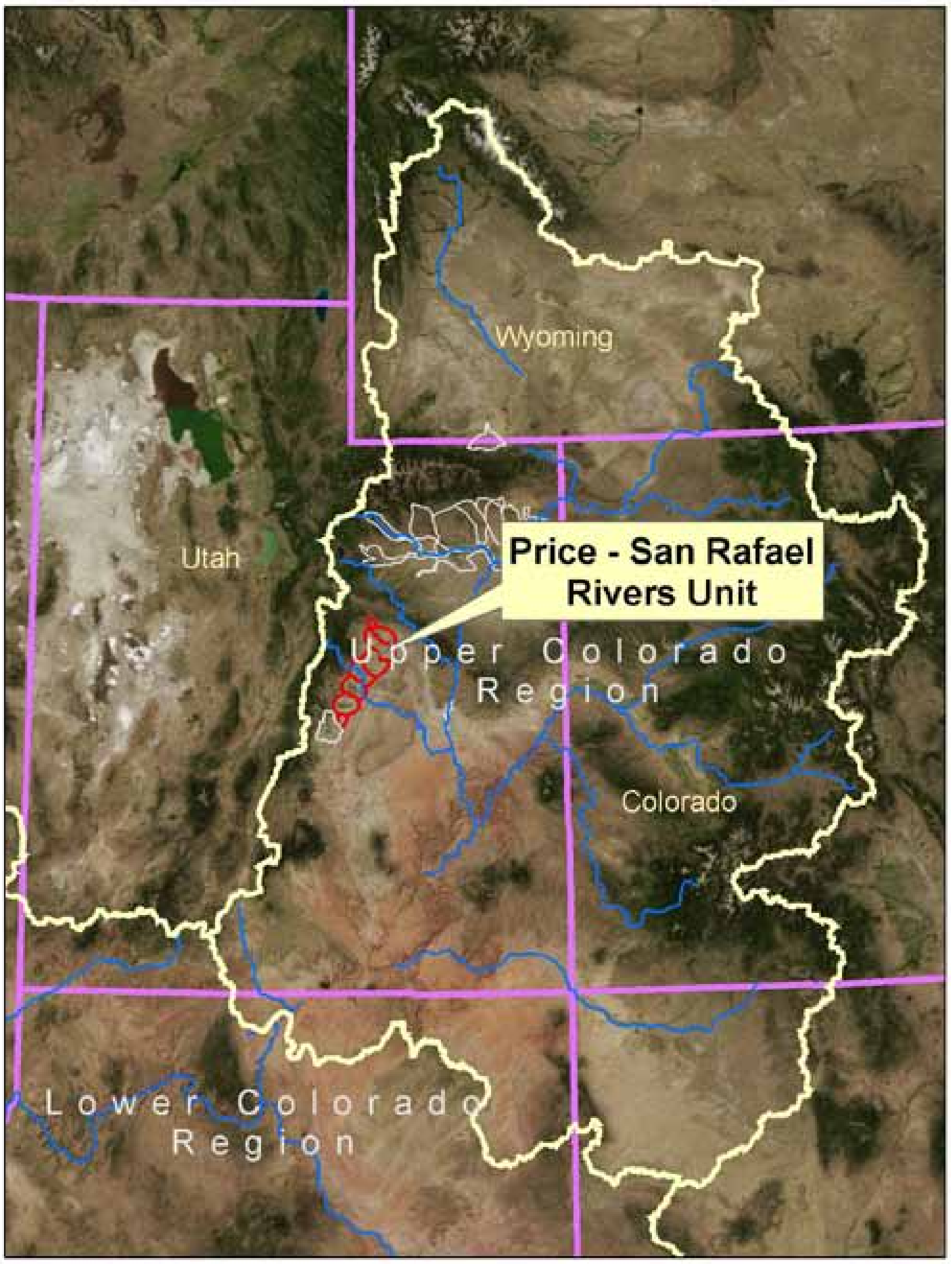
Colorado River Basin Salinity Control Program

Price – San Rafael Rivers Unit

Monitoring and Evaluation Report, FY2011



U.S. Department of Agriculture

Natural Resources Conservation Service

Executive Summary

Project Status

- For FY2011, $2.49 million was obligated planning 1,215 acres to reduce salt loading by 3,425 tons/year at an amortized cost of $78/ton FA+TA.
- Since 1997, $45.5 million (2011 dollars) has been obligated planning 29,500 acres to reduce salt loading by 87,900 tons/year at an amortized cost of $63/ton FA+TA, in line with the $63/ton implied in the 1993 EIS.
- For FY2011, $4.99 million was applied on 2,235 acres to reduce salt loading by 8,835 tons/year at an amortized cost of $61/ton FA+TA.
- Since 1997, $34.0 million (2011 dollars) has been applied on 27,800 acres to reduce salt loading by 84,300 tons/year at an amortized cost of $48/ton FA+TA.
- In 2011 dollars, pre-project NEPA documents anticipated a salt load reduction cost of $62/ton. Cumulative planned cost is $63/ton, and cumulative applied cost is $48/ton. Cumulative costs are expected stabilize or decrease as the Huntington – Cleveland project reaches completion.
- Of 66,000 water-rights acres, 36,050 acres were projected to be improved by the EIS.
- Of approximately 73,000 original off-farm tons/year, USDA programs have applied 3,628 tons/year of salt load reduction for lateral construction.
- The 2008 Farm Bill funds EQIP through 2012.

Hydro-salinity

- IWM record keeping, soil moisture monitoring, and sprinkler condition surveys all indicate that salt load reduction estimates, using current calculation procedures, are conservative.
- An intense IWM practice is included in the NRCS salinity payment schedule to help encourage Soil moisture monitor installation.

Wildlife Habitat and Wetlands

- In FY2011, five wildlife habitat replacement projects were planned or funded for a total of 220 acres.
- In FY2011, 34 acres of wildlife habitat replacement were applied.

Economics

- Alfalfa production is clearly in an upward trend, but yield/acre is declining slightly.
- Applications for salinity control projects remain strong.

Table 1. Project progress summary

Price - San Rafael Rivers Unit, All Programs				
CONTRACTS PLANNED	UNITS	CURRENT FY	CUMULATIVE	TARGET
1. CONTRACT STATUS				
A. Contracts Approved	Number	55	843	
	Dollars	2,486,802	33,970,153	
	Acres	1,215	29,544	45,000
On-farm	Tons/Year	3,425	84,310	147,000
Off-farm	Tons/Year	-	3,628	
B. Active Contracts	Number		263	
	Dollars		13,868,872	
	Acres		8,613	
On-farm	Tons/Year		24,545	
Off-farm	Tons/Year		837	

PRACTICES APPLIED	UNITS	CURRENT FY	CUMULATIVE	TARGET
2. EXPENDITURES				
Financial Assisstance (FA)	Dollars	4,986,151	26,746,369	
3. IRRIGATION SYSTEMS				
A. Sprinkler	Acres	2,283	27,786	45,000
B. Improved Surface System	Acres	-	-	
C. Drip System	Acres	13	61	
4. SALT LOAD REDUCTION				
A. Salt load reduction, on-farm	Tons/Year	7,435	80,524	147,000
B. Salt load reduction, off-farm	Tons/Year	1,400	3,819	
C. Tons of salt controlled prior to EQIP	Tons/Year		-	

NRCS Salinity Control Programs			
Program Name	Acronym	Start Year	End Year
Environmental Quality Incentive Program	EQIP	1997	Current
Basin States Parallel Program	BSPP	1998	Current

*Note: On-farm Salt Load Reduction has been recalculated using the procedure adopted in FY2007 by three Upper Basin States. All EQIP and BSPP contracts were reviewed and acres corrected. All cumulative numbers reflect results of recalculation.

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Monitoring and Evaluation History and Background

The Colorado River Basin Salinity Control Program was established by the following Congressional Actions:

- 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.
- 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 Bureau of Reclamation (Reclamation). USDA was instructed to support Reclamation's program with its existing authorities.
- The Environmental Protection Agency (EPA) promulgated a regulation in December, 1974, which established a basin wide salinity control policy for the Colorado River Basin and also established a water quality standards procedure requiring basin states to adopt and submit for approval to the EPA, standards for salinity, including numeric criteria and a plan of implementation.
- 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 required continuing technical assistance along with monitoring and evaluation to determine effectiveness of measures applied.
- 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).
- 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).
- The Farm Security and Rural Investment Act of 2002 and the Food, Conservation, and Energy Act of 2008 reauthorized and amended EQIP, continuing opportunities for USDA funding of salinity control measures.

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 but less detailed evaluation of many farms and environmental concerns, driven by budgetary restraints 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 Uintah Basin Unit in 1980 and revised in 1991 and 2001.

Project Status

FY2011 Project Results

FY2011 project results for the Price – San Rafael Rivers Unit (PSR) are summarized in table 2.

Cumulative Project Results

The normalized, amortized cost of salt load reduction is relatively close to the cost anticipated by the EIS. (Table 3) Cooperators continue to apply for salinity control contracts and opportunities still exist to further reduce salt loading at an average cost/ton comparable to that expected at project inception.

Table 2. FY2011 results

FY2011	Units	Planned	Applied
Federal cost share, FA	$	2,487,000	4,986,000
Amortized federal cost share, FA	$	161,300	323,400
Irrigation improvements	acres	1,215	2,296
Salt load reduction	tons /year	3,425	8,835
Federal cost, FA+TA	$/ton	78	61

Detailed Analysis of Status

Table 3. Project goals and cumulative status, 2011 dollars

Cumulative	Units	EIS	Planned	Applied
Federal Cost Share, FA+TA	2011 $	$73,900,000	$76,000,000	$56,600,000
Amortized federal cost share, FA+TA	2011 $	$7,450,000	$5,600,000	$4,000,000
Irrigation Improvements	Acres	36,050	30,000	27,800
Salt load reduction	Tons /year	120,220	88,000	84,000
Federal cost FA+TA	2011 $ /ton	$62	$63	$48

Pre-Project Salt Loading

Agricultural irrigation is a major source of salt loading into the Colorado River and is completely human induced. Irrigation improvements have great potential to control salt loading.

In 2007 U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) and U.S. Department of the Interior, Bureau of Reclamation (Reclamation) reviewed available literature and came to a consensus agreement on the most reasonable pre-project salt contribution from agriculture prior to implementing Federal Salinity Control Programs. (Figure 1)

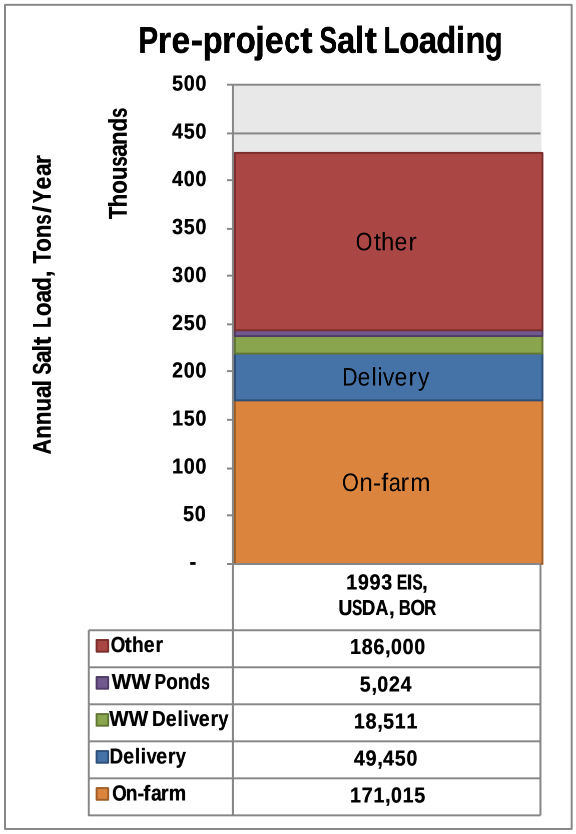


Figure 1. PSR pre-project agricultural salt load allocation

Salinity Control Practices

On-farm practices used to reduce salt loading include improved flood systems, sprinkler systems, and advanced irrigation systems, along with diversions, water delivery systems, pumps, ponds, etc., required for the proper operation of irrigation systems. Salt load reduction is achieved by improving uniformity of water application and reducing over-irrigation and deep percolation.

Off-farm practices used to reduce salt loading are associated with the reduction and/or elimination of canal/ditch seepage, usually by installing pipelines.

Planning Documents

For PSR, in 1993, U.S. Department of Agriculture (USDA) Soil Conservation Service (now NRCS) and U.S. Department of Interior Bureau of Reclamation (Reclamation) developed a joint environmental impact statement (EIS).

Using the same salt cost calculation used in the Colorado River Basin Salinity Control Project (CRBSCP) today, the initial EIS suggested that the cost of on-farm salt load reduction would be about $62/ton in 2011 dollars. ($27/ton in 1989)

Table 4, an updated version of Table IV-12 of the EIS, summarizes cost calculations using current procedures with EIS data.

Table 4. Calculation of salt load reduction cost using pre-project, EIS projections, 2011 dollars

1993 EIS, Federal Project Cost		On-farm	Off-farm	Winter Water	Total Project
Irrigation projects	acres	36,050			36,050
Canals and ditches	miles		156		156
Winter Water Improvements				Various	
Salt Load Reduction	tons/ year	120,220	7,937	32,885	161,042
Total Federal Cost (1989), FA+TA	Nominal $	$32,522,760	$31,962,300	$5,547,000	$70,032,060
Amortized @ 8.875%, 25 years[1]	1993 $/year	$3,277,546	$3,221,065	$559,010	$7,057,621
Salt Load Reduction Cost, nominal	Nominal $/ton	$27	$406	$17	$44
Salt Load Reduction Cost	2011 $/ton	$62	$923	$39	$100
Salt Load Reduction Cost, combined on-farm & off-farm	2011 $/ton	$115		$39	
Salt Load Reduction Cost, combined off-farm and winter water	2011 $/ton	$62	$210		

[1] The EIS amortized at 8.875% (1989 discount rate) over 50 years. NRCS' contemporary salt load calculations use a 25 year life.

Amortized at 8.875% (1989 discount rate) over 25 years, as is typical for NRCS' salt cost calculations, the combined cost of on-farm and off-farm improvements, less winter water improvements, cited in Table IV-12 of the EIS, would have been $44/ton nominal, not the $45/ton calculated using a 50 year practice life. The equivalent cost in 2011 dollars is $115/ton, which might be a good target estimate of the cost of a combined on-farm/off-farm project in FY2011.

With the joint EIS in place, Reclamation funded several off-farm projects over the years. The costs of these projects were generally justified by combining total federal cost of on-farm and off-farm salinity control components and weighing the cost against total salt load reduction, as was done in the EIS. Regardless of how a project is justified, each agency remains accountable for federal dollars expended by their agency and salt load reduction directly associated with those federal expenditures.

In general, on-farm practices are much more cost effective at reducing salt loading than are off-farm practices. However, quality off-farm practices help to optimize installation of on-farm practices by providing gravity pressure and delivery scheduling not available from open delivery systems. Like a highway, where it is often necessary to build expensive bridges along with less expensive miles of roadway, the most effective irrigation projects include more expensive off-farm practices along with less expensive on-farm practices in a combination that ultimately produces the most cost effective result.

Implementation has not always been divided along agency lines or on-farm/off-farm boundaries. Traditionally NRCS has focused on on-farm projects and Reclamation has emphasized off-farm projects. (Where on-farm and off-farm come together is blurry at times.) However, this tradition is not hard and fast and Reclamation has done some on-farm projects and NRCS has done some off-farm projects. Consequently, it is expected that Reclamation and NRCS will each allocate salt load reduction to on-farm and off-farm practices funded through their agency. This report deals only with NRCS funding and associated salt load reduction.

FY2011 Obligations

Planned Practices (Obligations)

Planned practices (obligations) represent contracts with participants to apply improved irrigation practices to the landowner's agricultural activities. Only the federal share of project cost is analyzed in this section.

The installation of salinity control practices is voluntary on the part of landowners. An incentive to participate is created by cost-sharing on installation using federal grants. In essence, federal cost-share purchases salt load reductions in the Colorado River, while the participant's cost-share buys them reduced operating costs and increased production.

Federal cost-share is obligated when a contract is signed with the participant assuring timely installation, to federal standards, of salt load reducing irrigation practices. A few of these contracts are never completed, for various reasons, making tracking of the cumulative federal obligation problematic in that it decreases over time, as contracts are modified or cancelled.

Table 5 tabulates annual planned obligations and cost/ton in nominal and 2011 dollars.

Table 5. Cost/Ton of annual planned obligations

FY	Federal Water Project Discount Rate	Contracts Planned	FA Planned Nominal	Acres Planned	Salt Load Reduction Planned, Tons/Year	Amortized FA+TA Nominal	$/Ton FA+TA Nominal	2011 PPI Factor	FA Planned, 2011 Dollars	Amortized FA+TA 2011 Dollars	$/Ton 2011 Dollars	Cum $/ton, 2011 Dollars
1997	7.375%	25	692,103	614	1,752	102,350	58	175%	1,214,113	179,545	102	102
1998	7.125%	40	549,723	1,178	3,362	79,507	24	180%	989,501	143,113	43	63
1999	6.875%	32	868,613	1,851	5,282	122,831	23	180%	1,563,503	221,096	42	52
2000	6.625%	52	856,158	1,537	4,386	118,338	27	173%	1,476,873	204,133	47	51
2001	6.375%	95	1,796,895	3,686	10,518	242,688	23	168%	3,024,043	408,426	39	46
2002	6.125%	106	1,276,055	2,681	7,650	168,351	22	167%	2,130,189	281,037	37	44
2003	5.875%	38	1,147,673	1,268	3,619	147,859	41	162%	1,856,002	239,115	66	46
2004	5.625%	70	3,044,481	4,508	12,864	382,901	30	156%	4,738,403	595,943	46	46
2005	5.375%	50	2,477,342	2,499	7,131	304,063	43	145%	3,586,082	440,147	62	48
2006	5.125%	44	3,224,288	2,622	8,115	386,076	48	140%	4,509,646	539,985	67	50
2007	4.875%	37	2,440,200	1,244	4,522	284,959	63	131%	3,196,952	373,330	83	52
2008	4.875%	93	4,291,323	1,684	4,808	501,128	104	117%	5,018,706	586,069	122	57
2009	4.625%	45	3,929,835	1,147	3,280	447,408	136	113%	4,445,171	506,078	154	61
2010	4.375%	61	4,888,662	1,810	7,223	542,430	75	108%	5,298,144	587,865	81	63
2011	4.125%	55	2,486,802	1,215	3,425	268,825	78	100%	2,486,802	268,825	78	63
Totals		788	33,970,153	29,544	87,938	4,099,712	47		45,534,131	5,574,708	63	

Salt Load Reduction Calculation

The estimated salt load reduction from FY2011 planned practices is 3,425 tons/year, calculated by multiplying the original tons/acre for the entire unit, by the acres to be treated and a percentage reduction factor based on change in irrigation practice. For PSR, the initial estimate of on-farm irrigation salt loading is 3.28 tons/acre-year. As an example, if 40 acres are converted from wild-flood to wheel-line sprinkler, an estimated 84% of salt loading will be eliminated. Hence, 40 acres x 3.28 tons/acre-year x 84% = 110 tons/year salt load reduction.

Cost/Ton Calculation

The federal cost/ton for salt load reduction is calculated by amortizing the federal financial assistance (FA) over 25 years at the federal discount rate for water projects (4.125% for FY2011). Two-thirds of FA is added for technical assistance (TA) and the amortized total cost is divided by tons/year to yield cost/ton. TA is the estimated cost of administering the contract, designing and monitoring installation, and following through for the contract life.

The Producer Price Index (PPI) for agricultural equipment purchased is applied to normalize past obligations to 2011 dollars.

Obligation Analysis

In FY2011, $2.49 million was obligated to treat 1,215 acres, reducing salt loading by 3,245 tons/year. The resulting cost is $78/ton FA+TA.

In 2011 dollars, cumulative obligation thru FY2011 is $45.5 million, planned on 29,500 acres, with a salt load reduction of 87,900 tons/year, resulting in an overall cost of $63/ton, very near the $62/ton cost projected by the EIS for on-farm practices.

Normalizing obligations, using the PPI for farm equipment purchases, makes historic cost comparisons more realistic. (Figure 2)

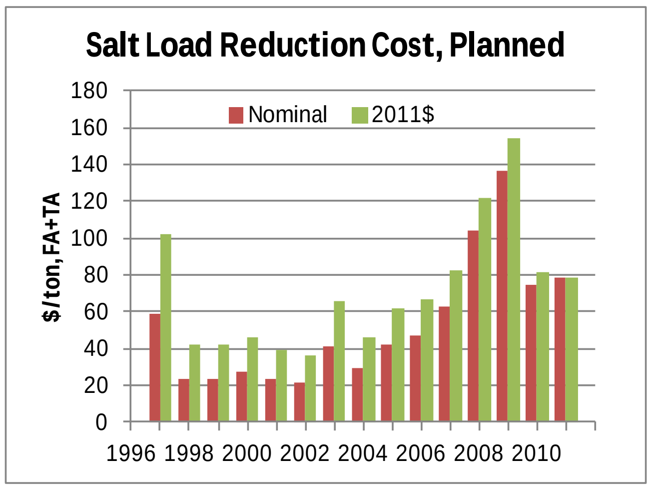


Figure 2. Cost/Ton planned, nominal and 2011 dollars

Cost-Share Enhancement

Typical federal payment percentage, over the last several years, has been about 75% of total installation cost for salinity projects. A feature of the 2002 and 2008 Farm Bills is cost-share enhancement, increasing the federal share, from 75% to 90% of the total cost for beginning farmers (those who have not claimed agricultural deductions on income tax for 10 years), limited resource farmers (a farmer with gross farm income less than a prescribed limit), and members of historically underserved minorities.

In FY2011, 41 enhanced contracts were written, obligating $1.419 million FA to treat 816 acres, reducing salt loading by 2,292 tons/year at a cost of $67/ton FA+TA.

Since 2003, 244 enhanced contracts have been written, obligating $13.25 million (2011$) FA to treat 8,680 acres, reducing salt loading by 24,700 tons/year at a cost of $63/ton (2011$) FA+TA.

Cumulative average salt load reduction cost for enhanced contracts of $63/ton FA+TA (2011 dollars), compares to $65/ton FA+TA for non-enhanced contracts from the same time period. (Figure 3) The incremental cost of enhancement is $1.59 million FA (2011$), about 7.9% of total FA for all contracts in the FY2003-FY2011 time period. Two-hundred, sixteen contracts are beginning farmers and twenty-eight are limited resource farmers.

For the FY2003-FY2011 time period, about 53% of contracts involved enhanced federal participation. (Figure 4)

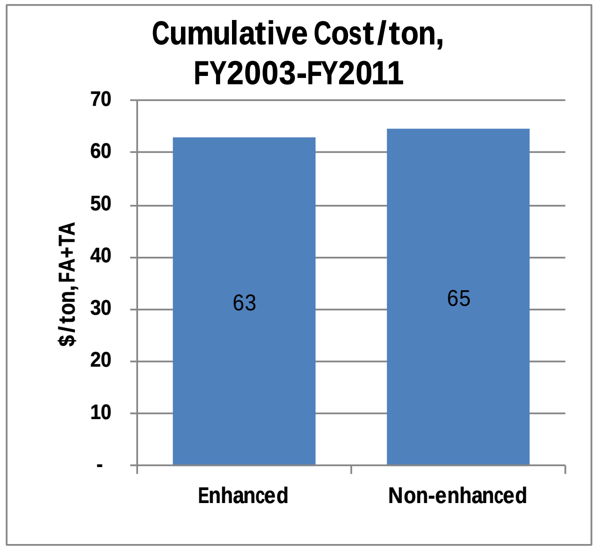


Figure 3. Cost/Ton, comparison

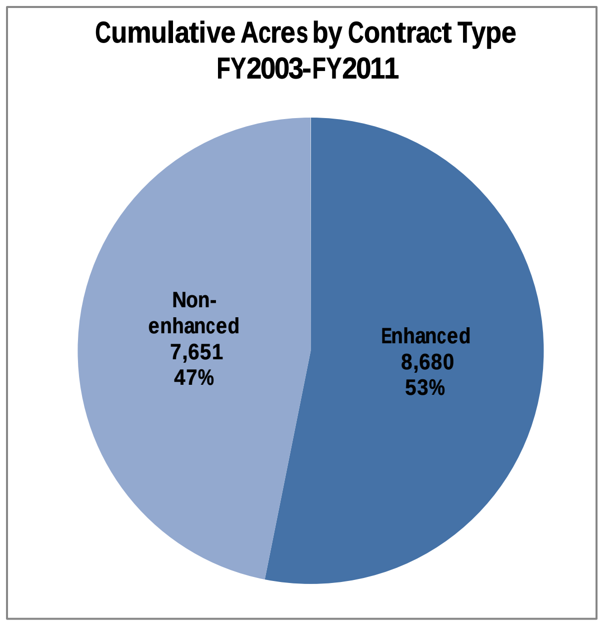


Figure 4. Acres with enhanced funding

Applied Practices

FY2011 Expenditures

In FY2011, $4.99 million FA was expended applying 2,296 irrigated acres. The estimated salt load reduction is 8,835 tons/year, on-farm and off-farm, at an amortized cost of $61/ton FA+TA.

Cumulative expenditure FY1997-FY2011 is $34.0 million FA (2011 dollars), applied to 27,800 irrigated acres, reducing salt loading by 84,300 tons/year, on-farm and off-farm, at a cost of $48/ton FA+TA (2011 dollars). (Table 6)

Application of salinity control practices lags planning by the time required for practice installation. Between planning and application, a few contracts are de-obligated for various reasons. (Figure 5)

For tracking, irrigation contracts are assumed to be applied in proportion to dollars expended as of September 30th, the last day of the fiscal year.

Salt load reduction in this report is calculated using the procedure outlined in "*CALCULATING SALT LOAD REDUCTION*", July 30, 2007.

Table 6. Summary of annual applied expenditures and cost/ton

FY	Federal Water Project Discount Rate	FA Applied, Nominal	Irrigation Acres Applied	Salt Load Reduction Applied, Tons/Year	Amortized FA+TA, Nominal	$/Ton Applied, Nominal	2011 PPI Factor	FA Applied, 2011 Dollars	Amortized FA+TA 2011 Dollars	$/Ton 2011 Dollars	Cum $/ton, 2011 Dollars
1997	7.375%	-	-	-	-	-	175%	-	-	-	-
1998	7.125%	-	-	-	-	-	180%	-	-	-	-
1999	6.875%	598,610	1,447	4,130	84,650	20	180%	1,077,498	152,370	37	37
2000	6.625%	464,327	1,093	3,119	64,179	21	173%	800,964	110,709	35	36
2001	6.375%	260,567	771	2,201	35,192	16	168%	438,515	59,226	27	34
2002	6.125%	2,062,990	3,497	9,980	272,171	27	167%	3,443,862	454,350	46	40
2003	5.875%	1,542,280	2,743	7,828	198,697	25	162%	2,494,156	321,330	41	40
2004	5.625%	1,016,295	1,434	4,091	127,818	31	156%	1,581,752	198,935	49	41
2005	5.375%	1,072,550	1,781	5,081	131,642	26	145%	1,552,572	190,559	38	41
2006	5.125%	2,037,288	2,708	7,728	243,945	32	140%	2,849,450	341,193	44	41
2007	4.875%	2,729,685	3,228	10,667	318,764	30	131%	3,576,211	417,619	39	41
2008	4.875%	1,849,751	3,008	8,837	216,008	24	117%	2,163,286	252,622	29	39
2009	4.625%	3,835,806	1,560	4,424	436,703	99	113%	4,338,812	493,969	112	44
2010	4.375%	4,290,069	2,281	7,421	476,012	64	108%	4,649,412	515,884	70	46
2011	4.125%	4,986,151	2,235	8,835	539,007	61	100%	4,986,151	539,007	61	48
Totals		26,746,369	27,786	84,343	3,144,789	37		33,952,642	4,047,773	48	

Evaluation by Program

Funding for the Colorado River Salinity Control Project in the Price – San Rafael Rivers Unit (PSR) has been provided by two programs, EQIP and BSPP. (Table 7)

EQIP funding is about 77% of total federal funds obligated for on-farm practices. (Figure 6)

About 34% of acres expected to be planned are not yet obligated. (Figure 7)

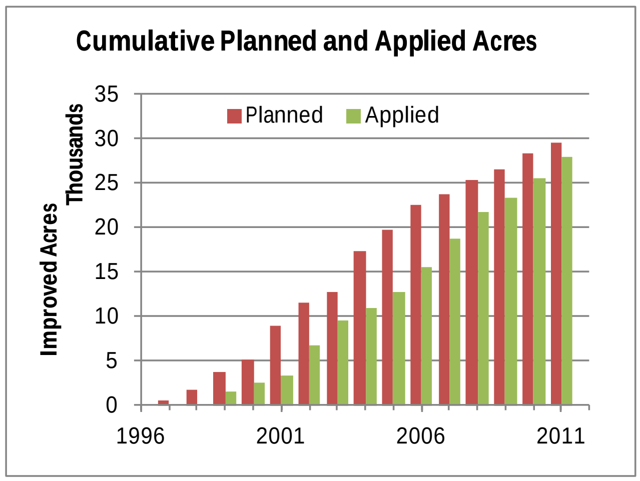
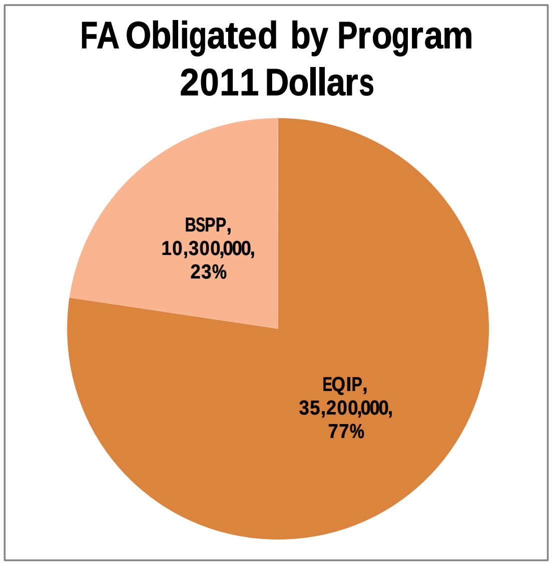


Figure 5. Cumulative Planned and Applied Acres

Table 7. Project funding by program in 2011 dollars

FY2011	Planned				Applied				
Program	Contracts	FA	Irrigation Practices	Salt Load Reduction	FA	Irrigation Practices	FA	Salt Load Reduction	Salt Load Reduction
	Number	2011$	Acres	Tons/year	2011$	Acres	$/Acre	Tons/year	Tons/acre
EQIP	700	35,201,613	23,152	67,622	24,978,490	22,067	1,132	64,755	2.93
BSPP	143	10,332,517	6,392	20,316	8,974,152	5,719	1,569	19,588	3.43
Totals	843	45,534,131	29,544	87,938	33,952,642	27,786	1,222	84,343	3.04



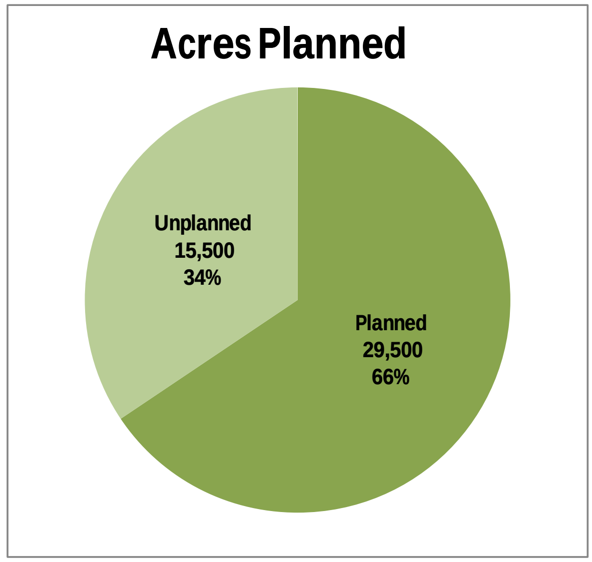


Figure 6. Cumulative FA obligated by program **Figure 7. Planned and unplanned acres**

Hydro Salinity Monitoring

Three assumptions guide the calculation of salt load reduction from irrigation improvements:

1. Salt concentration of subsurface return flow from irrigation is relatively constant, regardless of the amount of canal seepage or on-farm deep percolation.

2. The available supply of mineral salts in the soil is essentially infinite and salinity of out-flowing water is dependent only on solubility of salts in the soil. Therefore, salt loading is directly proportional to the volume of subsurface return flow.

3. 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, 1994).

Deep percolation and salt load reductions are achieved by reducing or eliminating canal/ditch seepage/leakage and by improving the efficiency and uniformity of on-farm irrigation. It is estimated that upgrading an average uncontrolled flood irrigation system to a well designed and operated sprinkler system will reduce deep percolation and salt loading by 84-91%.

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

Salinity Monitoring Methods

The 1991, "*...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:

- Intensive instrumentation and analysis on several irrigated farms, requiring expensive equipment and frequent field visits to ensure and validate collected data

- Detailed water budgets to determine/verify deep percolation reductions
- Multi-level soil moisture measured weekly, with a neutron probe
- Detailed sprinkler evaluations, using catch cans, ran annually on selected farms
- Crop yields physically measured and analyzed

As a result of labor intensive testing 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 never fully implemented in PSR. 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:

- Utilizing random cooperator surveys to collect and evaluate cooperator understanding, and impressions concerning contracts and equipment
- Formal and informal Irrigation Water Management (IWM) training and encouragement
- Equipment spot checks and operational evaluations
- Agricultural statistics collected by government agencies

In PSR, virtually all salinity program irrigation improvements are sprinkler systems. About 55% of sprinkler systems are wheel lines, 45% center pivots, on an acreage basis, presumably due to relatively small average field size. The average contract size is 45 irrigated acres.

Cooperator questionnaires, interviews, and training sessions

In FY2002 and FY2003, 164 cooperators, selected randomly, were surveyed. No additional surveys were done in FY2004 through FY2010.

Irrigation Water Management (IWM)

The goal of IWM is to assure that irrigated crops receive the right amount of water at the right place at the right time, which will accomplish the goal of minimizing deep percolation and salt loading in the river. Proper IWM is achieved by careful equipment design, cooperator education, and maintenance resulting in implementation of effective water management techniques.

In general, sprinkler systems designed by NRCS are capable of irrigating the most water-consumptive potential crop in the warmest months of the year. When growing crops with lower water needs, or at other times in the growing season, these systems are capable of over-irrigating to some extent.

Over irrigating in early spring and late fall is mitigated by water storage aspects of the soil. Crops generally use water before irrigation begins and after irrigation ends, leaving the soil moisture profile somewhat depleted. Filling the soil with water requires additional irrigation, over and above crop needs, in the spring.

Preventing over-irrigation is a contractual obligation of the cooperator. To help cooperators fulfill this obligation they must be educated and coached in the proper use and maintenance of their irrigation systems.

Cooperator interest is enhanced by creating financial incentives for IWM. To collect payment for the IWM practice (449), a cooperator must do the following:

1. Attend a two hour IWM training session or attend an approved water conference, or augur a hole on his field, with an NRCS representative, and estimate soil profile moisture by the "feel" method.

2. Keep detailed irrigation records using the IWM Self-certification spreadsheet, and

3. Review the records with an NRCS employee or contractor trained to evaluate and explain IWM principals.

4. Starting in FY2008, an additional "intensive" IWM practice was made available that would pay a higher rate if the cooperator purchases, installs, and utilizes a soil moisture monitor (explained below) with the additional compensation.

Most operators are keenly interested in learning to understand IWM principals and operate their irrigation systems professionally, and profitably.

Water management seminars and conferences are sponsored by various government agencies, associations, and commercial groups, encouraging everyone to manage and conserve water. NRCS is a willing and eager participant in these partnership educational endeavors.

In addition, personal guidance is available to cooperators, on request, at local NRCS field offices.

Intensive and continuous IWM training is essential to successful long term salt load reduction.

Irrigation Record Keeping

NRCS has developed and provided the, "IWM Self Certification Spreadsheet" which enables cooperators to graphically evaluate available water content (AWC) in the soil and compare actual irrigation with projected average crop water requirements and/or with modeled crop evapotranspiration. Evapotranspiration is calculated from weather data collected by NRCS and other public agencies, using the Penman-Montieth method developed by the Food and Agriculture Organization of the United Nations (FAO).

System design, crop information, and soil information is entered on the input form, along with the starting date of each irrigation cycle. The spreadsheet then calculates the AWC and deep percolation. (Figure 8)

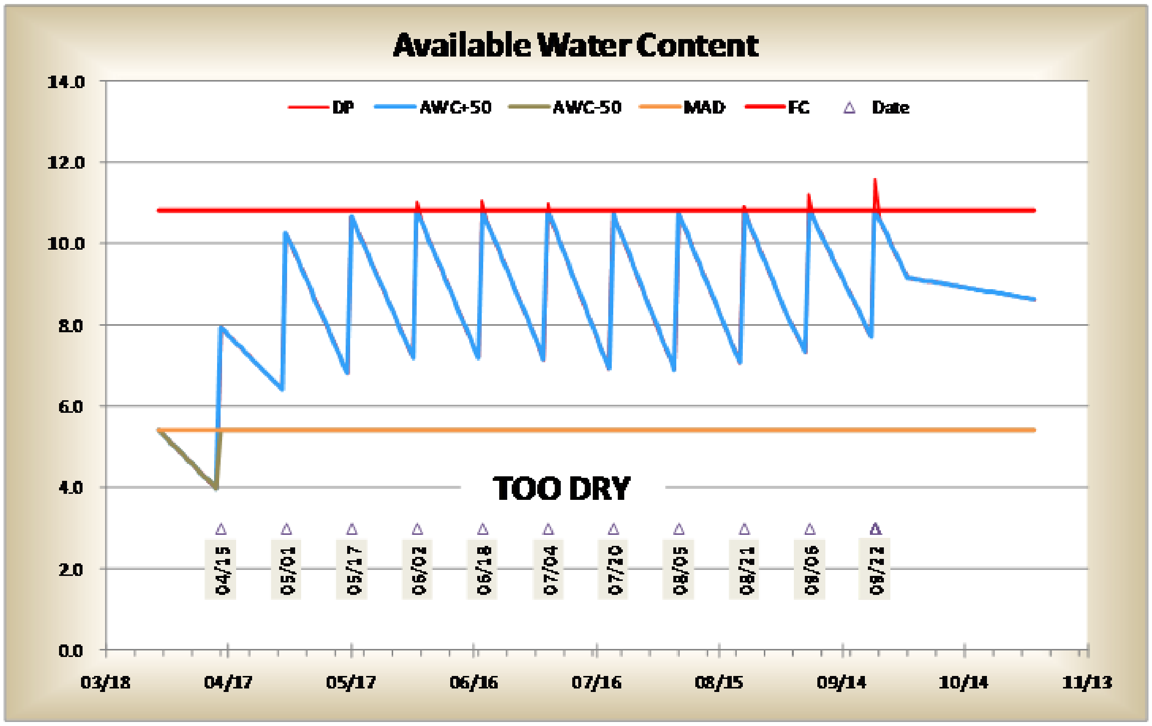
Two graphs are generated, depicting AWC in the soil and comparing water applied with water required on a seasonal basis. (Figure 9)

Irrigation Water Use Record - Farmer Self Certification

Cooperator:		**Crop:**	Alfalfa	**Year:**	2011
Tract/Field:	Tract 9	**Root Depth, ft:**	5.00		
Date:	11/15/2011	**Station:**	Castledale	**CU:**	32 inches
				Contract Eligible Acres:	70.00
Soil Texture:	Loamy Fine Sand	**Irrigation method:**	Pivot		
AWC, In/Ft:	2.16	**Efficiency:**	75%		
AWC Max, in:	10.80	**Evaluated Acres:**	129.98		
MAD, in:	5.40	**Evaporation %:**	10%		
Pre-season AWC, In.	8.10	**Cycle Hours:**	180		
		Flow rate, gpm:	900		

Start date of irrigation cycle	End date of irrigation	Total Cycle Hours	Alternate Cycle Hours	Flow, gpm	Inches Applied Cycle	Inches Applied Season	CU Season (Table)	Irrigation Gain	AWC	Deep Perc
05/03/11	05/10/11	180		900.0	2.48	2.48	1.45	1.02	9.12	0.00
05/11/11	05/18/11	180		900.0	2.48	4.96	3.01	0.92	10.04	0.00
05/19/11	05/26/11	180		900.0	2.48	7.44	4.57	0.92	10.80	0.16
05/31/11	06/07/11	180		900.0	2.48	9.92	6.91	0.14	10.80	0.14
06/12/11	06/19/11	180		900.0	2.48	12.39	9.62	-0.23	10.57	0.00
06/24/11	07/01/11	180		900.0	2.48	14.87	12.33	-0.23	10.33	0.00
07/03/11	07/10/11	180		900.0	2.48	17.35	14.49	0.33	10.66	0.00
07/12/11	07/19/11	180		900.0	2.48	19.83	16.88	0.09	10.75	0.00
07/21/11	07/28/11	180		900.0	2.48	22.31	19.27	0.09	10.80	0.03
07/30/11	08/06/11	180		900.0	2.48	24.79	21.66	0.09	10.80	0.09
08/09/11	08/16/11	180		900.0	2.48	27.27	24.01	0.14	10.80	0.14
08/19/11	08/26/11	180		900.0	2.48	29.75	26.31	0.17	10.80	0.17
08/29/11	09/05/11	180		900.0	2.48	32.22	28.62	0.17	10.80	0.17
09/18/11	09/25/11	180		900.0	2.48	34.70	31.00	0.10	10.80	0.10
Total inches of water applied during the season (total of all lines above):								34.70		1.00
Total Acre Feet Applied during the Season:								375.9		
Seasonal Irrigation Efficiency (CU requirement/inches of water applied per acre):								89%		

Figure 8. Sample IWM Self Certification Spreadsheet – Data Entry Page



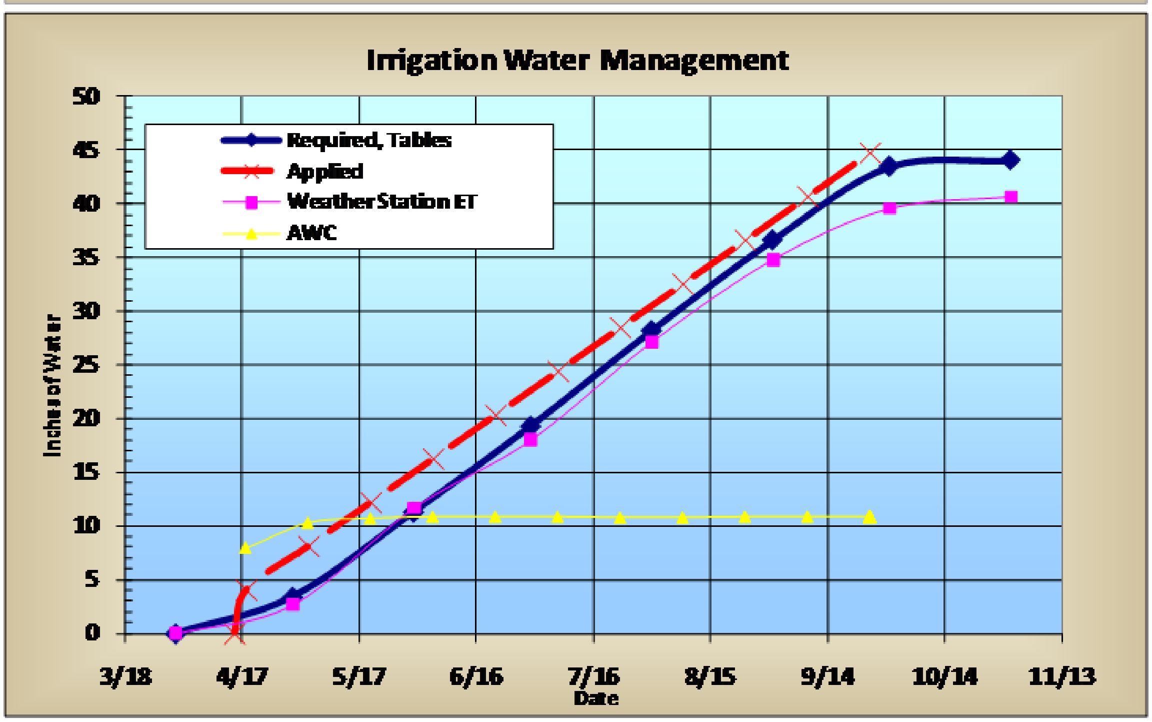


Figure 9. Sample graphs from the IWM Self Certification Spreadsheet

In the first plot the goal is to keep AWC between 50% and 100% of root zone moisture capacity. Red spikes above the 100% line indicate deep percolation. A moderate amount of deep percolation is designed into the system as a leaching fraction. In the second plot, the blue line is a long-term average water requirement, based on location and crop. The red line is actual water applied. Where data is available, the purple line is modeled from near-real-time data collected at a nearby weather station.

In order to receive incentive payment for IWM, each irrigator must keep irrigation records and present the data to the field office, where data is entered into the spreadsheet and the results are discussed. Graphs are plotted for the farmer's reference. In general, cooperators respond positively to this training and strive to irrigate more efficiently.

Irrigation records and subsequent training are very important to cooperator understanding and should be an integral part of any IWM certification effort.

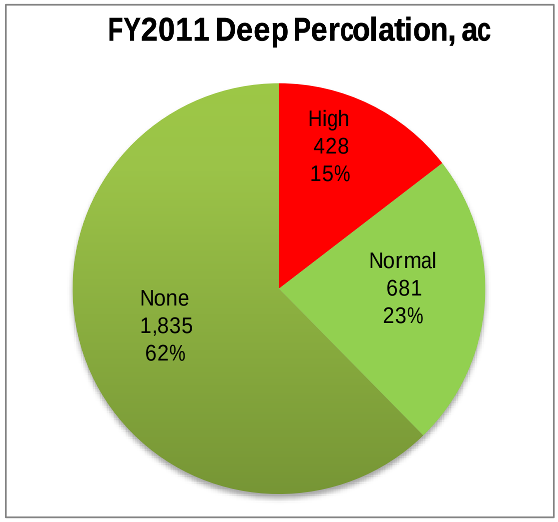


Figure 10. Deep percolation from IWM records, acres, FY2011 reports

From 556 completed IWM certification records, it appears that 85% of acres in PSR do not deep percolate excessively. (Figure 10) Actual deep percolation volume is estimated to be about 24% of what would be considered normal.

New sprinkler owners in PSR are much more likely to under-irrigate than to over-irrigate. Typically, the price for under-irrigation is reduced yield, not dead crops. Without careful record keeping, the farmer may not recognize this error.

Due to the prevalence of under-irrigation, it can be assumed that, based on irrigation record keeping, salt load reduction projections are conservative.

Soil Moisture Monitoring

A time-tested method for timing irrigation involves augering a hole and determining the water content of soil in the root zone to decide when to apply the next irrigation. This may well be the best method available for irrigation timing, both simple and inexpensive. However, few operators take time to do it.

NRCS is demonstrating and guiding cooperators in the use of modern soil moisture monitoring systems utilizing electronic probes and data recorders. Such systems can now be installed for about $600, giving the cooperator information on the water content of his soil at multiple depths and locations without time-consuming augering.

In a typical case, electronic probes are installed at various depths, such as 12", 24" and 48". Using a simple data recorder, indicated soil pore pressure (implied soil moisture content) is read and recorded multiple times per day. With some recorders, soil pore pressure is presented graphically on an LCD display in the field, making it a simple matter to estimate when the next irrigation will be required. (Figure 11)

Since gravimetric drainage generally does not occur unless the soil horizon is nearly saturated (above field capacity), it is assumed that deep percolation is not occurring if the deepest probe reading is below -10 centibars. In PSR, six installed data recorders indicate that deep percolation occurs less than 3% of the time on monitored fields.

PSR also has several fields with probes but no data recorder. When they were installed, the Soil Conservation District intended to read all of the probes manually, on a weekly basis, and plot the results. Unfortunately, personnel changes have thwarted this effort. Installing data recorders at each of these fields would be much less expensive and more reliable than manual reading.

Figure 11. Soil moisture data recorder with graphing

In the FY2008 - FY2011 payment schedules, an additional IWM Intense (449) practice is included that increases the IWM payment for participants who agree to install soil moisture monitoring equipment in addition to taking classes, attending workshops, and keeping records. It is hoped that future contracts will capitalize on this opportunity to enhance instrumentation and IWM interest at the field level.

AWC is easily graphed from downloaded soil moisture data. (Figure 12)

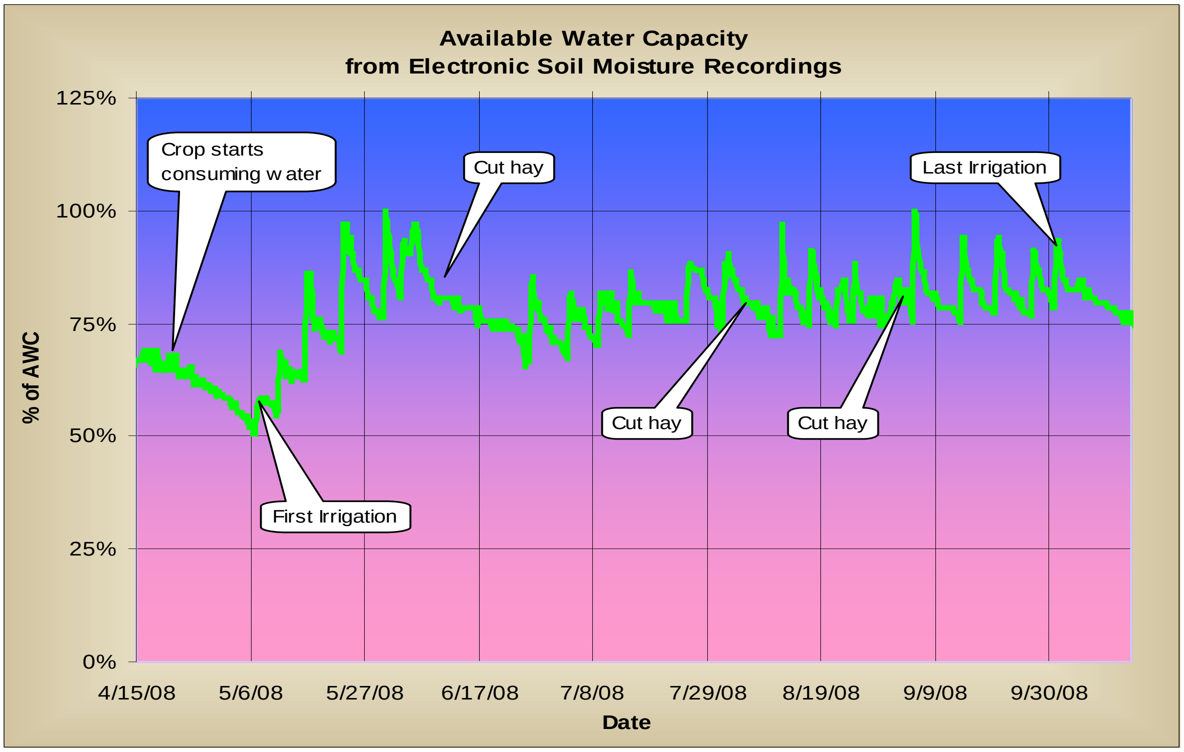


Figure 12. AWC estimated from downloaded soil moisture data

Equipment Spot Checks and Evaluations

Catch-can Testing

In FY2011, no catch-can tests were ran, due to limitations described in the FY2005 M&E report. As reported in the FY2005 M&E Report, the most useful aspects of catch-can testing on wheel lines were observations made before the test was ran. With sprinkler systems running, an assessment of leaks and malfunctioning heads can be made very quickly, often without leaving the vehicle.

Operating Sprinkler Condition Inventory

From FY2006 to FY2008 two hundred and thirty-nine systems were visually evaluated, of which 218 were operating wheel-line, hand-line, or pod systems.

The sprinklers in PSR are relatively new, compared to other salinity areas. No operational or maintenance trends were identified that would significantly increase deep percolation.

Study results were detailed in the FY2008 M&E Report.

Wildlife Habitat and Wetlands

Background

The Final Environmental Impact Statement (EIS) for the Price/San Rafael Rivers Unit was completed in December, 1993. The EIS discusses, at length, anticipated impacts that 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 its programs; however, the primary goal of the CRBSCP - 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, ponds in sandstone members of the Mancos Shale Formation, and many other alternatives were discussed in the EIS.

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 this framework plan, 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 in funding for technical assistance, wildlife habitat monitoring efforts were reduced in 1997 and discontinued in 1999. Two employees, a biologist and a civil engineer, were hired in September 2002 as the 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 constraints 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 Basin Salinity Control Program to the current date.

In FY2005 it was determined by the M&E Team 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 wetland 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 also 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 changed 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 staff is needed to assist in gathering data needed to create accurate land cover maps to achieve the most accurate and reliable result possible.

At the end of FY2011 no additional workforce had been acquired to assist the M&E team in data gathering. Photo points will be established and displayed when relevant information can be extrapolated from photos. Case studies are on-going and will be reported in future versions of this document.

Basin Wide Wildlife Habitat Monitoring

Permanent photo points, at representative locations throughout the area, of wetlands, wildlife habitat, agricultural areas, and areas where pipelines have recently been built, have been selected and a protocol established to compare across the years. The initial years will be baseline data as there will be no comparison photos. Photographs will be taken near the same date annually, and compared.

Wildlife Habitat Contract Monitoring

In the PSR Salinity Unit there were five wildlife habitat replacement projects planned and funded in FY2011 totaling 220 acres (Table 8). There were 764 applied wildlife habitat replacement acres from prior year contracts also in Table 8.

Cumulative acres of practices planned and applied are tabulated in Table 9.

Planned practices are assumed to be applied in proportion to funds expended.

Tables 10 and 11 provide more insight as to the amount of money spent on the ground for wildlife habitat replacement using EQIP, BSPP, and WHIP funding.

Table 8. Wildlife Practices Planned and Applied in FY2011

Acres of Wildlife Habitat Creation or Enhancement by FY2011 Annual practices				
Program	Acres Planned		Acres Applied	
	Wetland*	Upland	Wetland*	Upland
BSPP	-	-	-	-
EQIP	-	220	-	34
WHIP	-	-	446	284
Total	**-**	**220**	**446**	**318**

***Wetland acres include riparian habitat**

Table 9. Cumulative Wildlife Practices Applied in FY2011

Acres of Wildlife Habitat Creation or Enhancement by FY2011 Cumulative practices				
Program	Acres Planned		Acres Applied	
	Wetland*	Upland	Wetland*	Upland
BSPP	-	425	-	6
EQIP	613	568	607	255
WHIP	1,685	987	446	284
Total	**2,298**	**1,979**	**1,053**	**457**

***Wetland acres include riparian habitat**

When is a contract completed? As stated above in the Hydro-salinity portion of this document, the cooperator may receive several partial payments in the course of construction. They may complete construction, commence operation, be reimbursed for 99% of FA and still have two years of Upland Wildlife Habitat Management left in the contract before it is officially completed. For this document, all practices in contracts are assumed to be applied in proportion to dollars paid out, on a contract by contract basis.

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 Conservation District meetings throughout the Salinity Area. The Utah NRCS Homepage (http://www.ut.nrcs.usda.gov/) also has information and deadlines relating to Farm Bill programs.

Table 10. EQIP, BSPP, and WHIP Habitat Planned

FY	Contracts	Obligation	Wetland	Upland	PPI Factor	Normalized
	Number	$	Acres	Acres		2011$
1997	2	$7,644		15	175%	$13,409
1998	1	$1,139		2	180%	$2,050
1999	1	$502		1	180%	$904
2000	1	$2,862		13	173%	$4,937
2001	1	$962		1	168%	$1,619
2002	5	$89,298		310	167%	$149,070
2003	9			82	162%	
2004	1			1	156%	
2005	5	$122,700	607	36	145%	$177,615
2006	3	$24,927		112	140%	$34,864
2007	5	$1,278,201	1,691	1,087	131%	$1,674,595
2008					117%	
2009	3	$36,710		100	113%	$41,524
2010	5	$125,051		220	108%	$135,525
2011					100%	
Totals	42	$1,689,996	2,298	1,979		$2,236,112

Table 11. EQIP, BSPP, and WHIP Habitat Applied

FY	Payments	Wetland	Upland	PPI Factor	Normalized
	$	Acres	Acres		2011$
1997	$0	0	0	175%	$0
1998	$0	0	0	180%	$0
1999	$0	0	0	180%	$0
2000	$1,111	0	2	173%	$1,916
2001	$23	0	0	168%	$38
2002	$1,768	0	2	167%	$2,952
2003	$0	0	0	162%	$0
2004	$835	0	1	156%	$1,300
2005	$8	0	0	145%	$11
2006	$0	0	0	140%	$0
2007	$113,212	293	100	131%	$148,321
2008	$6,557	0	46	117%	$7,668
2009	$68,777	314	20	113%	$77,796
2010	$10,537	0	55	108%	$11,420
2011	$388,289	446	318	100%	$388,289
Totals	$591,117	1,053	545		$639,712

Economics

Cooperator Economics

Production Information

While alfalfa yields have not improved markedly since inception of salinity control measures, total production of alfalfa is trending up. (Figure 13)

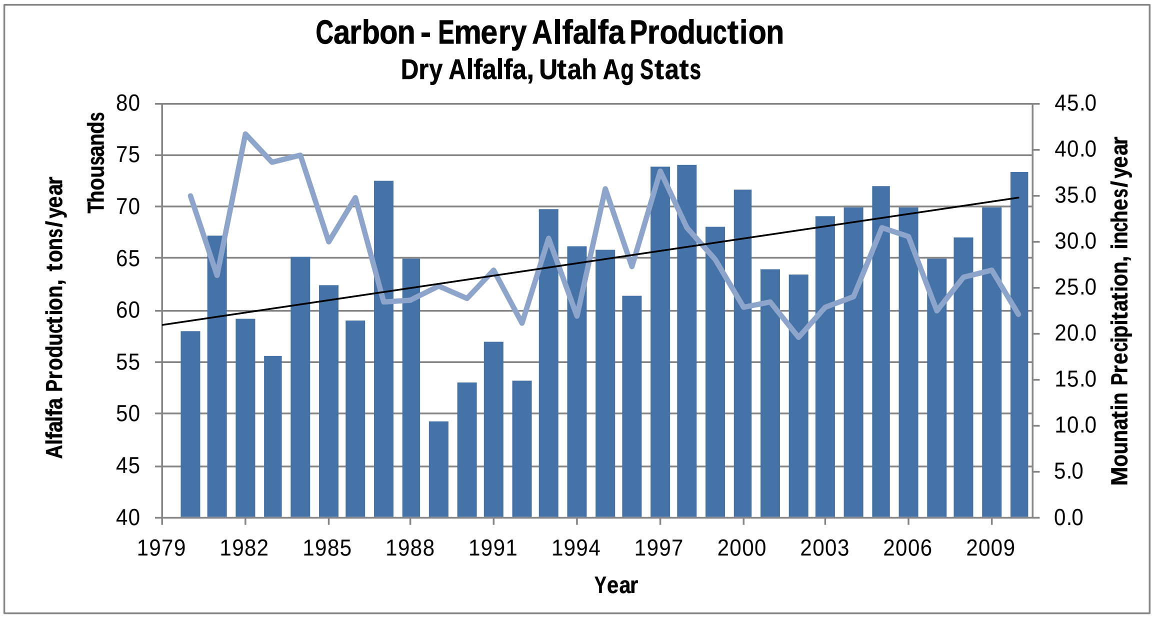


Figure 13. PSR alfalfa production and mountain rainfall

Labor Information

From National Agricultural Statistics Service (NASS) data, labor benefits are elusive as both *Hired Farm Labor* and *Total Farm Production Expenses* have increased steadily over the 1987, 1992, 1997, 2002, and 2007 Agricultural Censuses.

While numerical data seems negative, anecdotal information is positive.

According to the 2007 Census of Agriculture, 66% of farmers have full-time occupations other than farming. Only 27% of farm owners hire any outside help. Since the majority of farmers do not hire outside labor, it is assumed that most cooperators are satisfied with their own personal labor savings. The local labor market in PSR is fairly steady due to demand for energy.

Public Economics

Ninety-five percent of survey respondents believe that salinity control programs have a positive economic affect on the area and region.

Positive public perceptions of the Salinity Control Program include:

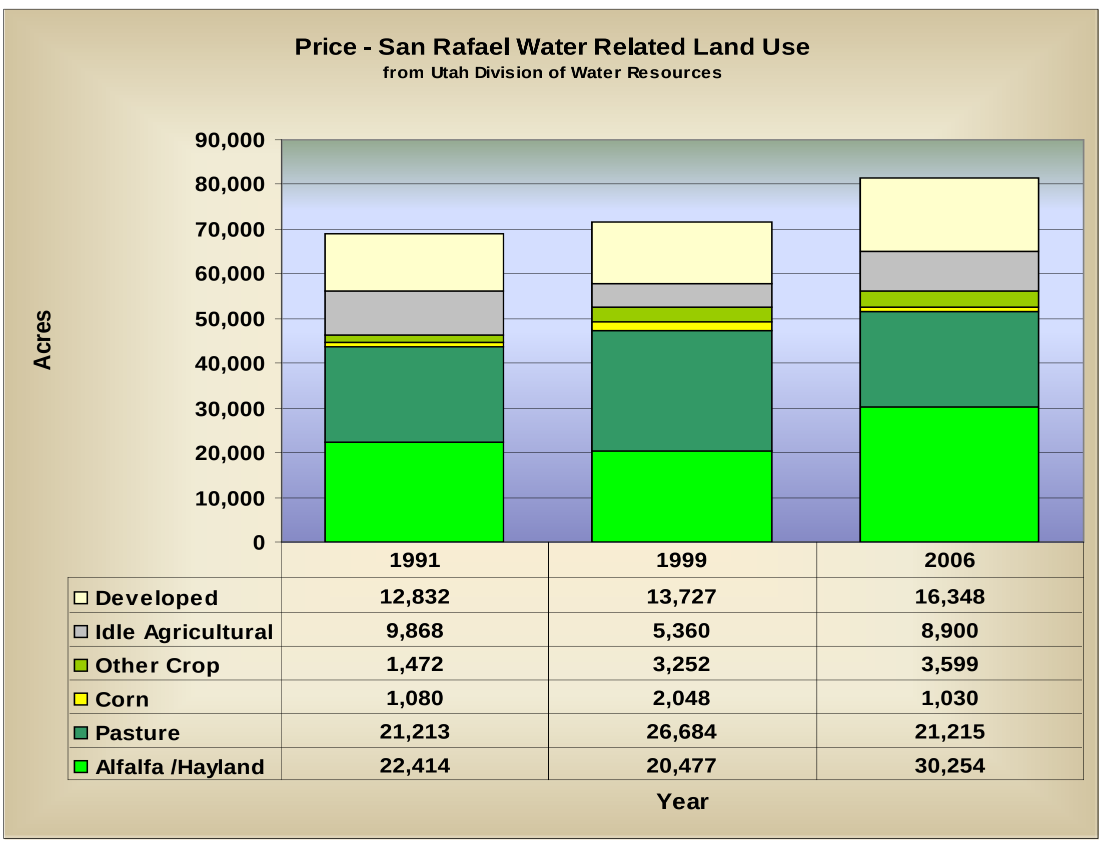
- Reduced salinity in the Colorado River
- Increased flows in streams and rivers
- Economic lift to the entire community from employment and broadened tax base
- Local availability of expertise, information, and materials for public conservation
- Aesthetically pleasing, green fields, denser, for longer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

Negative public perceptions of the Salinity Control Program include:

- "Greening" of desert landscape
- Conversion of artificial wetlands to upland habitat and other shifts in wildlife habitat
- Changes in Water Related Land Use (WRLU)

Water Related Land Use (WRLU)

The State of Utah Division of Water Resources tracks land use on a regular basis. (Figure 14) The goal of the WRLU report is to account for all agricultural lands in the State along with immediately adjacent water related land uses.



	1991	1999	2006
Developed	12,832	13,727	16,348
Idle Agricultural	9,868	5,360	8,900
Other Crop	1,472	3,252	3,599
Corn	1,080	2,048	1,030
Pasture	21,213	26,684	21,215
Alfalfa /Hayland	22,414	20,477	30,254

Figure 14. Water Related Land Use

Summary

Local land owners seem willing and able to participate in salinity control programs although the future economic environment is uncertain. The effect of current economic conditions on future participation remains to be seen.

Past participants are apparently satisfied with results and generally positive about salinity control programs.

Colorado River Basin Salinity Control Programs are successful and cost effective in reducing salt load in the Colorado River.

Glossary and Acronyms

Average salt pickup – The increase in the amount of salt carried by a stream as it flows as a result of inflows containing increased salt from dissolution of the soil. Usually expressed as tons/acre-foot.

Annual average salt load – The average estimated annual salt load carried by a stream, based on a period of record of several years. Usually expressed as tons/year.

Application efficiency – The portion of the irrigation water delivered to the field that is stored in the soil to be consumed by the crop, expressed as a percentage of the total delivery volume.

Applied Practices – Functioning practices for which Federal cost share dollars have been expended.

BSPP – Basin States Parallel Program

Bureau of Reclamation (Reclamation) – A branch of the U.S. Department of Interior charged with water interests in the United States. Reclamation is the lead agency for salinity control in the Colorado River.

Catch can testing – a procedure whereby dozens of containers are spread out under a sprinkler system in an array, to determine how much water is being applied to different areas under the sprinkler to evaluate uniformity.

cfs – Cubic feet per second or second-feet.

Cover Map – a map categorizing land use based on surface cover, e.g. urban, crop type, wetlands, etc.

Crop Consumptive Use (CU) – The amount of water required by the crop for optimal production. CU is dependant on many factors including altitude, temperature, wind, humidity, and solar radiation. In general use, CU and ET are synonymous.

CRBSCP – Colorado River Basin Salinity Control Program. The overall federal effort to control salinity in the Colorado River.

CRSCP – Colorado River Salinity Control Program. A specific USDA/SCS funding program which ran from 1987 to 1997.

Daubenmire cover class frame – An instrument used to quantify vegetation cover and species frequency occurrences within a sampling transect or plot.

Deep Percolation – The amount of irrigation water that percolates below the root zone of the crop, usually expressed in acre-feet.

Dissolved salt or Total Dissolved Solids (TDS) – The amount of cations and anions in a sample of water, usually expressed in milligrams/liter or parts per million, but often expressed in Tons/Acre-foot for salinity control programs.

Distribution Uniformity (DU) – A measure of how evenly the irrigation water is applied to the field. If DU is poor, more water is needed to assure that the entire crop has an adequate supply.

EQIP – Environmental Quality Improvement Program

Evapotranspiration (ET) - The amount of water used by the crop. ET is generally synonymous with CU and is frequently mathematically modeled from weather station data.

Financial Assistance (FA) – The Federal cost share of conservation practices. FA is normally 60% of total federal cost of conservation practices.

Gated Pipe – Water delivery pipe with individual, evenly spaced gates to spread water evenly across the top of a field.

Hand line – An irrigation system composed of separate joints of aluminum pipe, each with one sprinkler, designed to irrigate for a period of time and be moved to the next parallel strip of land.

Improved Flood – Increasing the efficiency of flood irrigation systems with control and measurement structures, corrugations, land-leveling, gated pipe, etc.

Irrigation Water Management (IWM) – Using practices and procedures to maximize water use efficiency by applying the right amount of water at the right place at the right time.

Leakage – Water loss from ditches and canals through fissures, cracks or other channels through the soil, either known or unknown.

National Agricultural Statistics Service (NASS) - A branch of the U.S. Department of Agriculture (USDA) charged with collecting, analyzing, and disseminating agricultural data.

Natural Resource Conservation Service (NRCS) A branch of the U.S. Department of Agriculture (USDA) charged with providing technical assistance to agricultural interests and programs.

Periodic Move – A sprinkler system designed to irrigate in one position for a set amount of time, then be periodically moved to a new position by hand or on wheels repeatedly until the field is covered.

Pivot or Center Pivot – A sprinkler system that uses moving towers to rotate a sprinkler lateral about a pivot point.

Planned Practices – Practices for which Federal cost share dollars have been obligated by contract.

Ranking – A process by which applications for federal funds are prioritized based on their effectiveness in achieving Federal goals.

Return Flow – The fraction of deep percolation that is not consumed by plants, animals, or evaporation and returns to the river system, carrying salt.

Salts – Any chemical compound that is dissolved from the soil and carried to the river system by water. Salt concentration is frequently expressed as "Total Dissolved Solids" measured in parts per million (ppm) or milligrams per liter (mg/l). For salinity control work, it is often converted to Tons per acre-foot of water.

Salt load – The amount of dissolved salt carried by a flowing stream.

Salt Pickup – The difference in salt load measured above and below an irrigated treatment area.

Seepage – Fairly uniform percolation of water into the soil from ditches and canals.

Salt Load Reduction – A measure of the annual tons of salt prevented from entering the waters of the Colorado River. As applied to agriculture, salt load reduction is achieved by reducing seepage and deep percolation from over-irrigating.

Soil Conservation Service (SCS) – The predecessor agency to NRCS.

Technical Assistance (TA) – The cost of technical assistance provided by Federal Agencies to design, monitor, and evaluate practice installation and operation, and to train and consult with cooperators. TA is generally assumed to be 40% of the total federal cost of conservation practices.

Uniformity – A mathematical expression representing how evenly water is applied to a plot of ground by a sprinkler system. The two most common measures used by NRCS are Christiansen Coefficient of Uniformity (CCU) and Distribution Uniformity (DU).

Utah Division of Wildlife Resources (UDWR or DWR) – The State of Utah's agency for managing wildlife resources.

Wheel line, Wheeline, Sideroll, Periodic Move – A sprinkler system designed to be moved periodically by rolling the sprinkler lateral on large wheels.

WHIP – Wildlife Habitat Incentives Program, a Farm bill program instituted in 1997, designed to create, restore, and enhance wildlife habitat.

Water Budget – An accounting for the amount of water entering (irrigation and precipitation) and the amount of water leaving (evaporation, CU, deep percolation) a given plot of land to determine efficiency and estimate deep percolation.

Yield (or Crop Yield) – The amount of a given crop harvested from an acre of ground. Yield is usually expressed as Tons/Acre or Bushels/Acre, depending on the crop.

References

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