CHAPTER 9: SALINITY CONTROL PROGRAM

Introduction

The salinity of the Colorado River increases substantially from its headwaters in the States of Wyoming and Colorado to its termination in the Gulf of Mexico. The effects of salinity are a major concern to water users in the United States and the United Mexican States (Mexico). In a 2005 report entitled *Quality of Water, Colorado River Basin, Progress Report No. 22*, the Bureau of Reclamation (Reclamation) estimated economic damages of $306 to $312 million per year in the United States due to salinity, based on 2004 salinity levels at Imperial Dam.

Approximately half of the salt in the Colorado River is derived from natural sources, such as when ground water flows through salt formations before entering the river or when water from saline springs flows into tributaries and then into the river. Another major contributor to the river's salinity is the use of Colorado River water for irrigated agriculture. Some of the diverted water, once applied to crops, seeps into the ground, picks up salt from the soil, and returns to the river with a much higher salt content. Because some of the diverted water does not return to the river, there is less water in the river to dilute the added salt from the return flows and the salinity of the river further increases.

With the enactment of the Colorado River Basin Salinity Control Act, Public Law (Pub. L.) No. 93-320, 88 Stat. 266 (1974) (Salinity Control Act), Reclamation began efforts to reduce salinity. Title I of the Salinity Control Act addresses programs downstream of Imperial Dam. See Chapter 4. Title II of the Salinity Control Act addresses measures to be taken upstream of Imperial Dam and authorizes the Secretary of the Interior (Secretary) to implement specific salinity control projects and to conduct planning investigations of other projects. See *Updating the Hoover Dam Documents 1978*, Chapter XIV.

Several amendments to the Salinity Control Act were enacted during the period from 1979 through 2008 and are discussed in this chapter. The salinity control projects constructed by Reclamation in accordance with the Salinity Control Act and its subsequent amendments are also discussed.

Colorado River Basin Salinity Control Act

Salinity Control Projects and Planning Reports

Table 9-1 summarizes the salinity control projects originally authorized under Title II of the Salinity Control Act.

Table 9-1. Summary of Salinity Control Units Authorized by Title II of the Salinity Control Act

Unit	General Description	Salt Removed[1] (tons/year)
Paradox Valley	The Paradox Valley Unit is located near Bedrock, Colorado, about 10 miles east of the Colorado-Utah state line. The Dolores River picks up an estimated 205,000 tons of salt annually as it crosses the Paradox Valley, primarily from the surfacing of natural brine groundwater. The Paradox Valley Unit is designed to prevent this natural salt load from entering the system by intercepting the brine groundwater before it enters the Dolores River, and disposes of the brine by deep well injection. Major project facilities include a brine production well field, brine surface treatment facility, injection facility, an injection well approximately 16,000 feet deep, and associated roads, pipelines, and electrical facilities. Construction of the Paradox Valley Unit was essentially completed in 1996.	112,000
Grand Valley	The Grand Valley Unit is located in west-central Colorado along the Colorado River near Grand Junction. The purpose of the Grand Valley Unit is to reduce the estimated 580,000 tons per year of salt added to the Colorado River as a result of conveyance system seepage and irrigation return flows passing through highly saline soils and the underlying Mancos Shale Formation. The recommended plan included piping and lining selected portions of the irrigation system in the Grand Valley to reduce seepage into the groundwater system. Construction of the Grand Valley Unit was essentially completed in 1998.	127,500
Crystal Geyser	An abandoned well near the Price River, Utah.	n/a[2]
Las Vegas Wash	Located in Clark County in southern Nevada, the Las Vegas Wash is a natural drainage channel that conveys storm runoff and wastewater from the Las Vegas Valley to Lake Mead. The Las Vegas Wash Unit was originally planned to be constructed in phases. The initial phase of the project is the 4-mile long Pittman Bypass Pipeline. The pipeline separates wastewater discharge from highly saline soils by diverting industrial return flow from an open, unlined ditch to reduce groundwater flow and consequent pickup of salts leached from the soil. Construction of the Pittman Bypass Pipeline was essentially completed in 1985. Additional construction was deferred pending the results of further hydrologic studies of the ground-water and surface-water conditions of the Las Vegas Wash. These studies showed that cost effective, technically feasible, and publicly acceptable measures were not available.	3,800

[1] Tons removed in 2004. Salt removal occurred in similar quantities per year for most units from 1998 through 2003. Source: *Quality of Water, Colorado River Basin, Progress Report No. 22*, Bureau of Reclamation, 2005.

[2] Deauthorized under the 1984 amendments to the Salinity Control Act.

Title II further authorized planning reports for four irrigation source control units (Lower Gunnison, Uintah Basin, Colorado River Indian Reservation, and Palo Verde Irrigation District), three point source control units (La Verkin Springs, Littlefield Springs, and Glenwood-Dotsero Springs), and four diffuse source control units (Price-San Rafael Rivers, Dirty Devil River, McElmo Creek, and Big Sandy River), which are summarized in Table 9-2.

As of December 31, 2008, a review of the quantity of salt removed through these salinity projects was underway, and Reclamation anticipates that the values appearing in Table 9-2 will be updated and revised.

Table 9-2. Summary of Planning Reports Authorized by Title II of the Salinity Control Act

Unit	General Description	Salt Removed[1] (tons/year)
Lower Gunnison Basin	The Lower Gunnison Basin Unit is located in west-central Colorado in Delta and Montrose Counties. In 1984, an amendment to the Salinity Control Act authorized portions of the unit for construction. The plan of development included winter water replacement and lateral lining programs in the Uncompahgre River Valley.	43,675
Uintah Basin	The Uintah Basin Unit is located in northeastern Utah. The area includes portions of Duchesne and Uintah Counties. By 2003, Reclamation had implemented a total of 14 projects in the Uintah Basin Unit. These projects reduce salinity by improving the efficiency of existing irrigation projects, including piping selected canals and laterals to gain pressure to run high-efficiency sprinkler irrigation systems.	138,374
Colorado River Indian Reservation	The Colorado River Indian Reservation is located in La Paz County, Arizona, and the eastern parts of San Bernardino and Riverside Counties, California. The purpose of the Colorado River Indian Reservation Unit investigation was to formulate a plan to reduce the salt loading to the Colorado River from irrigation on the reservation. An analysis of the diversions to, and the drainage from, the reservation indicated that the reservation did not make a net salt contribution to the river. Consequently, the investigation was terminated and a concluding report released in 1979.	n/a
Palo Verde Irrigation District	The Palo Verde Irrigation District is located in Riverside and Imperial Counties, California. Water for irrigation is diverted from the Colorado River at the Palo Verde Diversion Dam. The irrigation return flows are collected in a drainage system and returned to the Colorado River. Analyses of water samples returning to the river have shown a downward trend in salinity concentration since the mid-1960s. This trend and the high cost of measures to control salinity led Reclamation to conclude that salinity control would not be cost-effective in this area. In 1988, Reclamation terminated the planning investigation for the Palo Verde Irrigation District Unit.	n/a

Unit	General Description	Salt Removed[1] (tons/year)
La Verkin Springs	La Verkin Springs is located on the Virgin River in southwestern Utah in Washington County. Reclamation evaluated several alternatives for La Verkin Springs, but did not find a feasible or cost-effective method for salinity control. Reclamation suspended further studies and published a concluding report in 1981.	n/a
Littlefield Springs	Located along the lower Virgin River in northeastern Clark County, Nevada, and northwestern Mohave County, Arizona, the Littlefield Springs Unit included natural saline springs near Littlefield, Arizona, and irrigated land along the Virgin River between the springs and Lake Mead. Initial and follow-up studies performed in the 1970s were terminated due to the infeasibility of proposed alternatives for salinity control and a concluding report was published in 1981.	n/a
Glenwood-Dotsero Springs	The Glenwood-Dotsero Springs Unit is located along the Colorado River in Eagle, Garfield, and Mesa Counties in west-central Colorado. The purpose of this unit is to reduce the salt contribution to the Colorado River from mineral springs in two areas, one near the town of Glenwood Springs and the other near the rural community of Dotsero. Reclamation started detailed planning investigations in 1980. Many alternatives were analyzed; the most cost-effective plan at the time could not compete with alternatives available in other units proposed under the Salinity Control Program. A concluding report was completed in 1986.	n/a
Price-San Rafael Rivers	The Price-San Rafael Rivers Unit is located in east-central Utah, in Carbon and Emery Counties. By 2003, Reclamation had implemented a total of eight projects in the Price-San Rafael Rivers Unit. The projects include Ferron, Wellington, Cottonwood, Allen Projects, North Carbon, Moore, Seeley-Collard, and Lawrence South. These projects reduce salinity by improving the efficiency of existing irrigation projects by piping selected canals and laterals to gain pressure to operate sprinkler irrigation systems.	24,629
Dirty Devil River	The Dirty Devil River Unit is located in Emery and Wayne Counties in southern Utah. The study area included Muddy Creek, Fremont and Dirty Devil Rivers, and the tributaries of Muddy Creek, Hanksville Salt Wash, and Emery South Salt Wash. The unit was designed to reduce the salinity of the Dirty Devil and Colorado Rivers by collecting saline spring water in Hanksville Salt Wash and Emery South Salt Wash and disposing of it by deep well injection. Reclamation completed a planning report in 1987. As of 2003, the unit had not been implemented due to its marginal cost-effectiveness.	n/a

Unit	General Description	Salt Removed[1] (tons/year)
McElmo Creek	The McElmo Creek Basin is located in southwestern Colorado in Montezuma county. Early studies showed that salt loading resulted from both irrigation and diffuse sources, with irrigation being the main contributor. The plan was to improve the irrigation system and reduce groundwater seepage from canals to reduce the amount of salt returned to McElmo Creek. The McElmo Creek Unit was authorized for construction in 1984, as part of the Dolores Project, and was essentially completed in 1996.	23,000
Big Sandy River	The Big Sandy River Unit is located in Sweetwater County in southwestern Wyoming. The purpose of the Big Sandy River Unit investigation was to determine the feasibility of lowering the salt inflow to the Big Sandy River. The study was specifically directed toward reducing salt pickup from seeps and springs along a 26-mile reach of the Big Sandy River west of Eden, Wyoming. Studies conducted in cooperation with the United States Department of Agriculture (USDA) indicated that salinity control of on-farm irrigation by USDA was the most cost-effective alternative for controlling salinity in the Big Sandy River Unit, rather than off-farm alternatives implemented by Reclamation. USDA's ongoing program to control salinity on the Big Sandy River began in 1988. As of 2003, the unit had not been implemented.	n/a

[1]Tons removed in 2004. Salt removal occurred in similar quantities per year for most units from 1998 through 2003. Source: *Quality of Water, Colorado River Basin, Progress Report No. 22*, Bureau of Reclamation, 2005

Statutory Amendments

The Salinity Control Act was amended in 1980, 1984, 1995, 1996, 2000, and 2008. The 1980 amendment authorized a desalting research program, which began in 1989. See Chapter 4.

The 1984 amendments, in the Act of October 30, 1984, Pub. L. No. 98-569, 98 Stat. 2933 (1984), directed the Secretary of Agriculture to establish a voluntary on-farm cooperative salinity control program within the United States Department of Agriculture (USDA). The 1984 amendments also modified the United States Department of the Interior's program for salinity control in several respects by providing:

- Authorization to construct Stage I of the Lower Gunnison Basin Unit and the McElmo Creek Unit as part of the Dolores Project
- Deauthorization of the Crystal Geyser Unit

- Direction to the Secretary to develop a comprehensive program to minimize the salt contributed from public lands administered by the Bureau of Land Management (BLM)

- Direction to the Secretary to give preference to alternatives that reduce salinity at the least cost per unit of salinity reduction

- Authorization for joint feasibility studies with industrial water users as part of ongoing Saline Water Use and Disposal Opportunities activities

- Authorization for the Secretary to contract with non-Federal entities to construct, operate, maintain, and replace authorized salinity control facilities

- Requirement for concurrent replacement of incidental fish and wildlife values foregone as salinity control units are constructed

- Requirement to comply with procedural and substantive State water laws

- Authorization for advance planning studies on Sinbad Valley

The 1995 amendments, contained in the Act of July 28, 1995, Pub. L. No. 104-20, 109 Stat. 255 (1995), changed the United States Department of the Interior's approach to salinity control. As enacted in 1974, the Salinity Control Act envisioned and authorized large, federally constructed salinity control projects modeled after Reclamation's water development projects. The 1995 amendments authorized adoption of an open, competitive grant process as an alternative to federally constructed projects. The 1995 amendments:

- Authorized Reclamation to implement a basinwide salinity control program in the Colorado River Basin

- Authorized Reclamation to fund projects sponsored by non-Federal entities to control salinity through a competitive award process open to the public

- Increased by $75 million the amount authorized to be appropriated for Reclamation to carry out salinity control measures

The 1996 amendments, contained in the Federal Agriculture Improvement and Reform Act, Pub. L. No. 104-127, Title III-Subtitle D, 110 Stat. 1006 (1996), permitted upfront cost sharing by the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund in lieu of repayment.

The 2000 amendments, contained in the Act of November 7, 2000, Pub. L. No. 106-459, 114 Stat. 1987 (2000), increased the authorized appropriation ceiling for Reclamation's salinity control programs by an additional $100 million.

The 2008 amendments, contained in the Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, Title II, Subtitle I, Section 2806, 122 Stat. 1651 (2008), established the Basin States Program, directed that it be implemented by the Secretary through Reclamation, and clarified the authority for expenditure of cost-share funds from the Upper and Lower Colorado River Basin Funds (Basin Funds). The Basin States Program is implemented by the Secretary either directly or through grants or the advancement of funds to Federal or non-Federal entities. The program carries out: cost-effective measures and associated works to reduce salinity from multiple sources; operation and maintenance of salinity control features constructed under the Colorado River Basin salinity control program; and studies, planning, and administration of salinity control activities. The statute directed that money from the Basin Funds used for cost-sharing in the Reclamation and USDA-Natural Resources Conservation Service salinity control programs be administered through the Basin States Program.

Progress Toward Salinity Control

In furtherance of the objectives of the Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816 (1972) (Clean Water Act), the Environmental Protection Agency (EPA) approved numeric criteria for salinity levels at three monitoring stations at, or near, Hoover, Parker, and Imperial Dams along the Colorado River. The salinity of the water passing these stations is measured to ensure that the criteria are met.

In 2002, a report entitled *2002 Review - Water Quality Standards for Salinity, Colorado River System*, prepared by the Colorado River Basin Salinity Control Forum for the EPA in compliance with the Clean Water Act, estimated that 1.8 million tons of salt per year would need to be prevented from entering the Colorado River in order to maintain the water quality standards in the Lower Basin through 2025. The salinity control program continues to make progress toward that goal. In 2006, the combined Reclamation, USDA, and BLM salinity efforts were credited with preventing over 1.066 million tons of salt per year from entering the river system. While salinity did increase during the prolonged drought of 2000-2008 (which was ongoing as of December 31, 2008), the numeric salinity criteria set by EPA at, or near, Hoover, Parker, and Imperial Dams were not exceeded.

Salinity control progress is also tracked under Title II of the Salinity Control Act, which requires in Section 206 that the Secretary, beginning on January 1, 1975, submit periodic reports on the Colorado River Basin salinity control program, covering:

> …the progress of investigations, planning, and construction of salinity control units for the previous fiscal year; the effectiveness of such units; anticipated work needed to be accomplished in the future to meet the objectives of this title, with emphasis on the needs during the 5 years immediately following the date of each report; and any special problems that may be impeding progress in attaining an effective salinity control program.

The Salinity Control Act requires the reports to be submitted to the President, the Congress, and the Colorado River Basin Salinity Control Advisory Council (Advisory Council). The Advisory Council was created under Title II which provided that its membership shall consist of up to three representatives from each of the seven Basin States, appointed by the Governor of each respective State. As of December 31, 2008, twenty-three such reports had been prepared by the Secretary, acting through Reclamation.

In addition to the reports prepared by the Secretary, at the end of each fiscal year, involved Federal agencies (the United States Department of the Interior Bureau of Reclamation, Bureau of Land Management, and Fish and Wildlife Service; United States Geological Survey; the USDA – Natural Resources Conservation Service; and the United States Environmental Protection Agency) provide a Federal Accomplishments Report and an oral report to the Advisory Council. The Advisory Council then prepares an Annual Report on the Colorado River Basin Salinity Control Program and sends it to the Secretaries of Interior and Agriculture and the Director of the EPA. The annual report provides recommendations concerning the progress of the Salinity Control Program and the need for specific actions by involved Federal agencies.

Chapter 9: List of References

Treaties, Interstate Compacts, and Federal Statutes

Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816 (1972) (Clean Water Act).

Colorado River Basin Salinity Control Act, Pub. L. No. 93-320, 88 Stat. 266 (1974) (on DVD in *Updating the Hoover Dam Documents 1978* at XIV-14), later amended and supplemented by:

Act of September 4, 1980, Pub. L. No. 96-336, 94 Stat. 1063 (1980).

Act of October 30, 1984, Pub. L. No. 98-569, 98 Stat. 2933 (1984).

Act of July 28, 1995, Pub. L. No. 104-20, 109 Stat. 255 (1995).

Federal Agriculture Improvement and Reform Act of 1996, Pub. L. No. 104-127, Title III-Subtitle D, 110 Stat. 1006 (1996).

Act of November 7, 2000, Pub. L. No. 106-459, 114 Stat. 1987 (2000).

Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, Title II-Subtitle I, Section 2806, 122 Stat. 1651 (2008).

Reports

Colorado River Basin Salinity Control Forum, *2002 Review - Water Quality Standards for Salinity, Colorado River System*, 2002.

Bureau of Reclamation, *Quality of Water, Colorado River Basin, Progress Report No. 22*, 2005.

Other

Updating the Hoover Dam Documents 1978, Chapter XIV. On DVD.