Colorado River
Salinity Control Program
Price – San Rafael Unit
2003 Annual Report

U.S. Department of Agriculture
Natural Resources Conservation Service
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Executive Summary

Overview
In 2003, an additional 29 cooperators returned questionnaires concerning program participation. To date, 157 surveys have been completed, reflecting a generally positive public attitude toward salinity control programs

Hydro-Salinity
The effectiveness of properly installed and operated sprinkler installations in reducing deep percolation and salt loading is well established by countless on-farm evaluations in the past (Draper et al.). Several survey questions pertained to determination of how well cooperators maintain and operate installed equipment which will continue to affect salinity control results into the future. Results are encouraging with 94% of respondents operating the equipment as designed or with owner installed improvements.

Through the end of 2003, calculated annual salt loading has been reduced by 34,132 tons/year, with an estimated $10.24 million[1] invested.

Wildlife Habitat
No area-wide wildlife habitat or wetland monitoring was done in 2003.

Wildlife habitat projects planned and funded in 2003 total 127 acres under the Environmental Quality Incentive Program (EQIP) Wildlife only, program. No Wildlife Habitat Incentives Program (WHIP), or Basin States Parallel Program (BSPP) Wildlife only, money has been spent in the Price-San Rafael Salinity Units to date. Wildlife habitat implemented and on the ground in 2003 total five acres through the EQIP Wildlife only program.

Wildlife habitat replacement will continue to be encouraged and implemented on a voluntary basis.

Economics
Economic benefits to cooperators are apparent. A majority of survey respondents believe their share of the cost has or will pay out due to improved operating efficiencies.

Nearly all respondents believe that salinity control programs have had a positive economic affect on the area and region.

Conclusions
The original environmental evaluation estimated an ultimate salt load reduction of 161,000 tons/year. At the end of FY 2003, cumulative salt load reduction was estimated to be 34,132 tons/year. Future economic opportunities for additional reductions are abundant.

Future M&E efforts will focus on additional cooperator surveys, remote sensing evaluation of wildlife habitat, and the gathering and analysis of area wide production/irrigation data. By so doing, the value and effectiveness of salinity control measures can be quantified with modest resources.

Table 1 summarizes project status.

[1] $7,317,892 (Financial Assistance) + 40% (Technical Assistance) = $10.24 million.

Table 1 – Project Status (Mason 2003)

Price River - San Rafael Unit, 2003 Summary			
Practices Applied	**Unit(s)**	**FY2003**	**Cumulative**
1. Irrigation Systems			
A. Sprinkler	Acres	2,619	8,130
B. Improved Surface System	Acres	0	0
C. Drip Irrigation System	Acres	4	4
2. Irrigation Water Management	Acres	3,785	7,506
3. Wildlife Wetland Habitat Mgt	Acres	46	54
4. Wildlife Upland Habitat Mgt	Acres	183	189
5. Salt Load Reduction	Tons/Year	8,563	34,132
6. Deep Percolation Reduction (includes seepage); note: deep percolation is not equal to return flow.	Acre FT/Year	5,516	11,135
7. Contract Status		**FY2003**	**Cumulative**
Total Contracts	**Number**	36	376
	Dollars	1,135,541	7,317,892
	Acres	1,244	14,133

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Hydro-salinity

Background

Before implementation of salinity control measures, the Price-San Rafael Unit was estimated to contribute 258,000 tons of salt per year into the Colorado River (Dept. of Interior, 2001). It is estimated that 161,000 tons of this salt loading can be prevented with improved irrigations practices.

Two basic assumptions guide the calculation of salt load reductions from irrigation activities:

1. The salinity concentration of subsurface return flow from irrigation is constant, regardless of the amount of canal seepage or on farm deep percolation. The supply of mineral salts in the soil is infinite and the salinity of the out flowing water is dependant only on the solubility of the salts in the soil. Therefore, salt loading is directly proportional to the volume of subsurface return flow (Hedlund, 1992).
2. Water that percolates below the root zone of the crop and is not consumed by plants or evaporation, will eventually find its way into the river system. Salt loading into the river is reduced by reducing deep percolation.

Deep percolation (and proportional salt load) reductions are achieved by reducing or eliminating canal/ditch seepage and by improving the efficiency of surface irrigation. It is estimated that upgrading an uncontrolled flood irrigation system to a well designed sprinkler system will reduce deep percolation (and salt load) by 80-90%.

NRCS salinity control programs focus on helping cooperators improve irrigation systems, better manage water use, and sharply reduce deep percolation/salt loading.

Federal agencies have been tasked to "Provide continuing technical assistance for irrigation water management as well as monitoring and evaluation of changes in salt contributions to the Colorado River to determine program effectiveness" (Dept. of Interior, 2001).

There is an ongoing program of monitoring and evaluating past installations, designed to determine the effectiveness of these programs.

Past, detailed studies of installed irrigation systems determined that when operated as originally designed, irrigation efficiencies were greatly improved and deep percolation sharply reduced (Draper et al., 2001).

To evaluate continued conformance with approved design, systems are randomly evaluated on the basis of:

1. Cooperator questionnaires, interviews, and training sessions,
2. Equipment spot checks and evaluations.

Cooperator questionnaires, interviews, and training sessions

The following observations are derived from the 2003 cooperator's survey:

- 94% of installed systems are operating as designed or with operator installed improvements.
- 58% of respondents believe their share of the cost has or will pay out due to improved operating efficiencies.
- 100% of respondents believe that salinity control programs have had a positive economic affect on the area and region.
- 66% of respondents measure their water.
- 38% of respondents monitor soil water content, mostly by the "feel" method.

- 58% of respondents have attended a water management class, workshop, or demonstration, in the past five years.

Survey responses for 2003 are summarized in Appendix 1.

In 2003, two irrigation water management seminars were held in the Price – San Rafael Area to help educate cooperators. Future seminars are anticipated on a regular basis.

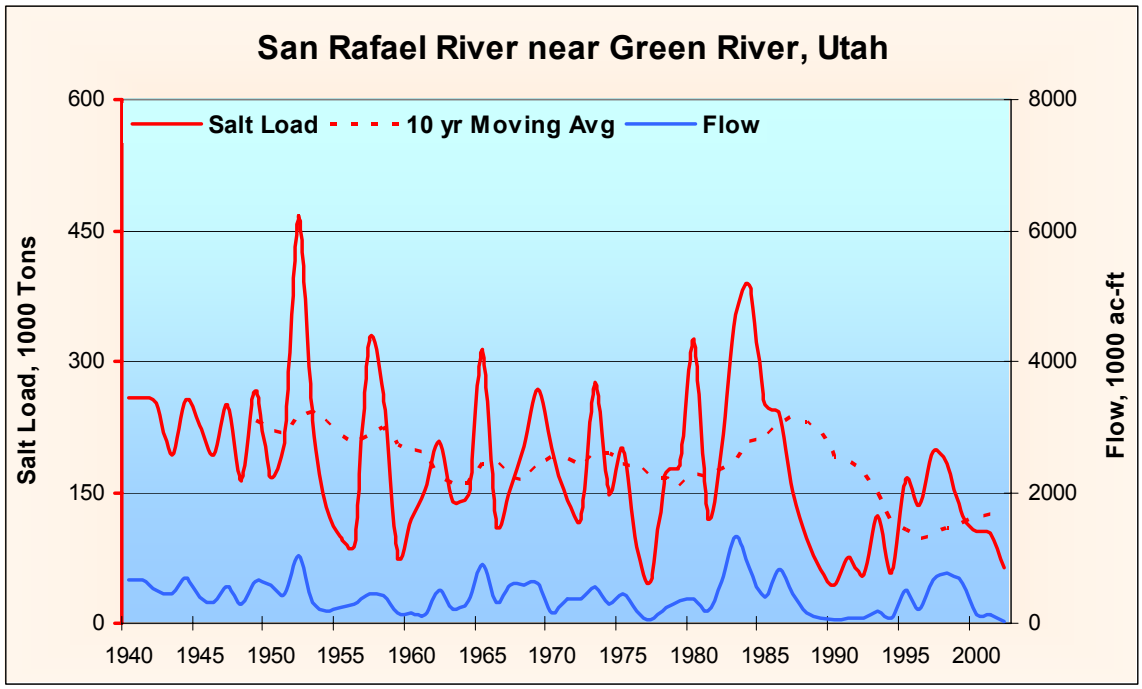
Equipment Checks and Evaluations

In 2003, randomly selected catch can tests were run on twenty-five wheel lines and four center pivots to determine operating efficiency. Overall efficiency of wheel lines averaged 76% and center pivot efficiency averaged 77%. While these efficiencies and their associated coefficients of uniformity primarily help cooperators maximize production, they also offer assurance that projected salt load reductions are being achieved. No major discrepancies were reported. All of the tested systems appeared to be properly maintained and operated.

Salt Load from Irrigation

Federal agencies are tasked to "determine the salt load resulting from irrigation . . . practices" (Dept. of Interior, 2001). The effectiveness of salt load reduction in the river system has been studied and assessed by the U.S. Geological Survey (USGS) and U.S Bureau of Reclamation (BOR). Their evaluations seem to indicate that salt loading in the river has been considerably reduced. Measured salt levels appear to be stable or down trending. Figure 1 is a graph of the calculated salt load in tons/year carried at the USGS gauging station on the San Rafael River near Green River, Utah

Figure 1, Total Annual Salt Load in the San Rafael River.



Wildlife Habitat and Wetlands

Introduction

The Executive Committee for the Colorado River Basin Salinity Control Program in Utah has approved the use of Geospatial technology techniques as the primary method to monitor and evaluate changes in extents of vegetation types in the Price–San Rafael and Uintah Basin Salinity Units. To date, no area-wide wildlife habitat monitoring has been done in the Price-San Rafael Salinity Unit.

On-Farm and Off-Site Wildlife Habitat Monitoring

The NRCS plan is to utilize Geospatial technology techniques to monitor wildlife habitat and wetland extent changes as the preferred methodology for M&E data gathering. In 2003:

- Satellite imagery was purchased for the Uintah Basin and the Price-San Rafael River Basins.
- Remote sensing image processing software and hardware was purchased to process the images.
- On the ground surveys were completed for use in ground truthing when the equipment is installed and functioning.
- Due to the delay in the FY 2003 budget, software and hardware were not purchased until late in the year, after the growing season. This delay prevented any data from being analyzed for the 2003 M&E report.

On-Farm Habitat

There were no WHIP or BSPP, Wildlife only projects planned or funded in FY 2003. One EQIP, Wildlife only project was planned and funded in FY 2003 in Emery County for a total of 127 acres to be treated.

The total wildlife habitat created or enhanced in FY 2003, in the Price-San Rafael basins, using EQIP, WHIP, and BSPP programs, was five acres. All five acres were implemented in Emery County, under the EQIP, Wildlife only program. There have been no implemented WHIP acres in the Price-San Rafael basins since the inception of the program in 1997 (see Table 1 and Table 2 below). Practices utilized in the implemented projects were Upland Wildlife Habitat Management (645), Tree and Shrub Establishment (612), and Fencing (382). The implemented projects used irrigation water to create tree plantings for the primary benefit of wildlife.

Acres of Wildlife Habitat Creation or Enhancement Planned and Funded in the Price/San Rafael Basin by Program and County in 2003.

	EQIP (Wildlife only)	WHIP	Parallel (Wildlife only)
Carbon County	0	0	0
Emery County	131	0	0

Acres of Wildlife Habitat Creation or Enhancement Implemented in the Price/San Rafael Basin by Program and County in 2003.

	EQIP (Wildlife only)	WHIP	Parallel (Wildlife only)
Carbon County	0	0	0
Emery County	5	0	0

Off-Farm Habitat

With hardware and software now installed and functioning, satellite imagery will be utilized in next years report to track changes in vegetation cover types, within and adjacent to project area agricultural lands, surrounding uplands, urbanization, and riparian and wetland areas downstream of project activities.

Some ground verification of cover types in the field was performed in 2003 to create an adequate level of confidence in the remotely sensed data. During field checks, special attention was given to features such as field borders, ditch bank habitats, wildlife travel corridors and riparian/wetland areas.

Voluntary Habitat Replacement

The NRCS will continue to encourage replacement of wildlife habitat on a voluntary basis. Federal and State funding programs are in place to promote wildlife habitat replacement. Programs include EQIP, Wildlife only, WHIP, BSPP, Wildlife only, Wetlands Reserve Program (WRP), Grassland Reserve Program (GRP), Conservation Reserve Program (CRP), and Continuous Sign-up Conservation Reserve Program (CCRP). Field Offices have several wildlife habitat projects in various stages of planning.

Practices for implementing wildlife habitat replacement are specified in the NRCS Field Office Technical Guide (FOTG), Section IV, and routinely used in contract development. See Appendix 3, for an example of the practices that may be reported for wildlife habitat replacement purposes.

Economics

Past studies indicate that in virtually all cases, the proper installation of sprinklers and education of cooperators results in increased yield and reduced labor. As reported previously in this document, 59% of survey respondents believe their share of the cost of salinity control projects has or will pay out due to increased yields and reduced labor costs.

Farming in the Price - San Rafael Area is still a difficult business, but irrigation improvements have improved crop yields, reduced labor requirements, and enhanced the cooperators ability to weather dry years. See Figure 2, for a 10 year precipitation analysis.

Future monitoring efforts are expected to study broader issues of how salinity control programs have affected community and society in general. Such studies may focus on the effect of fluctuating water availability on production and how well such variables are mitigated by salinity control projects.

100% of 2003 respondents believe that salinity control programs have had a positive economic affect on the area and region.

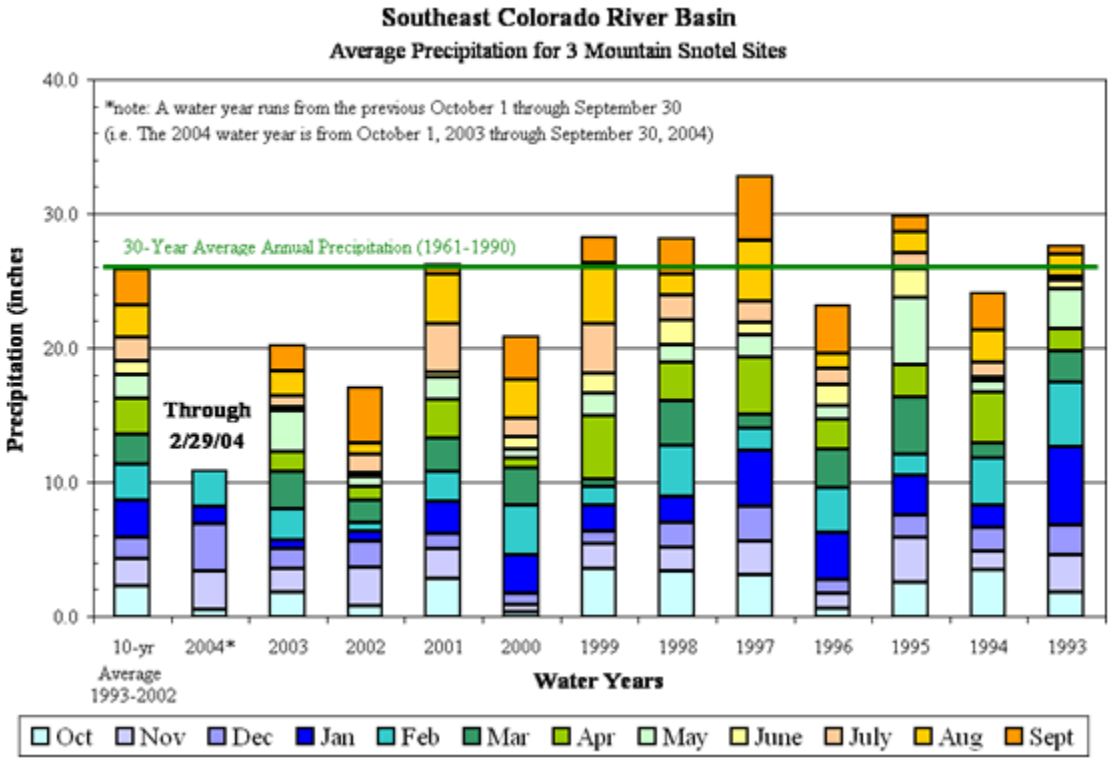
A cursory look at the Farm Census indicates that, on average, yields are well above pre-program levels, on a county basis, in spite of three consecutive years of drought. The 2002 Farm Census will be available in June, 2004, and will be addressed in the 2004 report.

Irrigation Water Management contracts provide monetary incentive for the cooperator to learn and apply technical knowledge that results in maximizing profit to the cooperator and salt load reduction for the Colorado River system.

Salinity control programs have a stabilizing effect on farmers, their communities, the region, and the environment.

Figure 2. Mountain Precipitation in the Price – San Rafael River Basin.

Courtesy of Utah Division of Water Resources.



Appendix 1 – 2003 Cooperator Survey Summary.

Random Selection Number	**Various**
Operation Name	**Price - San Rafael Totals***
Contract Number or Year/Years	**Various**

Irrigated Acres	**Flood**	**Wheel Line**	**Hand Line**	**Pivot**	**Total**
	2	**1143**	**680**	**70**	**1901**

Is the contract active and the land being cropped? (Circle One)	**Yes**	**No**
	27	**2**

Crop Acres	**alfalfa**	**pasture**	**grains**	**other**
	751	**456**	**214**	**182**

Is the current irrigation system the same as designed and planned at start of contract? (Circle one)	**Substantially improved**	**Slightly improved**	**Same as designed**	**Slightly degraded**	**Substantially degraded**
	2	**11**	**21**	**1**	**1**

Describe any changes to and the general condition of sprinkling equipment:
No changes. General condition is very good.
Changing of the nozzles
Love the Pivot- NRCS stuck us with 60 each handlines- It is not physically possible to move and attend these as needed. These need to be recycled into beer cans- something a bit more enjoyable. 1 to 2 acre maximum on Handlines should be designed for on farm use.
We made a change in the duration the sprinklers. Worked very good. (sic)
No changes- Equipment in excellent condition
Farmed some acres which were basically Idle. The equipment is practically new and in excellent condition.
Good
Will add 70 x 70 patch of pasture this year
Good
The main valve off of the main line was moved a small distance
Less buried pipe-2 movers-less risers make lenghth of irrigation time one third. Sprinkler equipment in excellent condition

Is water measured? (Circle one)	**Yes**	**No**
	25	**13**
If Yes, acre-ft/acre applied?	**1.9**	

Is soil moisture monitoring used for irrigation scheduling? (Circle one)	**Yes**	**No**
	15	**24**

If yes, what type? (Circle all that apply)	**"Feel" method**	**Tensio- meters**	**Gypsum blocks**	**Neutron probe**	**Remote sensing**
	17	**2**	**1**	**0**	**0**

Are Evapotranspiration calculations used for irrigation timing? (Circle one)	**Yes**	**No**
	5	**34**

Have you attended any irrigation water management classes, workshops, or demonstrations? (Circle one)	**In the last 12 months?**	**In the last 2 years?**	**In the last 5 years?**	**Never?**
	11	**7**	**4**	**16**

Do you employ or use a consultant or service that advises irrigation scheduling?	**Yes**	**No**
	4	**34**

Have the changes in yield, labor used, irrigation operation and maintenance cost	**Yes**	**No**
	20	**17**

My initial investment for the new system resulted in: (Circle one)	**Substantial economic gain**	**Minor economic gain**	**No economic change**	**Minor economic loss**	**Substantial economic loss**
	6	**16**	**7**	**9**	**0**

Do you feel that there is an effect economically overall to your area and region from this program? (Circle one)	**Substantial positive effect**	**Slight positive effect**	**No effect**	**Slight negative effect**	**Substantial negative effect**
	28	**10**	**0**	**0**	**0**

Has this project changed the quantity and quality of wildlife on your property? (Circle one)	**Substantial positive effect**	**Slight positive effect**	**No effect**	**Slight negative effect**	**Substantial negative effect**
	4	**8**	**19**	**5**	**2**

Appendix 2 – Examples of Wildlife Habitat Replacement Practices

from NRCS Field Office Technical Guide, Section IV.

NRCS Practice	NRCS Practice Number	Units Measured
Field Border	386	Linear Foot
Hedgerow Planting	422	Linear Foot
Pond	378	Number
Restoration and Management of Declining Habitat	643	Acres
Riparian Forest Buffer	391	Acres
Riparian Herbaceous Cover	390	Acres
Streambank and Shoreline Protection	580	Linear Foot
Stream Channel Stabilization	584	Linear Foot
Stream Habitat Improvement and Management	395	Acres
Tree/Shrub Establishment	612	Acres
Upland Wildlife Habitat Management	645	Acres
Wetland Creation	658	Acres
Wetland Enhancement	659	Acres
Wetland Restoration	657	Acres
Wetland Wildlife Habitat Management	644	Acres
Wildlife Watering Facility	648	Number
Windbreak/Shelterbelt Establishment	380	Linear Foot

Note: NRCS Field Office Technical Guide, Section IV may be accessed on the Internet at http://www.nrcs.usda.gov/technical/efotg/.

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6. Habitat Evaluation Procedures, U.S. Fish and Wildlife Service 1980.

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