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USDA SALINITY CONTROL  
AND  
ENVIRONMENTAL ASSESSMENT  
VIRGIN VALLEY SUBEVALUATION UNIT  
Of The Virgin River Unit  
Colorado River Basin Salinity Control Program

Prepared by

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Salinity Control Act, Public Law 93-320

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# CONTENTS

	Page
FOREWORD.....	i
SUMMARY.....	iii
INTRODUCTION.....	1
Authority for Investigation.....	1
Objective and Scope.....	2
Public Involvement Process.....	4
SETTING.....	7
Location.....	7
Natural Environmental Characteristics.....	10
Physiography and Geology.....	10
Climate.....	14
Water Resource.....	14
Surface Water.....	15
Ground Water.....	16
Water Use.....	16
Water Budget.....	16
Water Quality.....	18
Salt Budget.....	18
Irrigation Systems and Practices.....	23
Littlefield.....	23
Mesquite.....	28
Bunkerville.....	29
Rivrrside.....	30
Irrigation Methods in Virgin Valley.....	31
Land Resource.....	31
Soil Survey and Land Classification.....	31
Erosion and Sediment.....	35
Biotic Resources.....	36
Fisheries.....	36
Wildlife.....	37
Vegetation.....	37
Recreation Resources.....	38
Social and Economic Characteristics.....	39
Population.....	39
Cultural, Social and Economic Factors.....	39
Employment.....	40
Historic and Archeologic.....	41
PROBLEMS AND NEEDS.....	42
Problems and Needs Associated With Salt Loading.....	42
Sources of Salts.....	43
Amounts of Salts.....	49
Control Potential.....	49
Onfarm.....	49
Off-Farm.....	51
Problems and Needs Associated with Erosion and Sedimentation.....	52
Treatment Opportunities for Erosion Problems.....	54
Problems and Needs Associated with Water Resource.....	55

ALTERNATIVE PLANS.....	57
Future Without Salinity Program.....	62
Alternative 1.....	64
Alternative 2.....	67
Comparative Analysis for Plans.....	69
RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM.....	74
Public Recommendations.....	74
Basis for Selection of Recommended Plan.....	74
Additional Research and Demonstration Needs.....	75
Effects of Recommended Plan.....	76
Implementation Program.....	77
BIBLIOGRAPHY.....	81
APPENDICES	
Appendix A - Environmental Evaluation - Inventory Worksheets.....	A-1
Appendix B - Best Management Practices.....	B-1
Appendix C - Biotic Communities and Major Wildlife Resources.....	C-1
FIGURES	
Figure 1. Location Map.....	iv
Figure 2. Land Ownership.....	8
Figure 3. Program Area Map.....	9
Figure 4. Geologic Section.....	12
Figure 5. Geologic Map.....	13
Figure 6. Water Quality Measuring Stations.....	22
Figure 7. Irrigated Land, Littlefield Area, Arizona.....	24
Figure 8. Irrigated Land, Mesquite Area, Arizona-Nevada.....	25
<del>Figure 9. Irrigated Land, Bunkerville.....</del>	<del>26</del>
Figure 10. Irrigated Land, Riverside, Nevada.....	27
Figure 11. Soils Map.....	34
Figure 12. Salt Sources.....	44
Figure 13-A Agriculture Land With Saline Soils, Littlefield Area.....	45
Figure 13-B Agricultural Land With Saline Soils, Mesquite Area.....	46
Figure 13-C Agricultural Lands With Saline Soils, Bunkerville Area.....	47
Figure 13-D Agricultural Lands with Saline Soils, Riverside Area.....	48
Figure 14. Erosion Areas.....	53
TABLES	
Table 1. Annual Level of Funding for 10-Year Installation Period, Alternative 2.....	vii
Table 2. Summary of Costs, Benefits and Physical Effects of Alternative Plans.....	ix
Table 3. Summary Ratings, Environmental Evaluation.....	x
Table 4. Water and Salt Budgets, Present Conditions.....	17
Table 5. Chemical Composition, Virgin River Surface Waters.....	20
Table 6. Chemical Composition, Ground Water at WPRS Proposed Barrier Site.....	20
Table 7. Chemical Composition, Ground Water.....	21
Table 8. Onfarm Irrigation Water Management Analysis (IRMA).....	58
Table 9. Water and Salt Budgets for Alternative Plans.....	59
Table 10. Economic Development Account, Alternative 2.....	70
Table 11. Environmental Quality Account, Alternative 2.....	71
Table 12. Other Social Effects Account, Alternative 2.....	73
Table 13. Implementation Program - Salinity Control Practices.....	80



## INTRODUCTION

### Authority for Investigation

The Colorado River Basin Salinity Control Act (Public Law 93-320) signed June 24, 1974 authorized USDA to participate in salinity control investigations along with the U. S. Department of Interior (USDI) and the Environmental Protection Agency (EPA) in the states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. Title II (Section 203) of the act directs the Secretary of the Interior to cooperate with the Secretary of Agriculture in carrying out research and demonstration projects, and in implementing on-the-farm improvements and management practices and programs to further the objectives of the salinity control program upstream from Imperial Dam on the Colorado River.

Section 203, under Title II defines USDA responsibilities on specified irrigation and diffuse source control units along with other areas that may warrant study, including the Virgin River Basin of the Colorado River.

In this report, USDA presents alternative plans for reducing salt loading through improvement of onfarm irrigation efficiency and a plan for implementing the improvements.

1 The Memorandum of Understanding between USDI and USDA dated November 27,  
2 1974 (as extended October 26, 1979), was by authority of the Interdepartmental  
3 Work Service Act of March 4, 1915, (38 Stat. 1084), as amended; the Economy  
4 Act of June 30, 1932, (31 U.S.C. Sec. 686); and the Colorado River Basin  
5 Salinity Control Act of June 24, 1974, (88 Stat. 266). A Memorandum of Agree-  
6 ment, effective March 27, 1975 (as supplemented August 23, 1979) was entered  
7 into between the Water and Power Resources Service (WPRS) (formerly the U.S.  
8 Bureau of Reclamation) and the Soil Conservation Service (SCS) to implement  
9 the specific cooperative activities called for under Title II of the Colorado  
10 River Basin Salinity Control Act. Soil Conservation Service planning activitie  
11 are authorized under Section 6 of PL-83-566 with added authority under PL-93-32  
12 Section 203(a)(1) and (b)(1).

13

14 Objective and Scope

15

16 The objectives of the USDA's salinity control studies in the Virgin River  
17 Unit of the Colorado River Basin are:

18

- 19 1. To determine the contribution of salt and sediment loading from irrigated  
20 land and related private upland watershed areas.
- 21
- 22 2. To determine the opportunity for reducing salt loading (1) by reducing  
23 seepage and deep percolation losses through improving off-farm distribution  
24 systems and onfarm irrigation efficiencies and (2) by controlling erosion  
25 and reducing sediment delivery from irrigated and nonirrigated croplands  
and contributing private watershed areas.

1 This study corresponds to the primary objective of salinity control as  
2 set forth in the Colorado River Basin Salinity Control Act (Public Law 93-320)  
3 and is coordinated with studies of other federal, state and local agencies in  
4 the area.

5  
6 Salinity control contributes to the water quality improvement aspects of  
7 the Environmental Quality (EQ) objective as described in the Principles and  
8 Standards for Planning Water Resources, published by the U.S. Water Resources  
9 Council. The Act also recognizes the contribution that will be made to the  
10 Economic Development (ED) objective. By reducing salt loading the value of  
11 the Nation's output of goods and services will be increased. Components of  
12 the EQ and ED objectives in this study are:

13  
14 Environmental Quality (EQ) - Improve water quality by reducing the  
15 sediment and salt load to the Colorado River and enhance fish and wild-  
16 life resources.

17  
18 Economic Development (ED) - Increase the efficiency of agricultural  
19 production by improved irrigation efficiency and reduced downstream  
20 salinity damages.

21  
22 The significant effects of the alternative plans are displayed in  
23 three accounts. These include Economic Development, Environmental Quality,  
24 and Social Well-Being. See the Alternative Plans section of this report  
25 for tables displaying the effects of planned alternatives.

1 The objective of the planning effort is to formulate an acceptable imple-  
2 mentation plan of action to accomplish the program objectives. The primary  
3 focus of the plan is to reduce salt discharges to Colorado River by controlling  
4 salinity and erosion from irrigated and other private lands.

5

6 The results of this USDA study have been coordinated with WPRS planning  
7 on LaVerkin Springs and the Lower Virgin River Units through the Interagency  
8 Salinity Control Advisory Committee.

9

#### 10 Public Involvement Process

11

12 The Local Interagency Salinity Control Committee provided a forum for  
13 discussion of study findings and proposals, coordinated study activities  
14 and directed the public information program. This committee was organized  
15 on July 10, 1979 in Las Vegas. Prior to organization of the committee,  
16 public meetings were held to obtain local input. Meetings were held with  
17 WPRS's Interagency Planning Team for their Lower Virgin River Unit Salinity  
18 Study.

19

20 Following is a list of agencies participating on the Local Interagency  
21 Salinity Control Committee:

22

23

24

25



1	U.S. Department of Agriculture	Mohave County, Arizona
2	Agricultural Stabilization and Conservation Service	Littlefield-Hurricane Valley Natural Resources Conservation District
3	Forest Service	
4	Science and Education Administration-Agricultural Research	Mohave County Board of Supervisors
	Soil Conservation Service	
5	U.S. Environmental Protection Agency	Clark County, Nevada
6	U.S. Department of the Interior	Comprehensive Planning Conservation District Public Works Department
7	Bureau of Land Management	
8	Fish and Wildlife Service	Town Boards - Clark County, Nevada
	Geological Survey	
	Water and Power Resources Service	Bunkerville Mesquite
9	State of Arizona <sup>1/</sup>	
10	State of Nevada	Town Board - Mohave County, Arizona
11		Littlefield
	Department of Wildlife	
12	Division of Colorado River Resources	Irrigation Companies, Littlefield,
	Division of Water Resources	
13	Cooperative Extension Service	Eastside Irrigation Company
	Desert Research Institute	Westside Irrigation Company
14	Division of Environmental Protection	
15	State Of Utah <sup>1/</sup>	Irrigation Companies, Nevada
16		Bunkerville Irrigation Company
		Mesquite Irrigation Company
17		Riverside Irrigation Group
18		
19	<sup>1/</sup> Participation by requested review of this draft report.	
20		
21		
22		
23		
24		
25		

1 An interagency team was organized to conduct an environmental evaluation  
2 of the study area, and meetings were limited to participants having direct  
3 data contributions to specific study tasks. Participants included repre-  
4 sentatives of agencies listed on the Local Interagency Salinity Control  
5 Committee.

6  
7 The Soil Conservation Service requested in a letter dated March 29, 1979,  
8 from the USDI, Fish and Wildlife Service, initiation of formal Section 7  
9 consultation as required by PL 95-632, the Endangered Species Act, and  
10 Amendments of 1978, for the Virgin River Unit of the Colorado River Basin  
11 Salinity Control Study. The Fish and Wildlife Service in correspondence  
12 dated May 11, 1979 provided a list of the proposed and listed endangered  
13 and threatened species that may be present in the area. Informal consultation  
14 was directed to the Fish and Wildlife Service's Sacramento, California area  
15 office. Subsequently all correspondence for this study was directed to  
16 that office. In an April 1981 telephone inquiry to the Sacramento, California  
17 Area Office further correspondence was directed to the USDI, Fish and Wildlife'  
18 Ecological Service Office in Boise, Idaho.

19  
20 Members of the Nevada State Coordinating Committee for the Rural Clean  
21 Water Program have been informed of this proposed salinity control program  
22 for Virgin Valley.

1 FOREWORD

2  
3 Virgin Valley Subevaluation Unit, a portion of Virgin River Unit, drains  
4 to Lake Mead on the Colorado River. See the map on the inside of the front  
5 cover. Virgin Valley Subevaluation Unit was identified as a problem area  
6 where irrigation and erosion are diffuse sources of salinity. During the  
7 study, alternative solutions were identified and estimates were made of effects  
8 of the plans on reducing salt loading to Colorado River.

9  
10 An interdisciplinary team carried out the study and prepared the report.  
11 The "USDA Study Plan for the Virgin River Unit", revised August 1978, and the  
12 Soil Conservation Service (SCS) publication "Guide for Environmental Assess-  
13 ment", March 1977 along with SCS environmental policy and 7 CFR-650 were  
14 references. Information relating to evaluations for compliance with the  
15 National Environmental Policy Act of 1969 is in the appendices.

16  
17 Contributions from other Federal and State of Nevada agencies are acknow-  
18 ledged. Nevada Department of Wildlife information was used for biological  
19 assessment. The United States Department of Interior (USDI), Water and Power  
20 Resources Service (WPRS) and Geological Survey (USGS) published reports,  
21 provided stream gage data and other information. Other input included the  
22 Clark County Conservation District's onfarm irrigation inventories and area-  
23 wide water management planning reports prepared for Clark County, Nevada.

24

25

1 The USDA Science and Education Administration-Agricultural Research (SEA-AR)  
2 Salinity Laboratory, Riverside, California, outlined study needs, provided  
3 consultative assistance and analyzed water quality samples. Their assistance  
4 in interpreting laboratory test results and reviewing results of the study was  
5 most helpful.

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SUMMARY

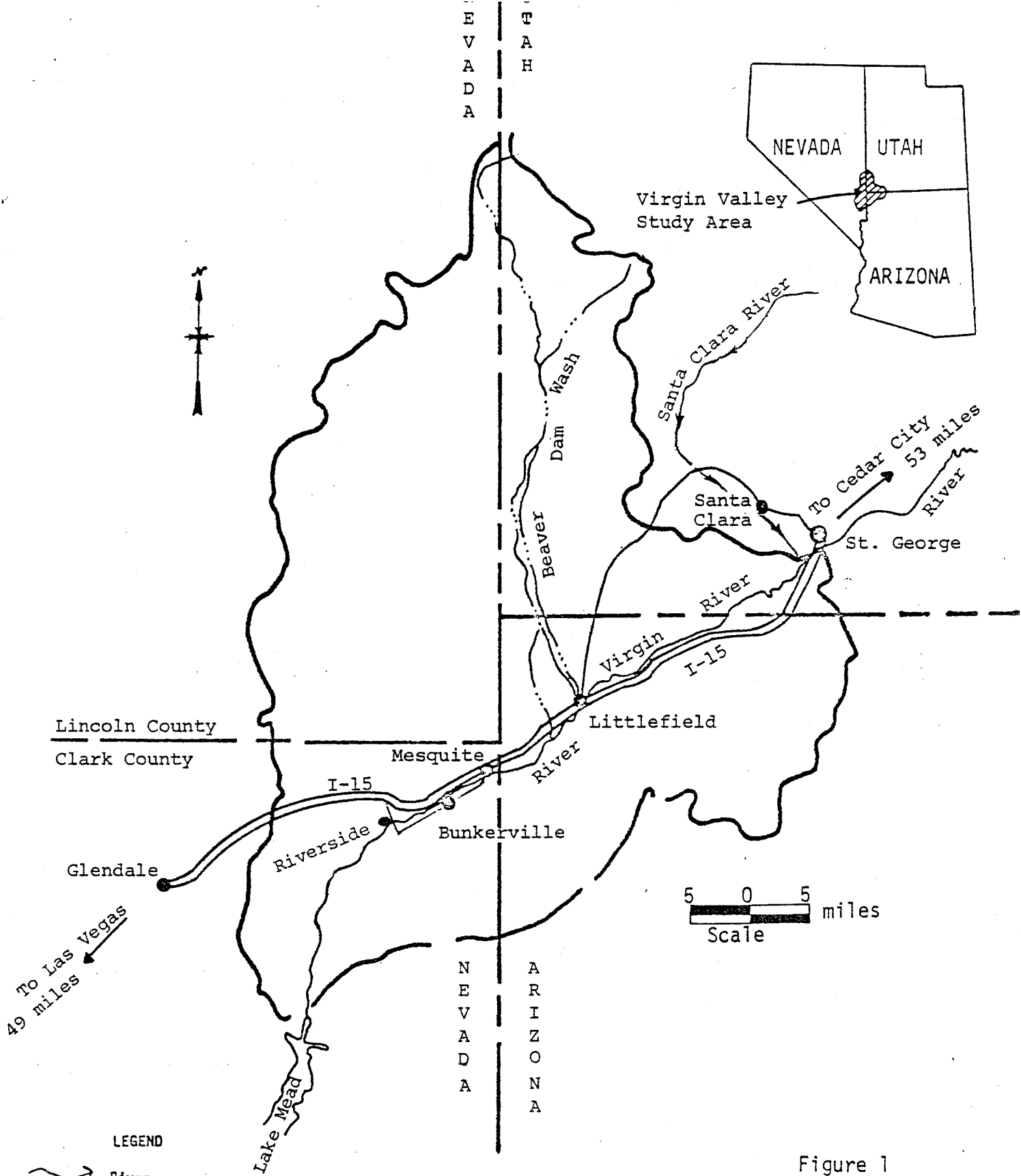
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Virgin Valley Subevaluation Unit, Nevada, is the second part of a USDA study of the Virgin River Unit in Arizona, Nevada and Utah. See Figure 1. The USDA study identified alternative solutions for reducing salt loading of Colorado River from irrigation and other diffuse salt sources.

Virgin River flows through Virgin Valley into Lake Mead on the Colorado River. Upstream from Littlefield, Arizona, the river flows through a narrows. Above the narrows is the St. George agricultural area in Utah. This area is being studied and reported on separately.

The total irrigated acreage in Virgin Valley is 4,625 with 3,526 acres irrigated by surface methods and 1,099 acres by sprinkler and drip systems. The surface irrigated acreage and the agricultural communities in the study area are Littlefield, Arizona, 438 acres; Mesquite, Nevada, 1,820 acres; Bunkerville, Nevada, 874 acres; and Riverside, Nevada 394 acres. The area being irrigated with sprinkler and drip systems does not significantly contribute to the salinity of Virgin River and irrigation improvements for this portion were not evaluated.

The existing condition and three alternative levels of salt reduction were analyzed: Future Without Program, Alternative 1, and Alternative 2. The benefits and costs associated with the alternatives are summarized in Table 2, page ix.




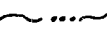

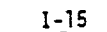
- LEGEND
-  River
  -  Intermittent Stream
  -  Hydrologic Boundary
  -  I-15 Interstate Highway

Figure 1

LOCATION MAP

Virgin Valley Subevaluation Unit  
 Arizona, Nevada, Utah  
 of the Virgin River Unit

Colorado River Basin Salinity Control Program

USDA-SCS

1 Virgin River contributes an average of 426,000 tons of salt and nearly  
2 six million tons of sediment to Lake Mead each year. An annual reduction of  
3 37,200 tons of salt could be accomplished in this subevaluation unit by:  
4 (1) improving the irrigation delivery system to reduce canal seepage (6,800  
5 tons); (2) improving water management by increasing the average onfarm  
6 irrigation efficiency from 44 to 62 percent (30,300 tons) and (3) a minor  
7 reduction of erosion by irrigation management (100 tons). These components  
8 are shown in Alternative 2, the Recommended Plan.

9  
10 Implementation of the Recommended Plan (Alternative 2) would require  
11 semiautomated onfarm irrigation systems with a construction cost of \$1,937,000.  
12 The present annual operation and maintenance cost would increase from \$5,000  
13 to <sup>A. B. 1970</sup> ~~\$35,300~~ because of labor, additional maintenance and replacement costs  
14 needed for the automated systems. These increased costs would be offset by  
15 increased efficiency of crop production.

16  
17 The existing canal and lateral distribution systems in Virgin Valley  
18 need improvement to reduce excessive seepage. Total installation costs of  
19 the off-farm distribution systems is estimated to total \$733,000. Presently,  
20 about \$10,000 is spent annually for operation and maintenance. Operation,  
21 maintenance and replacement costs of the recommended off-farm distribution  
22 system improvements would increase to \$23,400 annually.

23

24

25

1 Installation cost for Alternative 2 including \$430,000 for technical  
2 assistance totals \$3,100,000. Total program cost including operation, main-  
3 tenance and replacement costs and followup technical assistance added is  
4 estimated to be \$479,800 annually over a 25-year evaluation period.

5  
6 Downstream and onfarm annual benefits increase during installation and  
7 total \$2,172,200 following installation. Downstream annual benefits are  
8 \$2,052,400 based on a reduction of 3.97 milligrams per liter in salt concen-  
9 tration in the Colorado River at Imperial Dam near Yuma, Arizona. Annual  
10 onfarm benefits accruing from Alternative 2 are \$119,800. This includes  
11 labor savings of \$50,000. Total program benefits are \$3,234,200 annually  
12 (2,172,200 for a 25-year period and \$1,062,000 during the 10-year installation  
13 period).

14  
15 Implementation of Alternative 2 could require at least a 75 percent  
16 federal cost-share assistance to assure adequate farmer participation. Land  
17 users would furnish the remaining cost plus annual operation, maintenance,  
18 and replacement costs. See Table 1. Existing local indebtedness may require  
19 a higher level of cost-share assistance for the canal system improvements in  
20 Virgin Valley. Proper water management as well as improved systems are  
21 necessary to achieve the salinity control objectives.



1 TABLE 1. ANNUAL LEVEL OF FUNDING FOR 10-YEAR INSTALLATION PERIOD,  
 2 ALTERNATIVE 2, VIRGIN VALLEY SUBEVALUATION UNIT, ARIZONA, NEVADA

Annual Federal Funding			Annual Other Funding			Annual
Construction <sup>1/</sup>	Technical Assistance	Total	Construction	OM&R	Total	Total
\$	\$	\$	\$	\$	\$	\$
200,300	43,000	243,300	66,700	7,500	74,200	317,500

3  
4  
5  
6  
7  
8 <sup>1/</sup> 1980 Prices - Based on 75 percent federal cost-sharing assistance. No Utah  
 9 irrigated lands in this subevaluation unit.

10 Table 2 provides a summary of costs, benefits and physical effects, while  
 11 Table 3 is a summary of composite environmental ratings for alternative  
 12 resource uses. Environmental evaluation inventory worksheets are in Appendix A.  
 13 The environmental evaluation results in Table 3 show no adverse composite  
 14 effects to pertinent resource uses studied which result from the proposed  
 15 salinity control measures. Slight overall improvement in some resource con-  
 16 ditions will occur with implementation of the recommended plan. Better quality  
 17 water will enter Lake Mead.

18  
 19 Physical land treatment of rangeland in Virgin Valley could not be justified  
 20 for salinity control and is not included in this plan. There is no forest land  
 21 in this study area. Unique cultural, historical, archeological, or natural  
 22 resources will not be adversely disturbed by the installation of proposed  
 23 measures. About 10 acres of palustine wetland habitat adjacent to the unlined  
 24 field ditches and delivery canals will be converted to upland wildlife habitat.  
 25 This represents about 0.1 percent of the total wetland area in the Subevaluation  
 Unit.

1 Monitoring and evaluation of irrigation water management and related  
2 resources affected by the planned improvements will be initiated or expanded  
3 to assess impacts of proposed salinity control measures upon salt contributions  
4 to the Virgin River.

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TABLE 2. SUMMARY OF COSTS, BENEFITS AND PHYSICAL EFFECTS OF ALTERNATIVE PLANS  
VIRGIN VALLEY SUBEVALUATION UNIT, ARIZONA, NEVADA, UTAH

Item	Unit	Future Without	ALTERNATIVES	
			1/	2/
<b>COST (ONE-TIME):</b>				
Onfarm Construction	\$1,000	200.0	466.0	1,937.0
<u>Delivery System Construction</u>	<u>\$1,000</u>	<u>100.0</u>	<u>44.4</u>	<u>733.0</u>
Total Construction	\$1,000	300.0	510.4	2,670.0
Technical Assistance (10 Yrs)	\$1,000	90.0	182.6	430.0
Total Installation	\$1,000	390.0	693.0	3,100.0
<b>ANNUAL COST<sup>3/</sup></b>				
Installation <sup>4/</sup>	\$1,000	34.6	61.5	275.0
Operation, Maintenance and Replacement (OM&R)	\$1,000	15.0	18.0	53.4
Interest During Construction <sup>5/</sup>	\$1,000	31.4	33.8	137.9
<u>Followup Technical Assistance (25 Yrs)</u>	<u>\$1,000</u>	<u>13.5</u>	<u>13.5</u>	<u>13.5</u>
Total	\$1,000	94.5	126.8	479.8
<b>ANNUAL BENEFITS:</b>				
Salinity Reduction (Downstream) <sup>6/</sup>	\$1,000	1.4	861.9	2,052.4
<u>Increased Efficiency of Crop Production</u>	<u>\$1,000</u>	<u>14.6</u>	<u>184.5</u>	<u>119.8</u>
Subtotal	\$1,000	16.0	1,046.4	2,172.2
<u>Benefits During Installation (10 Yrs)</u>	<u>\$1,000</u>	<u>7.8</u>	<u>511.6</u>	<u>1,062.0</u>
Total	\$1,000	23.7	1,558.0	3,234.2
ANNUAL NET BENEFITS:	\$1,000	-70.8	1,431.2	2,754.4
<b>PHYSICAL EFFECTS</b>				
Salt Load Reduction	tons/yr	-200	15,100	37,000
Salt Concentration Reduction <sup>6/</sup>	mg/l	0.003	1.67	3.97
Net Annual Increase of Water in River System	ac-ft	200	800	800
Wetland Habitat Lost	ac-value	8	16	40
Upland Habitat Gained	ac-value	8	16	40
Onfarm Increase in Fossil Fuel Requirement (Average Annual	gal/yr	30	480	710

1/ Alternative 1 - Use existing canal and lateral systems with minor repairs, improve onfarm irrigation systems.

2/ Alternative 2 - improve canal, pipeline and lateral system and onfarm irrigation systems. Minimum deep percolation and high irrigation efficiency.

3/ Compound interest at seven and three-eighths percent on expenditures (equal amounts) during the ten year installation period.

4/ July 1980 price base, 25-year life and interest at seven and three-eighths percent.

5/ Includes O&M, interest on O&M, and interest on the construction cost incurred during the installation period.

6/ Colorado River at Imperial Dam, near Yuma, Arizona.

TABLE 3. SUMMARY RATINGS<sup>1/</sup>  
 ENVIRONMENTAL EVALUATION  
 VIRGIN VALLEY SUBEVALUATION UNIT  
 ARIZONA, NEVADA, UTAH

	Present Conditions	Future Conditions		
		Planning Alternatives		
		Future Without	1	2
Crop and Pasture Land Production	3	3	3	3
Fish Habitat	3	3	3	3
Irrigation Water	3	3	3	3
Low Flow	2	2	2	2
Recreation	3	3	3	3
Wildlife Habitat	3	3	3	3
Economic	3	3	3	4
Visual Quality of Landscape	3	3	3	3
Social	3	3	3	3
Unique, Cultural, Historical, and Natural	3	3	3	3
Composite Rating	3	3	3	3

<sup>1/</sup> The rating scale is from 1 to 5: 1, unsuited; 2, poor; 3, fair or neutral; 4, good; and 5, excellent.

Note: For detailed environmental evaluation data, see Appendix A.