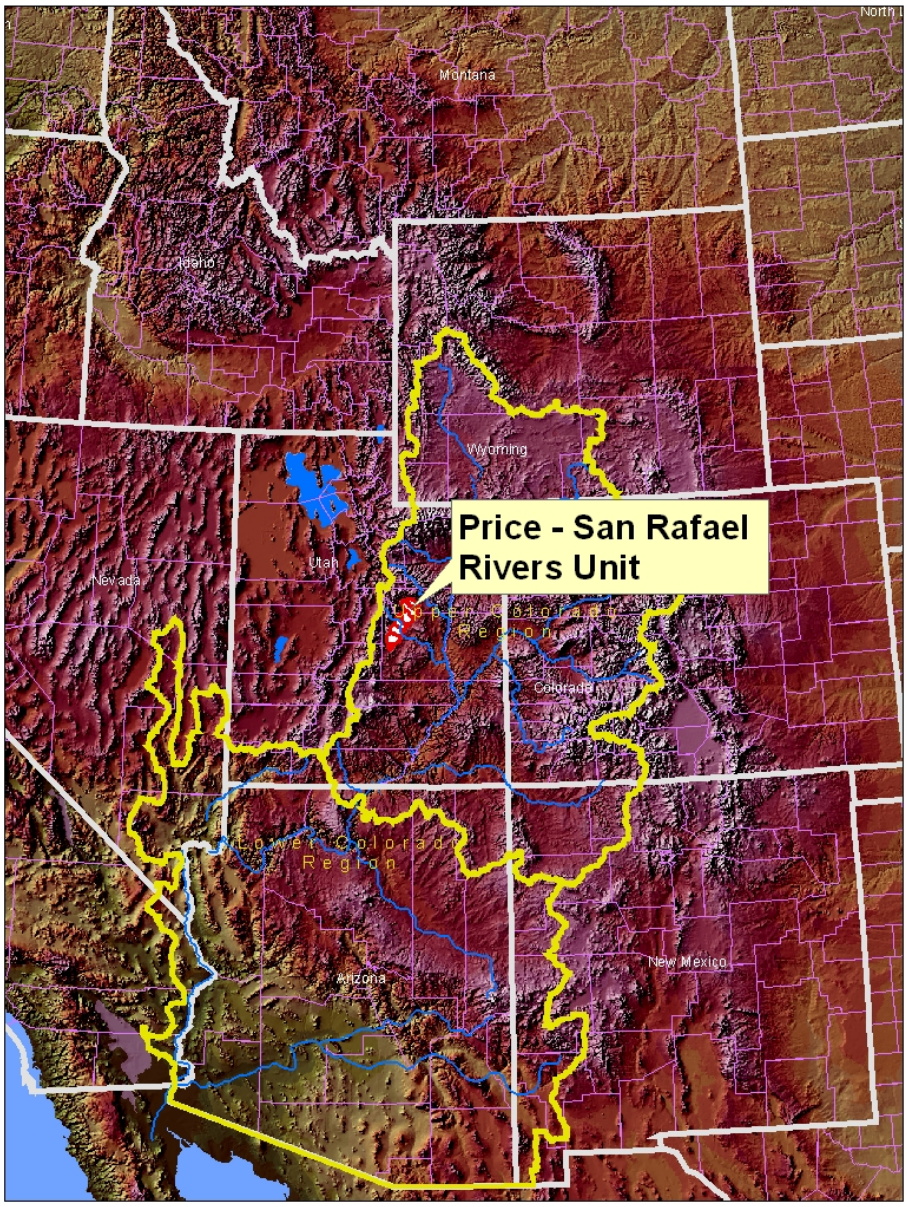
Colorado River
Salinity Control Program
Price – San Rafael Rivers Unit

Monitoring and Evaluation Report, FY2005



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Executive Summary

Hydro-Salinity

- Measures applied in FY2005 will result in salt load reduction of 7,967 tons on 1,898 acres. $1,072,553 Financial Assistance (FA) was expended yielding an estimated amortized cost of $19/ton for applied practices (includes 40% Technical Assistance (TA)).
- FY2005 planning includes 50 contracts for $2,477,342 (FA only) on 2,499 acres.
- Since program inception, 516 contracts have been signed for treating 21,318 acres at a cost of $12,838,093 (FA).
- Irrigation practices have been applied on 12,092 of 34,600 projected acres. Since inception, 46,771 of 146,900 projected tons of salt load reduction have been claimed – about 32% of the project.
- Due to inflation on pipe, pipe installation, and energy, some contract completions are lagging behind schedule. In addition, on-farm practices are being held up while waiting for off-farm components of joint projects to catch up.
- Irrigation induced erosion is generally eliminated by the installation of sprinkler systems.
- In FY2004-FY2005, 66 Sprinkler evaluations were completed. Eighty-six percent of installed systems achieved a Christiansen Coefficient of Uniformity within NRCS specifications.
- Soil moisture monitoring appears to have a positive impact on a cooperator's ability to apply proper irrigation water management (IWM).
- Beginning in 2004, EQIP provides financial incentives to cooperators to adopt IWM practices, including attending training sessions and record keeping.

Wildlife Habitat

- Landsat images of Ferron, Utah from June 22, 1997, July 30, 2002, and July 14, 2005 were classified; wetland and open water extents reported. Open water remained virtually the same, wetland extents were 287 acres in 1997, 151 acres in 2002, 244 acres in 2005. Precipitation difference between the three years was emphasized, 1997 being an above average water supply year, 2002 a dry year, and 2005 an above average water supply year.
- Conclusion was drawn that remote sensing alone is not sufficient to quantify changes in wetland/wildlife habitat extents.
- Detailed land-cover mapping, permanent photo points, and smaller scale case studies needed to accurately depict losses or gains of wetland/wildlife habitat.
- In spite of $100,000 Salinity EQIP funds NRCS set aside for wildlife habitat, no applications were received in FY2005. No wildlife habitat contracts were applied in FY2005.
- NRCS has partnered with Castleland and Dinosaurland Resource Conservation and Development (RC&D) Councils and others to develop a Request for Proposals (RFP) to accelerate wildlife habitat replacement. Through this partnership, a total of $250,000 Basin States Parallel Program (BSPP) funds are currently available for wildlife habitat proposals.
- Wildlife habitat replacement will continue to be encouraged and applied on a voluntary basis.

Economics

- Cost effectiveness is monitored by cooperator surveys, and data from the National Agricultural Statistical Service (NASS).
- Seventy-four percent of survey respondents believe their share of installation costs has or will pay out.
- Agricultural Census data indicates that alfalfa production has increased 30% since 1987.
- Fifty percent of Price – San Rafael farmers work full-time jobs off the farm.

Conclusions

- Public interest is high. All indications are that intended salt load reductions will be achieved, providing adequate funding is available and cost share ratios are maintained.
- Cooperators are willing and able to participate in wildlife projects.
- Private and public economics are favorable.
- Table 1 summarizes project status.

Table 1. Project Status, FY2005.

Price River - San Rafael Unit, 2005 Summary				
Practices Applied	**Unit(s)**	**FY2005**	**Cumulative**	**Goals ***
Irrigation Systems				
Sprinkler	**Acres**	1,898	12,716	**34,600**
Improved Surface System	**Acres**	0	0	
Drip Irrigation System	**Acres**	0	4	
Irrigation Water Management	**Acres**	1,898	12,092	
Wildlife Wetland Habitat Mgt	**Acres**	0	6	
Wildlife Upland Habitat Mgt	**Acres**	0	43	
Salt Load Reduction	**Tons/Year**	7,967	46,771	**146,900**
Deep Percolation Reduction (includes seepage); note: deep percolation is not equal to return flow.	**Acre FT/Year**	3,106	17,444	
Contract Status (Practices Planned)		**FY2005**	**Cumulative**	
Total Contracts (Irrigation Improvement)	**Number**	50	516	
	Dollars, FA	2,477,342	12,838,093	
	Acres	2,499	21,318	

***Note:** Goals for salt load reduction from the EIS were 120,220 tons/year from treating 30,050 acres. In 2001, goals were increased to 146,900 tons/year from treating 34,600 acres, based on greater than expected participation and sprinkler/improved flood ratio. No improved flood systems have been installed to date.

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Monitoring and Evaluation History and Background

The Colorado River Salinity Control Program has been established by the following Congressional actions:

1. The Water Quality Act of 1965 (Public Law 89-234) as amended by the Federal Water Pollution Control Act of 1972, mandated efforts to maintain water quality standards in the United States.
2. Congress enacted the Colorado River Basin Salinity Control Act (PL 93-320) in June, 1974. Title I of the Act addresses the United States' commitment to Mexico and provided the means for the U.S. to comply with the provisions of Minute 242. Title II of the Act created a water quality program for salinity control in the United States. Primary responsibility was assigned to the Secretary of Interior and the U. S. Bureau of Reclamation (BOR). USDA was instructed to support BOR's program with its existing authorities.
3. The U. S. Environmental Protection Agency (EPA) promulgated regulation in December, 1974, which established a basin wide salinity control policy for the Colorado River Basin and also established water quality standards procedure requiring basin states to adopt and submit for approval to EPA, standards for salinity, including numeric criteria and a plan of implementation.
4. In 1984, PL 98-569 amended the Salinity Control Act, authorizing the USDA Colorado River Salinity Control Program. Congress appropriated funds to provide financial assistance through Long Term Agreements administered by Agricultural Stabilization and Conservation Service (ASCS) with technical support from Soil Conservation Service (SCS). PL 98-569 also requires continuing technical assistance along with *monitoring and evaluation* to determine effectiveness of measures applied.
5. In 1995, PL 103-354 reorganized several agencies of USDA, transforming SCS into Natural Resources Conservation Service (NRCS) and ASCS into Farm Service Agency (FSA).
6. In 1996, the Federal Agricultural Improvement and Reform Act (PL 104-127) combined four existing programs, including the *Colorado River Basin Salinity Control Program*, into the Environmental Quality Incentives Program (EQIP).

Over the years, Monitoring and Evaluation (M&E) has evolved from a mode of labor/cost intensive detailed evaluation of a few farms and biological sites to a broader, less detailed evaluation of many farms and environmental concerns, driven by budgetary resources and improved technology.

M&E is conducted as outlined in "*The Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program*", first issued for the Price-San Rafael Unit in 1991, and revised in 2001. Progress is summarized in Table 2.

Table 2. Historical Progress Summary.

Colorado River Basin Salinity Control Program

Price - San Rafael Rivers Unit Cumulative Summary

	Planned			Applied					
FY	Contracts	Dollars	Acres Planned	Acres Applied, Irrigation	IWM	WL Wetland Habitat Management	WL Upland Habitat Management	On-farm Salt Load Reduction	Deep Perc Reduction
*Goals->			34,600	34,600	34,600			146,900	33,800
1998	41	613,448	1,291						
1999	90	1,879,613	4,395	937	182	0	0	5,561	867
2000	155	3,037,993	6,428	2,022	232	0	3	8,561	2,390
2001	248	4,756,901	9,730	2,772	978	1	10	13,278	3,378
2002	359	6,246,106	13,017	5,515	3,721	6	11	25,569	5,619
2003	376	7,317,892	14,133	8,134	7,506	6	11	34,132	11,135
2004	464	10,441,629	18,394	9,449	8,821	6	43	39,061	16,215
2005	516	12,838,093	21,318	12,720	12,092	6	43	46,771	17,444

***Note:** Goals for salt load reduction from the EIS were 120,220 tons/year from treating 30,050 acres. In 2001, goals were increased to 146,900 tons/year from treating 34,600 acres, based on greater than expected participation and sprinkler/improved flood ratio. So far, no improved flood systems have been installed.

Hydro-salinity

Before implementation of salinity control measures, the Price-San Rafael Rivers Unit contributed an estimated 430,000 tons of salt per year into the Colorado River, of which 244,000 tons were attributed to irrigation activities (Price – San Rafael Rivers Unit, Utah Planning Report/Final Environment Impact Statement, 1993 (EIS). It was projected that 120,220 tons of this salt loading could be prevented by installing improved irrigation practices on 30,050 acres of farm land, greatly reducing deep percolation and salt loading (USDA on-farm practices only). In 2001, it was recognized that cooperator participation was greater than anticipated and that applicants wished to install more efficient sprinkler systems as opposed to improved flood systems. In light of these observations, program goals were increased to 146,900 tons/year salt load reduction to be achieved by treating 34,600 acres.

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

1. The salinity concentration of subsurface return flow from irrigation is reasonably 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. (Hedlund, 1992).

Deep percolation (and proportional salt load) reductions are achieved by reducing or eliminating canal/ditch seepage and by improving 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 and better manage water use, sharply reducing deep percolation/salt loading.

Salinity Monitoring Methods

The 1991, "*The Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program*" as utilized in the Uintah Basin and adopted by the EIS for the Price – San Rafael Rivers Unit, focused on:

1. Intensive instrumentation and analysis on several irrigated farms, requiring expensive equipment and frequent field visits to ensure and validate collected data.
2. Detailed water budgets to determine/verify deep percolation reductions.
3. Multi-level soil moisture measured weekly, with a neutron probe.
4. Detailed sprinkler evaluations, using catch cans, run annually on selected farms.
5. Crop yields physically measured and analyzed.

As a result of labor intensive testing in the Uintah Basin Unit, it was confirmed that irrigation systems installed and operated as originally designed, produced the desired result of improved irrigation efficiencies and sharply reduced deep percolation rates, concurrent with reduced farm labor and improved yields.

Due to budget restraints, field intensive M&E efforts were curtailed in the late 1990s and a new "*Framework Plan for Monitoring and Evaluating (*M&E*) the Colorado River Salinity Control Program*" was adopted in 2001. Having established that properly installed and operated practices yield predictable and favorable results, the 2001 Framework Plan addresses hydro-salinity by:

1. Utilizing random cooperator surveys to collect and evaluate cooperator understanding, and impressions concerning contracts and equipment.
2. Formal and informal Irrigation Water Management (IWM) training and encouragement.
3. Random equipment spot checks and evaluations.
4. Agricultural statistics collected by government agencies.

Results of Hydro-salinity Monitoring

Cooperator questionnaires

In FY2002 and FY2003, 164 cooperators, selected randomly, were surveyed. A summary of survey responses are summarized in Table 3. No additional surveys were done in FY2004 or FY2005.

Table 3. Cooperator Surveys, FY2002-2003.

Random Selection Number	All				
Operation Name	Price - San Rafael Totals*				
Contract Number or Year/Years	Various				
Irrigated Acres	Flood	Wheel Line	Hand Line	Pivot	Total
	0%	30%	18%	2%	50%
Is the contract active and the land being cropped? (Circle One)	Yes	No			
	94%	6%			
Crop Acres	alfalfa	pasture	grains	other	
	46%	28%	14%	11%	
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
	68%	14%	14%	1%	3%
Is water measured? (Circle one)	Yes	No			
	75%	25%			
If Yes, acre-ft/acre applied?					
Is soil moisture monitoring used for irrigation scheduling? (Circle one)	Yes	No			
	40%	60%			
If yes, what type? (Circle all that apply)	"Feel" method	Tensio-meters	Gypsum blocks	Neutron probe	Remote sensing
	94%	3%	3%	0%	0%
Are Evapotranspiration calculations used for irrigation timing? (Circle one)	Yes	No			
	13%	87%			
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?	
	50%	14%	7%	29%	
Do you employ or use a consultant or service that advises irrigation scheduling? (Circle one)	Yes	No			
	36%	64%			
Have the changes in yield, labor used, irrigation operation and maintenance cost as well as other pre-harvest and harvest costs offset your share of the practice costs? (Circle one)	Yes	No			
	74%	26%			
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
	18%	55%	21%	6%	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
	53%	42%	1%	4%	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
	11%	21%	50%	13%	5%

Cooperator Training

In FY2005, no NRCS sponsored IWM training was held. Other state and local government and commercial groups provided seminars, in which NRCS often does training and cooperators attend. IWM training needs to have greater

emphasis in the Price – San Rafael Rivers Unit and is expected to improve as a result of EQIP incentives for IWM, which includes cooperator training.

For FY2006, NRCS is contracting with other conservation partners to do one-on-one IWM training with new contract holders. Adequate IWM training and technical assistance is essential to achieving salt load reductions anticipated from installation of improved irrigation systems.

Equipment Checks and Evaluations

In FY2004 and FY2005, 59 wheel lines and 7 center pivots, randomly selected, were evaluated using NRCS catch can methods.

Testing results are tabulated in Table 4.

Table 4. Summary of Sprinkler Evaluations.

	Number Systems Tested	Average Age	Christiansen Uniformity, CU		Within Specification
System Type	No.	Years	NRCS Standard	Measured	%
Wheel Line	59	2	75	86	93
Center Pivot	7	4	85	74	29
All	66	2		85	86

It is noteworthy that center pivots fail to reach the CU specification more often than wheel lines. This can be partially explained by testing procedures.

CU ratings obtained from catch-can testing of wheel lines do not reflect well on actual performance of the system. When testing a wheel line, three adjacent, normally operating sprinklers are selected to do the test, typically representing only about 3% of the total field. Since the tested sprinkler heads are selected for their normalcy and represent a very small portion of the total field, the calculated CU is more representative of system design than overall system performance. If heads are chosen randomly, it is a simple matter to look at the operation of the heads and determined whether or not they will achieve the CU standard, without running the test.

High CU on wheel lines is not a reliable indicator of adequate operation and maintenance (O&M). Future catch-can testing of wheel lines is not recommended for performance evaluation. The best indicator of good performance on wheel lines is conformance to original design and apparent quality of maintenance.

Conversely, CU ratings obtained for catch-can testing on center pivots is a reliable indication of system performance. When testing a pivot, only a fraction of sprinkler heads are tested, but they represent the entire length of the pivot, and hence the entire field, effectively reflecting performance of the complete system.

Inadequate CU on center pivots does indicate that better O&M is needed. Leaks on center pivots are rare. It is assumed that regular nozzle cleaning and conformance to the design nozzle package are the most important factors in keeping CU within specifications. Future catch-can testing of center pivots is recommended to reflect on maintenance and performance and to help educate pivot operators. It is imperative that test results be discussed with pivot operators with an emphasis on cleaning nozzles at least annually.

For FY2006, the M&E team has proposed to contract a large scale field inventory of operating sprinkler systems, observing and mapping leaks and other visually obvious operating anomalies. One or two field employees should be able to visually observe and map hundreds of sprinklers in a very short period of time, in lieu of doing two or three catch-can tests per day. This data will better reflect on the quality of O&M being performed and general condition of installed sprinkler systems.

Soil Moisture Monitoring

As part of the educational effort, NRCS and conservation districts have installed electrical resistance style soil moisture monitoring probes on 26 fields. Multiple probes are placed at various depths on a given field, and the soil moisture at each depth is read and recorded on a periodic basis. Four of the fields have continuous data recorders

that reduce labor costs significantly. Due to advances in technology, continuous recording soil data monitors can be installed for as little as $500/site.

In FY2004, 18 fields were monitored. On average, 8% of soil moisture readings indicated deep percolation was occurring. By contrast, in FY2005 only about 1% of readings are indicative of deep percolation. This is further evidence that given proper training and tools, cooperators are willing to correct operational procedures in order to conserve irrigation water and soil nutrients, and reduce salt loading to the river system.

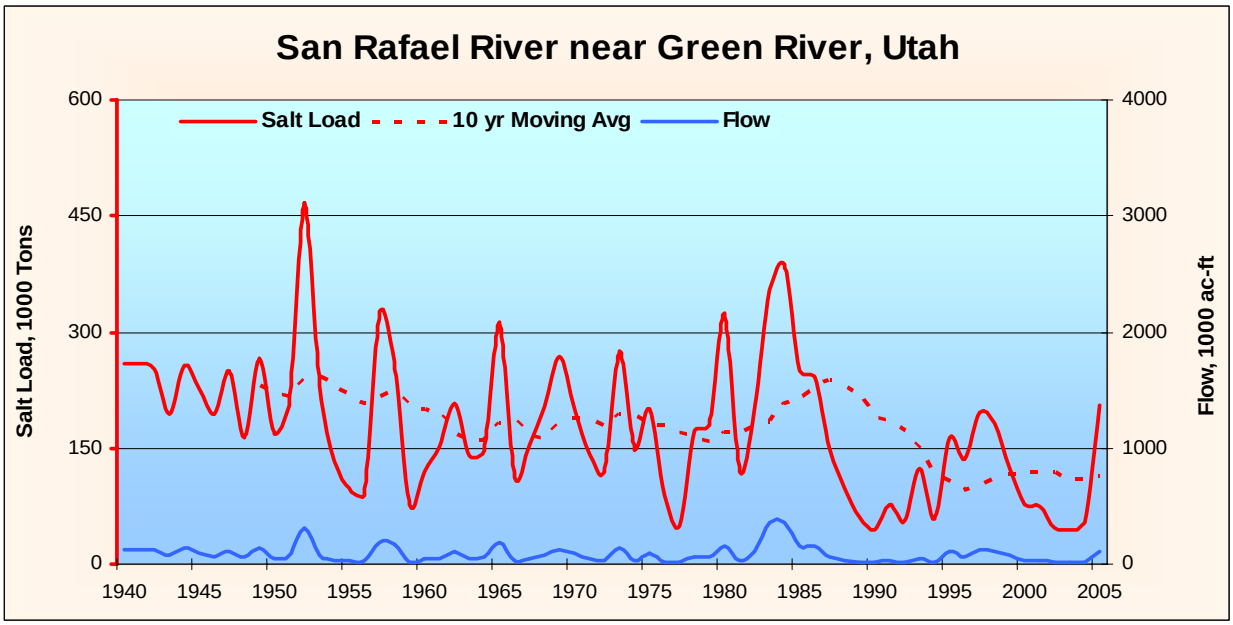
There is no way to estimate deep percolation volumes from this information. Its greatest value is to educate cooperators and help them with irrigation timing.

A summary of sites monitored with electronic sensors is in appendix 2.

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 U.S. Geological Survey (USGS) and U. S. Bureau of Reclamation (BOR). Their evaluations imply 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 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.



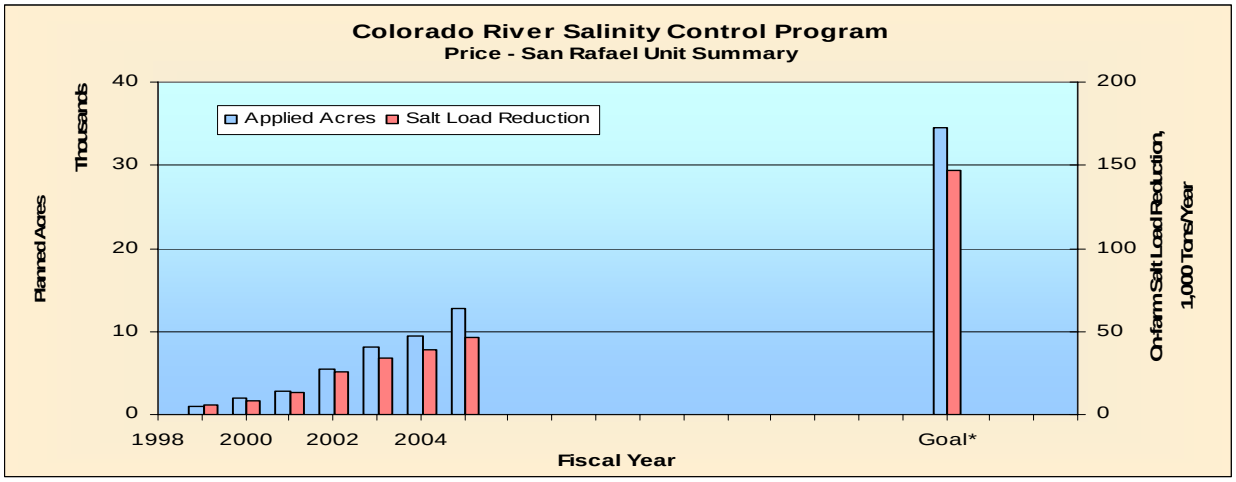
Note: This graph has been prepared by the authors, using USGS data.

Progress

At the end of FY2005, 58% of 34,600 acres targeted for treatment had projects planned. There were installed practices on 35% of targeted acres. Nearly all of the planned projects were sprinkler systems, with no improved flood systems and few drip irrigation installations. The preponderance of sprinklers is expected to result in a salt load reduction somewhat greater than projected in the EIS.

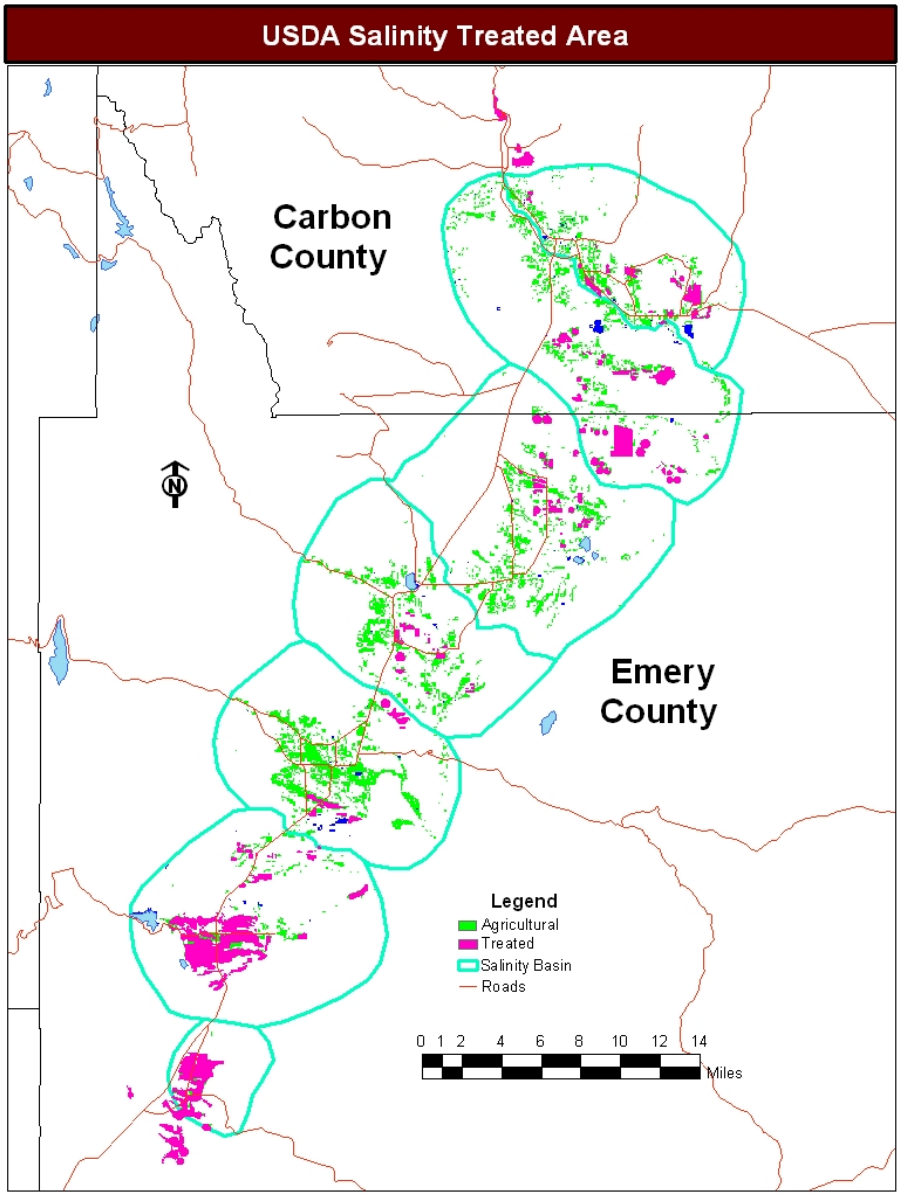
Salt load reductions from applied practices and total acres planned are depicted in Figure 2. Figure 3 is a map of treated acres.

Figure 2. Salt Load Reduction and Dollars Applied.



*__Note:__ No timing is implied, since progress depends on unpredictable federal budgets.

Figure 3. Treated Acres, Price-San Rafael Rivers Unit.



Wildlife Habitat and Wetlands

Background

The Final Environmental Impact Statement (EIS) for the Price/San Rafael Rivers Salinity Unit was completed in December, 1993. The EIS discusses at length anticipated impacts the application of the preferred plan will have on the landscape. The EIS states *"The replacement of wetland/wildlife habitat with like habitat is a goal of USDA in all of it's programs; however, the primary goal of the CRSC - to reduce salinity in the Colorado River - is not compatible with the preservation and/or replacement of wetlands supported by over irrigation."*. This persistent quandary caused much discussion of the necessity of wetland replacement. In the beginning Soil Conservation Service (SCS) met with Utah Division of Wildlife Resources (UDWR), U.S. Bureau of Reclamation (BOR), U.S. Environmental Protection Agency (EPA), and U.S. Fish and Wildlife Service (USFWS), to discuss alternatives to wetland vegetation replacement. The EIS also states *"…physical limitations severely restrict of placement of wetlands in close proximity to irrigated areas"*. Lined ponds with no outlets were discussed, ponds in sandstone members of the Mancos Shale Formation and many other alternatives.

Guidelines in the 1991 *"The Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program"* were adopted and placed in the EIS for the Price San/San Rafael Rivers Salinity Unit. In accordance with *"The Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program"*, 1991 wildlife habitat monitoring would be performed along 18 selected transects throughout the area. Color aerial photography would be taken every three years to monitor changes in the extents of wetlands as a result of project implementation of the CRSC Program. These photographs would be scanned and wetlands digitized and compared to prior year baseline maps. Changes over time would create inferences for the basin as a whole. To supplement aerial photographs, Wildlife Habitat Evaluations from individual plans or contracts would be analyzed to determine accumulated changes in wildlife habitat, both upland and wetland.

Due to a decrease of funding, wildlife habitat monitoring efforts were reduced in 1997 and discontinued in 1999. Two new employees, a biologist and a civil engineer, were hired in September 2002 as the new Monitoring and Evaluation (M&E) team.

In 2001 *"The Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program"* was revised and M&E evolved from a labor/cost intensive, detailed evaluation of a few biological sites, to a broader, less detailed evaluation of large areas and many resource concerns. This change was primarily driven by budget restraints and improved technology.

Methodology adopted in 2002 was to utilize remotely sensed images (Landsat), analyze them with commercial geospatial imagery software, classify, map, and measure vegetation extents, quantify losses or gains of wetlands and wildlife habitat. It was also anticipated that with the use of Landsat images NRCS could extrapolate results from current images back in time to images acquired prior to implementation of the Colorado River Salinity Control Program. Thus NRCS could compare wetland/wildlife habitat extents from pre-Colorado River Salinity Control Program to the current date.

Off-Farm 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. As mentioned in the 2004 M&E Report, three images from June 22, 1997, July 30, 2002, and July14, 2005 were classified for open water and wetland extents (Figs. 4-6). Ferron, Utah was chosen for initial analysis. A summary of results of the Ferron Landsat image classification is found in Table 5.

Table 5. Results of Ferron Landsat 5 image classification measured in acres of open water and wetland extents.

Date of Landsat Image	Acres of Open Water	Acres of Wetlands
June 22, 1997	5671	287
July 30, 2002	5665	151
July 14, 2005	5683	244

The year 1997 was an above average water supply year, 2002 was very dry, and 2005 was also an above average water supply year. Images for these years were chosen for their unique set of environmental factors, namely precipitation. In 2004 the M&E Team analyzed similar images for Pleasant Valley in the Uintah Basin, there was

considerable uncertainty concerning the ability of 30-meter resolution Landsat images to accurately identify small narrow wetland areas common to arid Salinity Units. Other factors were mentioned such as climate and human disturbance that might affect end results of the classification. If the EIS projection is true, irrigation induced/enhanced wetlands should be declining due to the piping of canals and replacement of wild flood systems with sprinklers; we should see a decline in number of acres of irrigation induced/enhanced wetlands each consecutive year. This is indeed true in the images of Ferron (Figs. 4-6). However, the 2005 image shows an increase in wetland extents from 2002, which the M&E Team attributes to above average precipitation recorded in 2005 compared with below average precipitation in 2002. The 1997 image shows a consolidated drainage pattern where 2005 is much more dispersed. An important fact to consider is that in 1997 the Price-San Rafael Rivers Unit, Utah was only one year old and the first projects were probably just installed.

In Pleasant Valley images in the Uintah Basin, however, evidence is more dramatic; wetland extents from 2005 exceeded acreage in pre-treatment year, 1984 (USDA-NRCS, 2005). This issue raised serious doubts concerning the accuracy of the image classification process. It was determined that use of Landsat images alone was not sufficient to accurately monitor and track small narrow wetland extents within Salinity Units.

Classification of 30-meter Landsat images is an excellent tool for quantifying and assessing land cover classes on large scale projects where there are large tracts of similar vegetation. The M&E team has found it difficult to accurately interpret subtle differences in vegetation types at smaller scales such as presented by small, narrow wetlands found in arid Salinity Units. Landsat images help locate areas of potential wetlands and wildlife habitat areas; once located, detailed mapping of actual extents of features is required to accurately identify and define real losses or gains of wetland/wildlife habitat. This can be accomplished with the help of current year, high resolution, aerial photograph interpretation and on-site visits.

A photographic history would be useful in documenting changes in vegetation type. Remote sensing alone will not achieve desired results sought by NRCS to report concurrency and proportionality of wildlife habitat replacement.

The M&E team has decided to redirect its methodology to include more precise measurements of actual habitat extents by incorporating detailed mapping, establishment of permanent photo points, and smaller-scale case studies. This approach is more labor intensive. The M&E Team believes that additional manpower may be needed to assist in gathering data needed to create accurate land cover maps to achieve the most accurate and reliable result possible.

Figure 4. Ferron wetlands and water classified from Landsat 5, June 22, 1997; 287 wetland acres. Background image is a true color aerial photograph taken in 2004 (2004 NAIP).

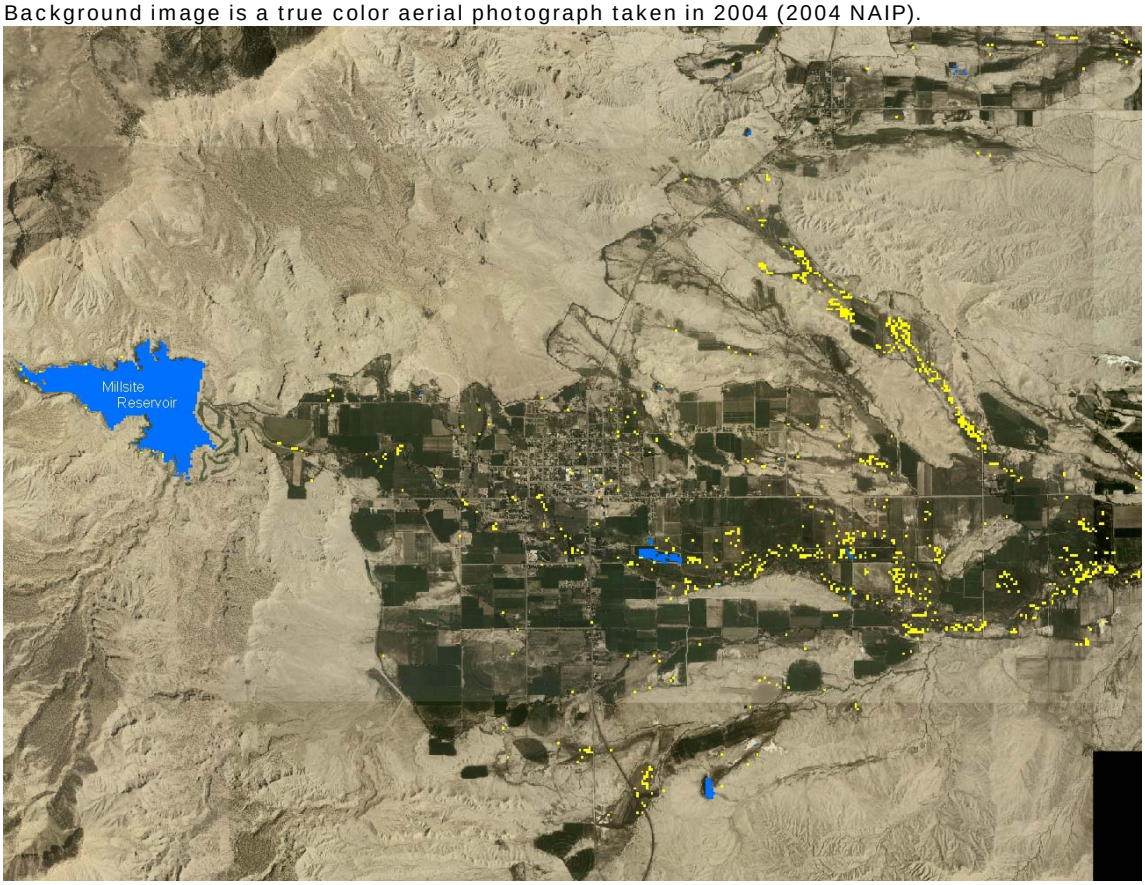


Figure 5. Ferron wetlands and water classified from Landsat 5, July 30, 2002; 151 wetland acres. Background image is a true color aerial photograph taken in 2004 (2004 NAIP).

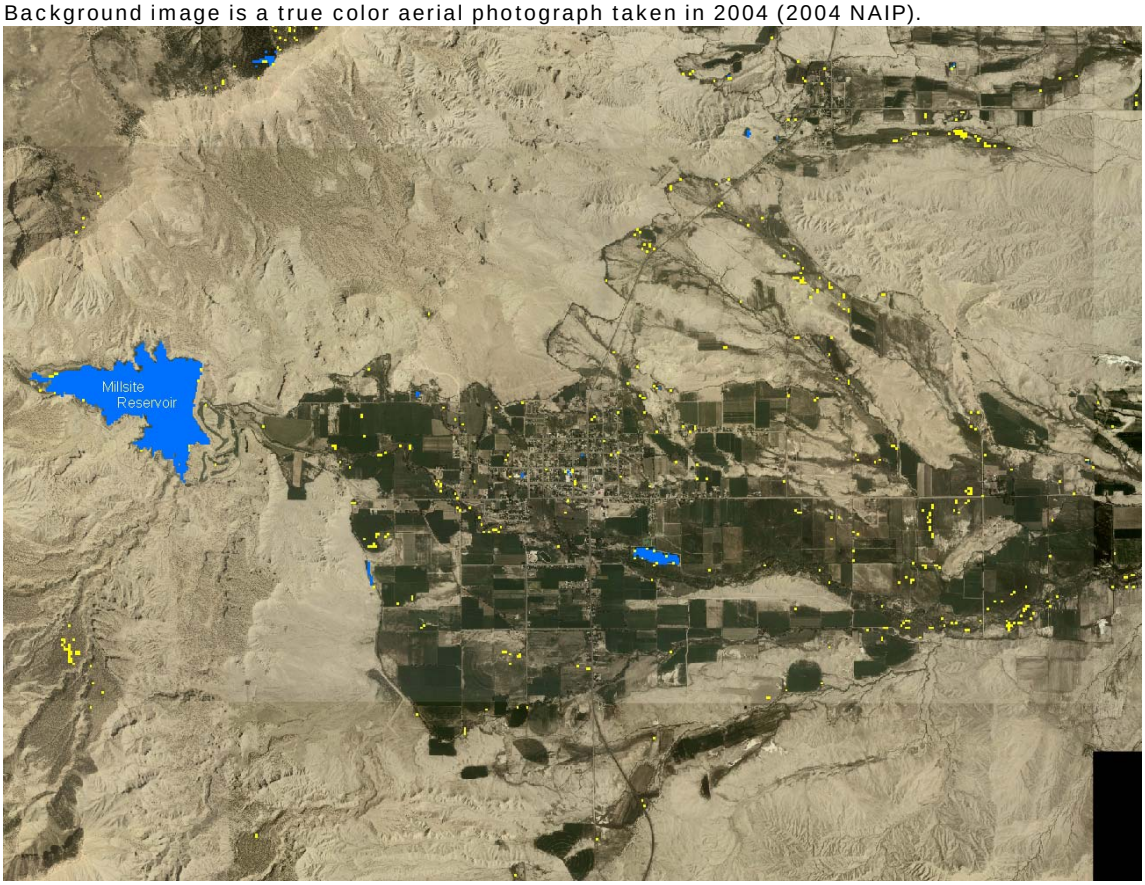
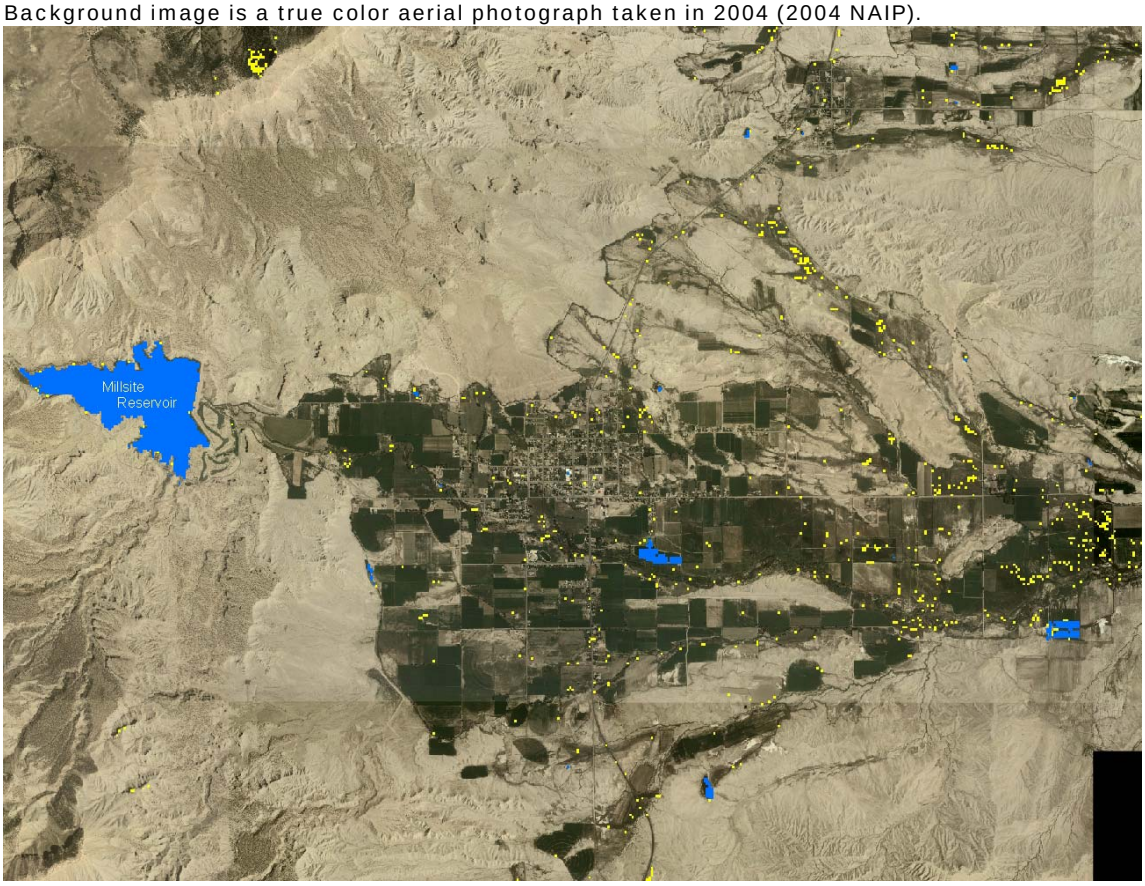


Figure 6. Ferron wetlands and water classified from Landsat 5, July 14, 2005; 244 wetland acres. Background image is a true color aerial photograph taken in 2004 (2004 NAIP).



On-Farm Habitat

In spite of $100,000 Salinity EQIP funds NRCS set aside for wildlife habitat, no Wildlife Habitat Development Plan (WHDP) applications were received by Price or Castledale Field Offices for FY2005 (Table 6). There were no applied WHDP contracts in FY2005 (Table 7). Ten thousand linear feet of stream restoration was completed on a large scale WHDP contract in Emery County, but the project will not be reported as completed until all practices in the plan have been certified.

Salinity funding levels appropriated to the area to implement the Colorado River Salinity Control Program are at an all time high. NRCS staff is under considerable pressure to obligate funds to interested landowners. Wildlife habitat projects tend to be a second priority when dealing with large fund appropriations. In FY2006 an agreement was reached with the Utah Division of Wildlife Resources (DWR) to hire four additional wildlife biologists throughout the state to work in NRCS offices. One of these biologists will be assigned to the Price, Utah office and will be available to work in all Salinity Units in Utah. This should help alleviate problems of wildlife habitat projects languishing due to lack of oversight and attention. It should also facilitate acquisition of new projects and increase landowner awareness of various programs available for wildlife habitat replacement.

Another issue is the difficulty NRCS has experienced in attempts to utilize Basin States Parallel Project (BSPP) funds for wildlife habitat enhancement projects. To help alleviate the situation, in FY2005 NRCS requested and was granted by the Salinity Forum $100,000 in BSPP dollars to fund a Request for Proposals (RFP) for accelerated habitat replacement projects. NRCS is partnering with local Resource Conservation and Development Councils (RC&D) who will provide administration of the program. The first RFP was released in spring of 2005; results of the awards are yet to be made public, an additional $150,000 was granted for the 2006 RFP. A total of $250,000 in the BSPP RFP program is available for wildlife habitat replacement projects. RC&D Councils have been assigned goals by NRCS to help direct the creation, enhancement, and restoration of wetlands and wildlife habitats. NRCS anticipates the number of BSPP wildlife projects to increase due to this new funding mechanism.

Table 6. Wildlife Practices Planned in FY2005.

Acres of Wildlife Habitat Creation or Enhancement Planned and Funded by Program and County
Price/San Rafael Rivers Basins, FY2005

	EQIP		WHIP		BSPP		Total (acres)
Management Type	**Wetland (*644)**	**Upland (*645)**	**Wetland (*644)**	**Upland (*645)**	**Wetland (*644)**	**Upland (*645)**	
Carbon County	0	0	0	0	0	0	0
Emery County	0	0	0	0	0	0	0
2004 Basin Totals	**0**	**0**	**0**	**0**	**0**	**0**	**0**

* Practice 644 is Wetland Wildlife Habitat Management; practice 645 is Upland Wildlife Habitat Management.

Table 7. Wildlife Practices Applied in FY2005.

Acres of Wildlife Habitat Creation or Enhancement Applied by Program and County
Price/San Rafael Rivers Basins, FY2005

	EQIP		WHIP		BSPP		Total (acres)
Management Type	**Wetland (*644)**	**Upland (*645)**	**Wetland (*644)**	**Upland (*645)**	**Wetland (*644)**	**Upland (*645)**	
Carbon County	0	0	0	0	0	0	0
Emery County	0	0	0	0	0	0	0
2004 Basin Totals	**0**	**0**	**0**	**0**	**0**	**0**	**0**

* Practice 644 is Wetland Wildlife Habitat Management; practice 645 is Upland Wildlife Habitat Management

Voluntary Habitat Replacement

NRCS continues to encourage replacement of wildlife habitat on a voluntary basis. Federal and State funding programs are in place to promote wildlife habitat replacement. This information is advertised annually in local newspapers, in local workgroup meetings, and Soil Conservation District meetings throughout the Salinity Area. The Utah NRCS Homepage also has information and deadlines relating to Farm Bill programs.

The addition of the BSPP RFP will give more flexibility in acquisition of potential projects as RC&D Councils will be able to actively solicit projects from landowners and possibly leverage funds with other government and non-governmental agencies.

Economics

Economics Monitoring Methods

The 1991, "*Framework Plan for Monitoring and Evaluating (M&E) the Colorado River Salinity Control Program*" specified a detailed evaluation of crop yields and labor requirements on a few farms. Due to the timing involved, very little data was collected in the Price - San Rafael Rivers Unit using this plan.

A revised "*Framework Plan for Monitoring and Evaluating (*M&E*) the Colorado River Salinity Control Program*" was adopted in 2001, changing the emphasis to wide-scale surveying of cooperators to determine on-farm economics, case studies, and reviewing agricultural statistics from government sources.

Cooperator Economics

Seventy-four percent of survey respondents believe their own share of treatment costs will pay out.

Production Information

While alfalfa yields have not improved markedly, total area production of alfalfa increased 30% from 1997 to 2002, according to the U.S. Census of Agriculture. Figure 7 reflects total alfalfa production and yield over a 19 year

period. Yield may be more closely related to precipitation than anything else. Figure 8 depicts historical mountain precipitation.

Figure 7. Price – San Rafael area Alfalfa Production and Yield. Source data is tabulated in Appendix 1.

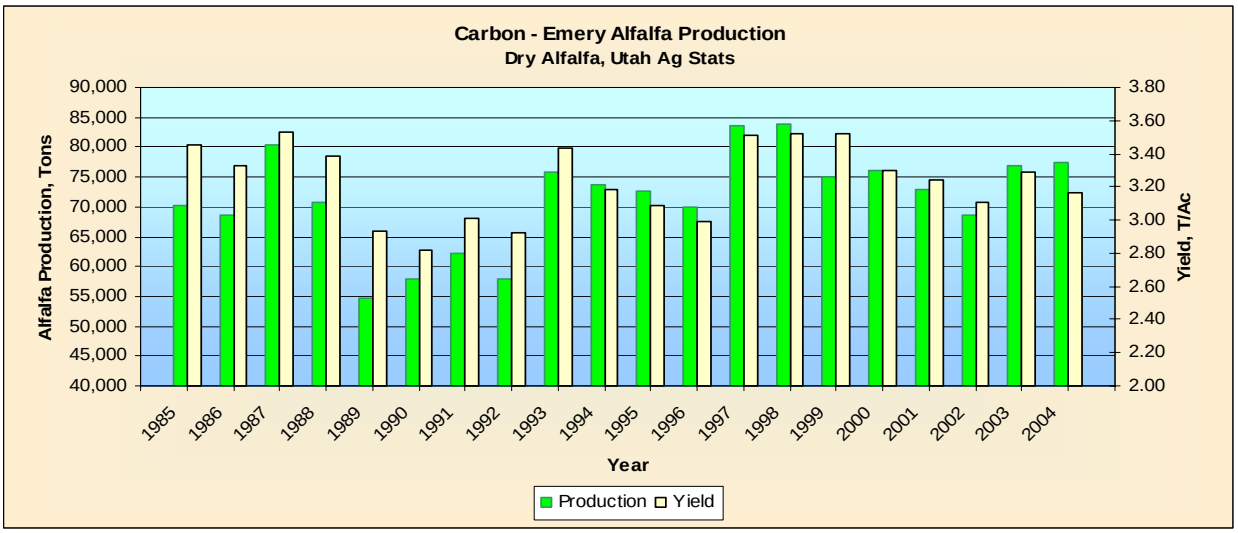
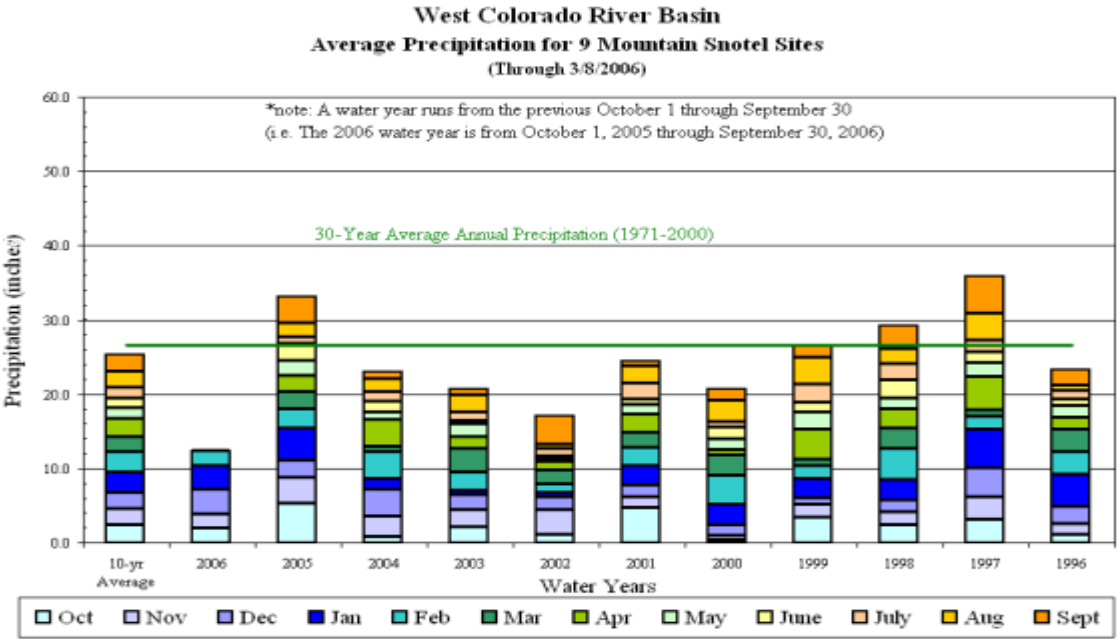


Figure 8. Mountain Precipitation in the Price – San Rafael River Basin.
Courtesy of Utah Division of Water Resources



Labor Information

From NASS statistics, labor benefits are elusive as both *Hired Farm Labor* and *Total Farm Production Expenses* have increased steadily over the 1992, 1997, and 2002 Agricultural Censes.

While numerical data is not definitive, anecdotal information is positive.

The 2002 Agricultural Census reports that 50% of farmers work off-farm jobs more than 200 days/year.

Public Economics

One hundred percent of survey respondents believe salinity control programs have a positive economic affect on the area and region.

Positive public perceptions of the Salinity Control Program include:

- Reduced salinity in the Colorado River.
- Increased flows in streams and rivers.
- Economic lift to the entire community from employment and a broadened tax base.
- Local availability of expertise, information, and materials for resource conservation.
- Aesthetically pleasing, green fields, more dense, and for longer periods of time.
- Improved safety and control of water resources, with reduction of open ditches and canals.

Negative public perceptions of the Salinity Control Program include:

- "Greening" of desert landscape.
- Conversion of artificial wetlands to upland habitat.

Summary

Farming in the Price – San Rafael Rivers Unit is still a difficult, largely part-time business. Irrigation improvements have benefited the farmer in many ways:

- Generally increased yields.
- Ability to upgrade crops.
- Reduced personal time demands.
- Enhanced ability to tolerate weather extremes.
- Some added economic stability – moderated highs and lows.

Appendices

Appendix 1. Price – San Rafael Alfalfa Production.

Price - San Rafael Unit			
Alfalfa Production			
Year	Harvested	Yield	Production
	Acre	T/Ac	Tons
1985	20,300	3.46	70,200
1986	20,600	3.33	68,500
1987	22,800	3.53	80,400
1988	20,900	3.38	70,700
1989	18,700	2.93	54,800
1990	20,500	2.82	57,800
1991	20,700	3.01	62,300
1992	19,800	2.92	57,900
1993	22,100	3.43	75,800
1994	23,200	3.18	73,800
1995	23,500	3.09	72,600
1996	23,400	2.99	69,900
1997	23,800	3.51	83,500
1998	23,800	3.52	83,800
1999	21,300	3.52	75,000
2000	23,100	3.30	76,200
2001	22,500	3.24	73,000
2002	22,100	3.11	68,700
2003	23,400	3.29	77,000
2004	24,500	3.16	77,500

Appendix 2. Price – San Rafael Soil Moisture Monitoring.

Soil Moisture Monitoring, FY2005					
Recording Method	**Total Number of Readings**	**Readings Pore Pressure < 2 cb**	**Readings Pore Pressure < 10 cb**	**% of Time with Probable Deep Percolation**	**Notes**
Manual	6	-	-	0%	
Manual	8	-	-	0%	
Manual	5	-	-	0%	
WM	7	-	-	0%	
AM400	149	-	-	0%	
Manual	25	-	-	0%	
Manual	25	-	-	0%	
Manual	5	-	-	0%	
Manual	5	1	1	20%	
Manual	25	-	-	0%	
Manual	29	1	1	3%	
Manual	5	-	-	0%	
Manual	17	-	-	0%	Probable Water Table Influence
AM400	563	-	-	0%	Probable Water Table Influence
Manual	26	-	-	0%	
Manual	19	1	1	5%	
Manual	22	2	2	9%	
Manual	22	1	1	5%	
Manual	5	1	1	20%	
Manual	25	-	-	0%	
Manual	19	-	-	0%	
WM?	12	1	1	8%	
Manual	27	4	4	15%	
Manual	5	-	-	0%	Probable Water Table Influence
Manual	10	-	-	0%	
Manual	26	-	-	0%	
26	1,092	12	12	1%	

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