11,050	125,255	15,900	20,349	19,336	18,827	16,173	14,497	14,497	13,493	2,200	788	788
14	Cumulative Subtotal:			125,255	141,155	161,504	180,840	197,667	213,840	228,337	242,834	256,327	258,527	259,315	260,103
15															
16	LCRB Fund Share														
17	Grand Valley Stage I				126	126	126	126	126	126	126	126	126	126	126
18	Grand Valley Stage II													652	709
19	Las Vegas Wash-Pittman					7	18	18	18	18	18	18	18	18	18
20	Paradox Valley Unit									305	404	404	404	404	404
21															
22	Subtotal-LCRB Fund Share			0	126	133	143	143	143	448	547	547	547	1,200	1,256
23															
24	P.L.98-569 Units														
25															
26	Grand Valley USDA	40,300	0	15,352	1,600	1,800	1,800	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
27	Uinta USDA	67,000	0	20,248	3,200	2,900	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
28	Lower Gunnison-Wntr Wtr	20,043	5,808	2,708	4,760	8,988	4,996	593	363	363	363	363	363	363	363
29	Lower Gunnison 1 USDA	34,500	0	1,737	1,500	1,500	1,500	1,600	2,000	2,000	2,000	2,000	2,000	2,000	2,000
30	Lower Gunn-2-Montrose USDA	36,940	0	0	800	800	800	1,000	1,700	1,900	1,900	2,000	2,000	3,000	3,000
31	Lower Gunn-2- Delta USDA	28,250	0	0	300	300	300	500	1,500	1,500	1,500	2,000	2,000	2,000	2,000
32	Lower Gunnison 3 USDA	5,760	0	0	0	200	300	300	400	500	700	1,000	700	700	760
33	Dolores-Salinity Contl-USBR	32,280	1,126	4,933	4,382	7,288	7,752	7,925	70	70	70	70	70	70	70
34	McElmo Creek USDA	15,500	0	397	900	900	1,000	1,000	1,500	2,000	2,000	2,000	1,000	600	500
35	Big Sandy USDA	9,720	0	1,243	800	800	1,000	1,200	1,300	1,000	1,000	1,000	377	0	0
36	Moapa Valley USDA	6,250	0	0	0	0	1,000	2,000	1,000	600	600	600	450	0	0
37	Price-San Rafael USDA	22,000	0	0	0	0	0	0	700	1,000	1,500	1,800	1,900	2,970	2,830
38	Price-San Rafael-USBR	35,500	0	0	0	0	0	0	1,000	2,000	3,000	3,000	3,000	3,000	3,000
39	Glenwood Sprg-Dotsero	0	105,302	0	0	0	0	0	1,788	7,154	7,154	7,154	7,154	7,154	7,154
40	San Juan - USDA	2,170	0	0	0	0	0	0	0	100	200	300	300	300	300
41	Hammond - USBR	11,433	0	0	0	0	0	0	0	2,482	7,788	1,163	0	0	0
42	Uinta Stage I	28,000	712	0	0	0	0	0	0	1,000	3,000	3,000	3,000	3,000	3,000
43															
44															
45	Subtotal P.L.98-569 Units	395,646	112,948	46,818	18,042	23,276	23,248	21,118	18,321	28,669	37,775	32,450	29,314	30,157	29,977
46	Cumulative Subtotal:			46,818	64,658	87,934	111,182	132,300	150,621	179,290	217,066	249,518	278,831	308,988	338,965
47															
48	Subtotal - LCRB Fund Share				4,601	5,935	5,928	5,385	4,872	7,311	9,633	8,275	7,475	7,690	7,644
49															
50	TOTAL - ALL UNITS	851,733	123,998	171,871	33,942	43,625	42,584	37,945	34,494	43,166	52,272	45,943	31,514	30,945	30,765
51	CUMULATIVE TOTAL:			171,871	205,813	249,438	292,022	329,967	364,461	407,627	459,900	505,843	537,358	568,303	599,068
52	Est. Remaining Program =	+	+	-											
53	$603,860	851,733	123,998	171,871											
54	TOTAL - LCRB Fund Share			0	4,727	6,068	8,072	5,528	4,815	7,759	10,180	8,822	8,022	8,890	8,900
55															
56	LCRB Funds (see below FUND CALCULATIONS)			0	(2,414)	7,586	7,586	7,586	7,586	7,586	7,586	7,586	8,389	9,119	9,119
57	Balance			0	(7,140)	1,518	1,515	2,058	2,771	(173)	(2,594)	(1,236)	367	229	219
58	Previous Balance			0	21,820	14,680	18,198	17,712	19,770	22,541	22,368	19,774	18,538	18,905	19,134
59															
60	Balance			0	14,680	18,198	17,712	19,770	22,541	22,368	19,774	18,538	18,905	19,134	19,353
61	Interest Component			0	0	0	0	0	0	0	0	0	0	0	0
62															
63	TOTAL - Balance			21,820	14,680	18,198	17,712	19,770	22,541	22,368	19,774	18,538	18,905	19,134	19,353
64															
65	LCRB FUND CALCULATIONS														
66															
67	HOOVER Revenues				9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119
68	PARKER-DAVIS Revenues				0	0	0	0	0	0	0	0	0	0	0
69	MINUS HOOVER DEFIC				11,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	730	0	0
70															
71	TOTAL FUNDS AVAILABLE				(2,414)	7,586	7,586	7,586	7,586	7,586	7,586	7,586	8,389	9,119	9,119
72	AS OF 1989:														
73	LCRBD Fund Revenues =	28,114													
74	- Hoover Deficiency pmts	4,599													
75	- Salinity Repayments	1,695													
76	Fund Balance	21,820													
77															
78															

Q	R	S	T	U	V	W	X	Y
late for 1990 to 2010 =			0.09000					
2002	2003	2004	2005	2006	2007	2008	2009	2010
8	8	8	8	8	8	8	8	8
265	265	265	265	265	265	265	265	265
50	50	50	50	50	50	50	50	50
465	465	465	465	465	465	465	465	465
788	788	788	788	788	788	788	788	788
260,891	261,879	262,467	263,255	264,043	264,831	265,619	266,407	267,195
126	126	126	126	126	126	126	126	126
709	709	709	709	709	709	709	709	709
18	18	18	18	18	18	18	18	18
404	404	404	404	404	404	404	404	404
1,256	1,256	1,256	1,256	1,256	1,256	1,256	1,256	1,256
2,000	1,500	648	0	0	0	0	0	
3,000	3,000	3,000	3,000	1,652	0	0		
363	363	363	363	363	363	363	363	363
2,000	2,000	2,000	2,000	2,000	2,000	663		
3,000	3,000	3,000	3,000	2,500	2,500	1,000	240	
2,000	2,000	2,000	2,000	2,000	2,000	1,900	450	
200	0	0	0	0	0	0	0	0
70	70	70	70	70	70	70	70	70
500	500	500	203	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2,800	2,800	2,800	900	0	0	0	0	0
3,000	3,000	3,000	3,000	3,000	2,000	500	0	0
7,154	7,154	7,154	7,154	7,154	8,205	8,205	8,205	6,205
300	270	100	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3,000	3,000	3,000	2,000	1,000	178	178	178	178
29,387	28,657	27,636	23,690	19,739	15,318	10,879	7,506	8,818
368,353	397,010	424,646	448,336	468,075	483,392	494,271	501,778	508,594
7,494	7,308	7,047	6,041	5,034	3,908	2,774	1,914	1,738
30,175	29,445	28,423	24,478	20,527	18,104	11,667	8,294	7,604
629,244	658,689	687,113	711,591	732,118	748,223	759,890	768,185	775,789
8,750	8,563	8,303	7,297	8,289	5,162	4,030	3,170	2,994
9,119	9,119	9,119	9,875	10,787	10,787	10,787	10,787	10,787
369	556	818	2,378	4,498	5,625	8,757	7,817	7,793
19,353	19,722	20,278	21,094	23,472	27,970	33,595	40,352	47,969
19,722	20,278	21,094	23,472	27,970	33,595	40,352	47,969	55,762
0	0	0	0	0	0		0	0
19,722	20,278	21,094	23,472	27,970	33,595	40,352	47,969	55,762
9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119
0	0	0	556	1,668	1,668	1,668	1,668	1,668
0	0	0	0	0	0	0	0	0
9,119	9,119	9,119	9,875	10,787	10,787	10,787	10,787	10,787

A1	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
81	Repayment Aanlysis - 1991 JER			$813 Million After. With Inflation			@	0.033631						Repayment Interest Rates-1990	
82															
83	$ in 1,000's	Total		Total											
84		Investment	O&M	thru											
85	P.L.93-320 Units	Costs	Costs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
86															
87	Grand Valley Stage I	29,205	231	29,213	8	9	9	9	9	10	10	10	11	11	12
88	Grand Valley Stage II	172,362	4,814	38,348	13,313	16,967	17,481	15,951	16,487	17,042	17,815	18,899	2,259	369	381
89	Las Vegas Wash - Pittman -	1,632	1,441	1,682	52	53	55	57	59	61	63	65	67	70	72
90	Paradox Valley Unit	73,876	10,265	56,012	3,062	4,712	3,808	3,190	2,526	567	586	606	626	647	669
91															
92	Subtotal P.L.93-320 Units:	277,076	18,751	125,255	16,435	21,741	21,353	19,207	19,082	17,680	18,274	17,581	2,963	1,097	1,134
93	Cumulative Subtotal:			125,255	141,690	163,430	184,784	203,991	223,073	240,752	259,027	276,607	279,570	280,667	281,801
94															
95	LCRB Fund Share														
96	Grand Valley Stage I				126	126	126	126	126	126	126	126	126	126	127
97	Grand Valley Stage II													733	811
98	Las Vegas Wash - Pittman -					7	19	19	19	20	20	21	21	22	22
99	Paradox Valley Unit									314	434	439	443	447	452
100															
101	Subtotal - LCRB Fund Share			0	126	133	145	145	146	460	581	586	590	1,328	1,411
102															
103	P.L.98-569 Units														
104															
105	Grand Valley USDA	50,086	0	15,352	1,654	1,709	1,767	1,826	2,360	2,439	2,521	2,606	2,694	2,784	2,678
106	Uinta USDA	82,385	0	20,248	3,308	3,098	3,313	3,424	3,540	3,659	3,782	3,909	4,040	4,176	4,317
107	Lower Gunnison - Winter Water -	21,714	8,456	2,706	4,920	7,466	5,517	677	428	443	458	473	489	505	522
108	Lower Gunnison 1 USDA	47,273	0	1,737	1,550	1,603	1,656	1,826	2,360	2,439	2,521	2,606	2,694	2,784	2,878
109	Lower Gunnison 2 Montrose USDA	53,872	0	0	620	855	883	1,141	2,006	2,317	2,395	2,606	2,694	4,176	4,317
110	Lower Gunnison 2 Delta USDA	41,690	0	0	310	321	331	571	1,770	1,829	1,891	2,606	2,694	2,784	2,878
111	Lower Gunnison 3 USDA	8,951	0	0	0	0	0	331	342	472	610	882	1,303	943	974
112	Dolores-Salinity Contl-USBR	34,856	1,723	4,933	4,529	7,786	6,561	9,046	83	86	89	92	95	98	101
113	McElmo Creek USDA	19,412	0	397	930	962	1,104	1,141	1,770	2,439	2,521	2,606	1,347	835	719
114	Big Sandy USDA	11,223	0	1,243	827	855	1,104	1,370	1,534	1,220	1,261	1,303	508	0	0
115	Moapa Valley USDA	7,443	0	0	0	0	1,104	2,283	1,180	732	756	782	606	0	0
116	Price-San Rafael USDA	31,443	0	0	0	0	0	0	828	1,220	1,891	2,345	2,559	4,134	4,072
117	Price-San Rafael USBR	52,120	0	0	0	0	0	0	1,180	2,439	3,782	3,909	4,040	4,176	4,317
118	Glenwood Sprg - Dotsero	0	181,760	0	0	0	0	0	2,110	8,725	9,018	9,321	9,635	9,959	10,294
119	Hammond - USDA	3,038	0	0	0	0	0	0	0	122	252	391	404	416	432
120	Hammond - USBR	14,359	0	0	0	0	0	0	0	3,027	9,617	1,515	0	0	0
121	Uinta Stage I	40,266	1,314	0	0	0	0	0	0	1,220	3,782	3,909	4,040	4,176	4,317
122															
123															
124	Subtotal P.L.98-569 Units	517,933	173,252	46,616	18,649	24,654	25,342	23,638	21,487	34,825	47,345	41,860	39,840	41,949	43,014
125	Cumulative Subtotal:			46,616	65,265	89,919	115,261	138,899	160,385	195,211	242,556	284,416	324,256	366,205	409,219
126															
127	Subtotal - LCRB Fund Share				4,755	6,287	6,462	6,028	5,479	8,880	12,073	10,674	10,159	10,697	10,969
128															
129	TOTAL - ALL UNITS	795,009	190,003	171,871	35,084	46,395	46,695	42,845	40,568	52,505	65,619	59,441	42,802	43,046	44,148
130	CUMULATIVE TOTAL:			171,871	206,955	253,349	300,045	342,890	383,458	435,963	501,582	561,023	603,826	646,872	691,020
131	Est.Remaining Program (w/inf)	=	+	+	-										
132	813,141	795,009	190,003	171,871											
133	TOTAL - LCRB Fund Share			0	4,881	6,420	6,607	6,173	5,625	9,341	12,654	11,260	10,749	12,025	12,380
134															
135	LCRB Funds			0	(2,414)	7,586	7,586	7,586	7,586	7,586	7,586	7,586	8,389	9,119	9,119
136	Balance			0	(7,295)	1,166	979	1,413	1,961	(1,754)	(5,068)	(3,874)	(2,361)	(2,906)	(3,261)
137	Previous Balance			0	21,820	14,525	15,691	16,671	16,084	20,046	18,291	13,223	9,549	7,189	4,283
138															
139	Balance			0	14,525	15,691	16,671	18,084	20,046	18,291	13,223	9,549	7,189	4,283	1,022
140	Interest Component			0	0	0	0	0	0	0	0	0	0	0	0
141															
142	TOTAL - Balance			21,820	14,525	15,691	18,871	16,084	20,046	18,291	13,223	9,549	7,189	4,283	1,022
143															
144	LCRB FUND CALCULATIONS														
145															
146	HOOVER Revenues				9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119
147	PARKER-DAVIS Revenues				0	0	0	0	0	0	0	0	0	0	0
148	MINUS HOOVER DEFIC				11,533	1,533	1,533	1,533	1,533	1,533	1,533	1,533	730	0	0
149															
150	TOTAL FUNDS AVAILABLE				(2,414)	7,586	7,586	7,586	7,586	7,586	7,586	7,586	8,389	9,119	9,119
151	AS OF 1989:														
152	LCRBD Fund Revenues =	28,114													
153	- Hoover Deficiency pmts	4,599													
154	- Salinity Repayments	1,695													
155	Fund Balance	21,820													
156															
157															
158															
159															
160															
161															
162															
163															
164															
165															
166															
167															
168	ANNUAL EXPENDITURES														
169															
170	Bureau of Reclamation and Soil Conservation Service (consrtuction costs only)														
171															
172														Years	
173				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
174															
175	USBR			25,042	34,625	32,084	25,345	19,394	27,566	35,872	28,243	15,787	14,375	14,375	
176	USDA			8,900	9,000	10,500	12,600	15,100	15,600	16,400	17,700	15,727	16,570	18,390	
177															
178	TOTAL			33,942	43,625	42,584	37,945	34,494	43,166	52,272	45,943	31,514	30,945	30,765	
179	CUMULATIVE TOTAL			33,942	77,567	120,151	158,096	192,590	235,756	288,029	333,972	365,487	396,432	427,197	

Q	R	S	T	U	V	W	X	Y
through 2010 =			0.09000					

2002	2003	2004	2005	2006	2007	2008	2009	2010
12	12	13	13	14	14	15	15	16
394	407	421	435	450	465	481	497	514
74	77	79	82	85	88	91	94	97
692	715	739	764	789	818	843	872	901
1,172	1,211	1,252	1,294	1,338	1,383	1,429	1,477	1,527
282,973	284,184	285,436	286,730	288,068	289,451	290,880	292,357	293,884
127	127	127	127	127	127	127	127	127
814	818	819	822	825	828	831	835	838
23	23	24	24	25	26	26	27	28
456	461	466	471	476	482	487	493	499
1,419	1,427	1,436	1,444	1,453	1,463	1,472	1,482	1,492
2,975	3,075	2,383	1,064	0	0	0	0	0
4,462	4,612	4,787	4,927	2,805	0	0	0	0
540	558	577	598	816	637	658	681	703
2,975	3,075	3,178	3,285	3,395	3,509	1,203	0	0
4,462	4,612	4,787	4,927	4,244	4,387	1,814	450	
2,975	3,075	3,178	3,285	3,395	3,509	3,448	844	0
1,094								
105	108	112	116	120	124	128	132	136
744	769	794	333	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
4,164	4,304	4,449	1,478	0	0	0	0	0
4,462	4,612	4,767	4,927	5,093	3,509	907	0	0
10,640	10,998	11,368	11,750	12,145	10,888	11,254	11,633	12,024
446	415	159	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
4,462	4,612	4,767	3,285	1,698	312	323	334	345
44,503	44,823	45,266	39,974	33,511	26,676	19,733	14,073	13,209
453,722	498,545	543,611	583,784	617,295	644,171	663,904	677,977	691,185
11,348	11,430	11,543	10,193	8,545	6,853	5,032	3,589	3,368
45,675	46,034	46,516	41,268	34,848	28,259	21,162	15,550	14,736
736,694	782,729	829,247	870,515	905,363	933,622	954,784	970,334	985,070
12,767	12,857	12,978	11,638	9,998	8,316	6,504	5,071	4,861
9,119	9,119	9,119	9,675	10,787	10,787	10,787	10,787	10,787
(3,648)	(3,736)	(3,859)	(1,963)	789	2,471	4,283	5,716	5,926
1,022	(2,863)	(7,195)	(12,049)	(15,273)	(15,788)	(14,515)	(11,153)	(5,926)
(2,626)	(6,601)	(11,054)	(14,012)	(14,484)	(13,317)	(10,232)	(5,437)	0
(236)	(594)	(995)	(1,261)	(1,304)	(1,199)	(921)	(489)	0
(2,863)	(7,195)	(12,049)	(15,273)	(15,788)	(14,515)	(11,153)	(5,926)	0
9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119	9,119
0	0	0	556	1,668	1,668	1,668	1,668	1,668
0	0	0	0	0	0	0	0	0
9,119	9,119	9,119	9,675	10,787	10,787	10,787	10,787	10,787

2002	2003	2004	2005	2006	2007	2008	2009	2010
14,375	14,375	14,375	13,375	12,375	9,004	8,104	7,604	7,604
15,800	15,070	14,048	11,103	6,152	6,500	3,563	690	0
30,175	29,445	28,423	24,478	20,527	16,104	11,667	6,294	7,604
457,373	486,818	515,242	539,720	560,247	576,352	588,019	596,314	603,918