LOWER COLORADO REGION

COMPREHENSIVE FRAMEWORK STUDY

OF

WATER AND LAND RESOURCES

FEBRUARY 1971

QUESTIONS and ANSWERS

Prepared by

Lower Colorado River Region State — Federal Interagency Group

for the

Pacific Southwest Interagency Committee

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Q. What is the purpose of the Lower Colorado Region Framework Study?

A. The basic objective of the framework study is to provide a broad guide to the best use, or combination of uses, of water and related land resources to meet foreseeable short- and long-term needs. To develop the program, data were collected and summarized from all known sources and the needs of the Region were projected until the year 2020. Intermediate objectives were also developed for the years 1980 and 2000.

Q. Under what authority is the study being carried out and who has overall responsibility?

A. The authority for the study comes from the Water Resources Planning Act of July 22, 1965 (P.L. 89-80), which established the Water Resources Council and charged the council with the responsibility for continuing assessments of national water and related land resources and the associated Federal policies and programs.

Q. Who are the members of the Water Resources Council, and to whom are they responsible?

A. The members of the Council are:

Secretary of the Interior, Chairman
Secretary of Agriculture
Secretary of the Army
Secretary of Health, Education, and Welfare
Secretary of Transportation
Chairman of the Federal Power Commission
Secretary of Commerce (Associate Member)
Secretary of Housing and Urban Development (Associate Member)
Director, Office of Management and Budget (Observer)

The council reports directly to the President, but is, of course, ultimately responsible to all of the people of the United States.

Q. Who participated in the study?

A. In the Lower Colorado Region, the study was carried out by work groups made up of resource experts from Federal, state, other public agencies, and semipublic organizations. The groups--each devoted to a special field of study--worked under the direction of the Staff of the Lower Colorado Region State-Federal Interagency Group which, in turn, was responsible to the Pacific Southwest Inter-Agency Committee and the Water Resources Council.

Q. Since the wise use of our water and related land resources is a national problem, as well as a state and regional problem, why is the study confined to the Lower Colorado River Basin within the Pacific Southwest?

A. The Lower Colorado Region Study is one of 17 such studies within the contiguous United States. In the southwestern United States, for example, there are three other regional studies in progress under the direction of the Pacific Southwest Inter-Agency Committee--the Upper Colorado, Great Basin, and California Regions. Together these efforts will provide an interlocking framework study of the water and related land resources of the segment of the Nation reaching from the Continental Divide to the Pacific Ocean, and extending from the Mexican border north to Oregon, Idaho, and Wyoming. This larger framework will in turn mesh with similar studies which cover the entire United States.

Q. Why was this study undertaken?

A. In order to meet the rapidly expanding demands for water throughout the Nation, the Water Resources Planning Act states: "That it is the policy of Congress to encourage the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal Government, states, localities, and private enterprise with the cooperation of those concerned." The Lower Colorado Region probably comes closer than any other region in the Nation in utilizing its last drop of available water and at the same time has one of the fastest rates of growth. To assure that people will have sufficient water, food, shelter, and recreation opportunities, it is essential that a plan for proper management of these resources be developed.

Q. What area does the Lower Colorado Region Study include?

A. The Lower Colorado Region Study includes slightly more than 141,000 square miles. This includes, generally, most of Arizona and western New Mexico; the southwest corner of Utah; and southern Nevada.

Q. Who will use the results of the study?

A. 1. The Water Resources Council--in the National Assessment of Water and Related Land Resources of the United States.

2. All public agencies, Federal, state, and local,dealing with resource planning.

3. Semipublic and private organizations supplying goods and resources to the people and those using the resources.

Q. How will the states in the Lower Colorado Region use the information gathered in this study?

A. The state and local agencies responsible for water resource and land-use planning will have information upon which they can identify problems and plan for meeting future needs. The framework plan should help local agencies to make better planning decisions and reduce duplication of effort. The plans of the state and local agencies will usually be more detailed than the framework plan; however, the local plans should be campatible with the overall framework plan.

Q. Is the report available to the public?

A. Yes. Copies of the report have been provided to universities, colleges, and public libraries, where it can be reviewed by anyone wishing to do so.

Q. What resource problems are covered in the overall study?

A. In the Lower Colorado Region Study specific subjects are covered in detail, each reported in a separate appendix. They are:

Economic Base and Projections
Irrigation and Drainage
Mineral Resources
Water Quality, Pollution Control, and Health Factors
Land Resources and Use
Fish and Wildlife
Watershed Management
Legal and Institutional Environment
Water Resources
Electric Power
Flood Control
Recreation
Municipal and Industrial Water

Q. How are the studies of specific subjects combined to provide an overall comprehensive framework plan?

A. Appendix XVIII, General Program and Alternatives, incorporates the findings of the 13 functional appendixes (as listed in the previous question and answer) in developing a comprehensive framework plan for the Region. The Main Report presents the study findings in a more condensed form.

Q. Many agencies and organizations, through long-range planning, have made projections of needs for years. Were these plans considered in the study?

A. Yes. All work group representatives of agencies with short- and long-range plans considered and reflected this work in their

contribution to the work groups but within the framework of national projections.

Q. What is the population of the Region and what growth is expected?

A. The population in 1965 was 1,877,000. The expected populations are as follows:

1980 - 2,911,000
2000 - 4,797,000
2020 - 6,983,000

Q. How fast is the Region's economy expanding as indicated by the study?

A. It is expanding at a very rapid rate. For example, the total personal income of the Region is expected to increase from 4.3 billion dollars in 1965 to nearly 86 billion dollars in the year 2020--about 20 times. Ths compares to an increase in the national personal income of nearly 12 times.

Note: The Region is well supplied with virtually all resources to meet this growth--except water.

Q. What is the single, major constraint to growth and development in the Lower Colorado Region?

A. Insufficient water supply.

Q. What is the expected increase in water use?

A. By the year 2020, the total regional water withdrawal requirements are expected to increase about 30 percent above the 1965 amounts.

Q. What is the difference between water withdrawal requirement and water depletion requirement?

A. Withdrawal requirement is the amount of water needed to operate a delivery and use system while depletion requirement is the amount actually consumed by the uses and is no longer available. The difference in volume is mostly returned to a supply source.

Q. Who uses the water and what do the projections of water requirements indicate?

A. Though irrigated agriculture is the major water user in the Region, the future increases in water requirements are expected to be largely related to population growth. By year 2020, it is expected that the need for municipal and industrial water would increase by about 6 times, recreation water uses by 6 times, fish and wildlife water uses by nearly 3 times, cooling water for thermal electric power plants by

75 times, and mining uses by about 3.5 times. Though there is an increase expected in irrigated acreage, improvements in water conveyance systems and increased farm irrigation efficiency is expected to result in a small reduction in water requirements for this use.

Q. Does the study consider the possibilities of importing water to the Southwest from other regions of the United States?

A. The study concludes that there is not enough water obtainable within the Lower Colorado Region to meet all of the projected needs until the year 2020. However, the study does not attempt to determine where the source of supplemental water should be. Legislative constraints and the guidelines for framework studies preclude consideration of transfers of water from outside the Pacfic Southwest Area. For this reason, the only importation source considered was desalting of ocean water.

Q. Will this study result in recommendations for changing our water and land laws?

A. The results of the study may indicate a need to change certain existing laws to serve some specific purposes, but the authority to make any such changes rests with local, state, and Federal governments.

Q. Does the study consider flood plain and agricultural land zoning?

A. Yes. Flood plain information studies should be accelerated and joint action should be taken by Federal, state, and local agencies to establish and implement appropriate flood plain management programs to prevent unwise use of flood plain land. Land zoning is recognized as one way to assist in getting the job done. However, zoning, formation of laws, and changes in laws must be implemented by the people through established processes.

Q. Does the study provide for authorization of any new projects?

A. No. The purpose of the study is to inventory resources and forecast demands that will be made upon those resources. It also suggests possible alternatives for meeting these demands and a possible general plan to meet future needs in phased steps. With this information, planners in the future charged with investigating resource problems and planning projects to solve them can work within the overall framework of regional requirements provided by this study. However, the study does recommend acceleration of the construction of certain presently authorized projects.

Q. In identifying future needs and suggesting alternative solutions, does the study also identify the costs of the solution?

A. Yes. General cost estimates for broad components of the framework plan are based primarily on experience.

Q. Is there enough land in the Region to satisfy the demands for various uses by the people?

A. Yes, generally. However, widespread adoption of the principle of multiple use of land will be necessary. That is, some land will need to be used for more than one purpose or even several purposes.

Q. What is the flood control program?

A. This program consists of both structural and management measures. The structures include flood detention reservoirs, channels, etc. Management reduces damages by watershed treatment measures, by regulations that limit the type and intensity of development, and through a flood forecasting program.

Q. What results could be expected of the flood control program?

A. Considering only projects installed to the year 1965, without further prevention measures, damage from floods is projected to increase to over 300 million dollars by the year 2020. The framework program would prevent about 80 percent of the damages from occurring.

Q. Will the present level of programs and activities concerning land treatment and management be sufficient to control the erosion, sediment, and runoff as well as provide needed food and fiber?

A. No. The annual rate of expenditure for the installation cost of the suggested land treatment and management program indicates that the going program in 1965 would not be adequate to meet the projected needs. Therefore, the framework program recommends that increased funding be provided.

Q. Does the proposed framework program include an increase in irrigated land in the Lower Colorado Region?

A. Yes. It is expected that nearly 300,000 acres of additional irrigated land will be developed by year 2020. Of this 60 percent is expected to occur on Indian reservations to improve the social and economic status of the Indians. In addition, it will be necessary to develop about 200,000 acres to compensate for the urban encroachment into presently irrigated farmland.

Q. How much of the land suitable for irrigation is expected to be irrigated by year 2020?

A. Only about 4.5 percent. There are 36 million acres in the Region suitable for irrigation. It is expected that only about 1.6 million acres would be developed for irrigation by year 2020. The remaining land constitutes a resource reserve that could be utilized if national needs dictated.

Q. Are increases in yield and improved varieties for farm crops considered in the program?

A. Yes. The increased acreage of irrigated land alone is not considered adequate to meet the projected demands for food and feed crops. Modern technology of farm management and plant research indicate that the yields of most crops will be increased significantly in the future.

Q. Does the study consider preservation needs and values?

A. Among the important goals of the study were the identification of preservation needs. The potential for additional wilderness and wild, scenic, and recreation rivers, natural areas and the protection of rare and endangered species, open space, historic and archeological areas, was examined. Where appropriate, recommendations have been made for either protective action or more intensive studies. It was also assumed that environmental factors will be taken into account in all water and related land resource development programs.

Q. In what way was recreation considered in the study?

A. The study is a water and related land resource study with recreation needs being considered as a significant objective. Needs for additional land and water recreation resources and their development were identified along with the costs involved. These recreation requirements related primarily to water and related land, although other recreation needs (including urban) and preservation values were also considered.

Q. Were conflicts between development and preservation reconciled in the study?

A. A review of preservation considerations revealed a number of potential conflicts with development proposals. The study does not attempt to reconcile these conflicts, but highlights the problems involved and directs attention to the need for further study and resolution.

Q. Were new national parks or any other recreation areas of national significance proposed in the study?

A. Because of the broad scope of the study, no specific proposals regarding the creation of new recreation areas were possible. However, potential recreation areas have been identified in previous independent studies and the framework program recommends that these be carefully reviewed with respect to the merit of protection from other types of development.

Q. Were measures considered to make more efficent use of the Region's water resources?

A. The framework program includes expansion of water conservation and management practices, more intensive water reuse, vegetative management for increased water yields, and treatment of brackish water.

Q. Can future water needs be met from resources within the Region without further increases in the rate of depletion of ground-water reserves?

A. No. If irreparable damage to the Region's ground-water aquifers is to be avoided, water must be imported from outside the Region to meet future water needs. Without importation, it is estimated that the deficiency would reach 4.5 million acre-feet per year by 2020 which could be met only by increasing the rate of depletions of ground-water reserves.

Q. What are the major water quality problems in the Region?

A. High levels of dissolved salts in the surface and ground water is the major water quality problem. The salinity of the Colorado River is expected to increase as development continues in the upstream areas. An effective salinity control program in the Colorado River Basin should be given high priority.

Q. How much increase is projected for mineral production?

A. Projections in this study indicate that mineral production could advance as much as 190 to 300 percent by the year 2020.

Attached is a summary of the framework program for water and related land resources development in the Lower Colorado Region.

SUMMARY OF FINDINGS

The Lower Colorado Region includes most of Arizona, and parts of Nevada, New Mexico, and Utah comprising 4.8 percent of the contiguous United States. The Region is richly endowed with favorable climate, abundant land, mineral, and other resources and leads the Nation in population growth rate as well as in several other economic indices. The population is concentrated principally in central Arizona and the Las Vegas, Nevada areas. The remainder of the Region is sparsely settled and much is uninhabited.

Inventories and appraisals of resources and development of the Lower Colorado Region established a base year of 1965 from which all projections of future requirements were made. These regional projections, originally made by the Office of Business Economics and the Economic Research Service, were somewhat modified to more closely reflect regional trends.

Water Supply--Though land is abundant, the Region probably comes closer than most any other to utilizing the last drop of available water for man's needs. The Region's economy is sustained by utilizing ground-water reserves accumulated over thousands of years. In 1965, the depletion rate of these reserves reached 2.5 million acre-feet annually largely due to the lack of facilities for enabling the Region to utilize its unused share of Colorado River water. The Southern Nevada Water Project, presently under construction; the authorized Central Arizona Project; and the authorized Dixie Project in Utah must be completed at an early date in order for the Region to utilize the remainder of the available renewable water supplies. However, in the absence of an imported water supply, ground-water overdraft is expected to continue and the regional water deficiency is projected to reach 4.72 million acre-feet annually by year 2020. Water resource-oriented programs need to be accelerated in the future with respect to both planning and implementation if future requirements are to be satisfied on a timely schedule. The basic long-range objective is augmentation of the Region's water supplies in sufficient increments to meet future water requirements and reduce ground-water overdraft. It is recognized that a program of this magnitude will probably require time, in the order of 20 years, to implement. In the meantime, all possibilities for lessening the effects of the increasing water deficiencies must be explored.

The framework program includes expansion of water conservation and management practices, more intensive water reuse, vegetative management for increased water yields, and treatment of brackish water. Further studies are needed to evaluate the potential of untapped ground-water reserves in remote basins to provide an interim water supply.

Implementation of the long-range program requires early initiation of planning for importing water to the Region. Studies should be included for evaluating the relative merits of all potential means of importation. Implementation of a water import program should be accomplished by year 1990 to provide about 2.25 million acre-feet. This should be increased to 4.15 million acre-feet by year 2020. The initial stage of the importation program would include the national commitment 1/ to relieve the Colorado River Basin States of the Mexican Treaty burden totaling 1.8 million acre-feet including associated losses.

Table 1 provides a summary of the present and projected water requirements and supplies.

Water Quality

Maintenance of an acceptable level of water quality is vital to the economy, environment, and general well-being of the people of the Region. Presently deficient water supplies and the probable cost of future imported water dictate maximum water utilization, including recycling, with little or no allowance for transporting salts or waste loads from the Region. It is recommended that an effective basinwide salinity control program be implemented to prevent increased salinity of Colorado River water. The water quality program also includes waste treatment facilities for urban centers, treatment of water from saline sources, and major water reuse facilities. Augmentation of the Colorado River would have effects of major significance on improvement of the quality of this principal water source. Continuing studies of the Region's increasingly complex water quality problems are recommended.

Land Resources and Use

The land resource base of the Region appears to be sufficient in variety and amount to satisfy the projected land use requirements through the year 2020. Most land has more than one use. Land used for livestock grazing and timber production in 1965, also supported some other compatible uses such as wildlife, recreation, and watershed. Further pressure for urban, recreation, wilderness, transportation and utility uses will require a reduction in area available for livestock grazing and timber production. Water quantity and quality control measures will also demand more land. Most uses are expanding and there will need to be further adoption to the multiple-use principle to satisfy the requirements of all uses.

The following tabulation shows the major land use requirements for the period of study.

1/ 90th Congress, Public Law 90-537, An Act to Authorize . . . the Colorado River Basin Project. . . , September 1968.

Use	Requirements - 1,000 Acres 1965	1980	2000	2020
Cropland	1,816	1,891	1,905	1,852
Livestock Grazing	76,054	73,739	69,902	65,807
Timber Production	5,458	5,358	5,153	5,044
Urban and Industrial	513	863	1,230	1,564
Outdoor Recreation (Designated)	5,542	5,888	6,012	6,146
Wilderness Areas	861	1,458	3,158	3,458
Fish and Wildlife	1,858	3,546	7,175	15,020
Military	4,126	4,126	4,126	4,126
Transportation and Utilities	660	858	1,030	1,145
Watershed Management (for Water Production) 1/	114	364	634	1,414

1/ Watershed lands upon which treatment could increase water yields.

As shown in the following tabulation of land ownership and administration, about 52 percent of the total land in the Region is federally owned, 12 percent is in state and other public ownership, and 36 percent is private land. About one-half of the latter is in Indian reservations held in trust by the Federal Government.

	Acres (thousands)	Square Miles
Federal Lands		
Administered by Department of Agriculture	14,975	23.4
Administered by Department of the Interior	27,733	43.3
Administered by Department of Defense and Other	4,183	6.5
Subtotal Federal Lands	46,891	73.2
State-owned Lands	10,576	16.6
Other Public Lands	25	-
Subtotal Non-Federal Public Lands	10,601	16.6
Privately-owned Lands	16,084	25.1
Private-Indian Trust Lands	16,412	25.7
Subtotal Private Lands	32,496	50.8
TOTAL	89,988	140.6

Land Treatment and Management

Irreversible losses of the Region's land resources must be minimized to preserve a freedom to choice for future resource users. Esthetic and environmental factors were of primary consideration in development of the program. Ideally, the land treatment and management program should harmonize with all water and related land resource development programs required to satisfy present and projected demands within the Region. On an equivalent acreage basis, as of 1965, a total of nearly 7 million acres of cropland, forest land, rangeland, and urban and other lands had received adequate treatment. The program includes treatment of an additional 64 million acres by 2020. In most cases, the same acre will require treatment more than once during the study period because of development of improved methods, or the limited life of the measure or practice installed.

Flood Control

The Region is subject to severe and sudden floods, with some flood damage occurring every year. Almost all land suitable for general development is subject to some degree of flood damage, either from a defined stream or overland flow. The average annual flood damages in 1965 were estimated at $41 million. With no additional flood control measures after 1965, annual flood damages of $310 million are estimated by the year 2020. Implementation of the flood control program of structural and nonstructural measures would effect damage prevention so that remaining damages of only $68 million are estimated by the year 2020. For these remaining damages there appear to be no feasible solutions.

Irrigation and Drainage

Irrigated land is expected to increase from the 1965 level of 1,285,000 acres to nearly 1.6 million acres by year 2020. About 60 percent of the increased acreage is expected to occur on Indian reservations. Urbanization is expected to remove about 200,000 acres from production. The total new irrigation development would be about 500,000 acres. The program includes completion of the rehabilitation of existing water conveyance systems for nearly 430,000 acres of presently irrigated lands and new distribution systems to serve about 1 million acres, a portion of which is presently irrigated exclusively from ground water. Onfarm water management measures such as land leveling and water control structures are recommended to provide better control and more efficient use of irrigation water and/or to reduce costs of irrigation. New drainage facilities are included to serve nearly 200,000 acres.

Municipal and Industrial Water

The rapidly increasing population will require that water for municipal and industrial uses be increased from a 1965 level of

450,000 acre-feet to about 2.8 million acre-feet in year 2020. Presently authorized projects will supply 446,000 acre-feet of additional water by 2000. Major urban centers would satisfy their additional water requirements through the importation program and through treatment and recycling of waste water for some uses. Smaller communities would fulfill their increasing needs by a variety of means, including further surface- and ground-water development, desalting of brackish ground water, and by importation.

Mineral Resources

Adequate mineral resources are available to meet the expected increased production, $511 million in 1965 to $1.93 billion in year 2020 (1958 dollars). Water withdrawal requirements would increase from 105,000 to 360,000 acre-feet in this period while land requirements would increase from 75,000 acres to 223,000 acres. Environmental impacts of the prospecting, developing, mining, and processing of ores will need to be minimized, especially with respect to air and water pollution, ecology and esthetics. Water requirements of the mineral industry may be met by direct diversion of imported water; by upstream developments on the basis that downstream rights would be met by exchange for imported water; by increased recycling; or by continued ground-water development, where available.

Recreation

Recreation needs of the Region are projected to increase from 144 million recreation days in 1965 to 672 million recreation days in 2020. Under existing legal, institutional, financial, and physical constraints only about 30 percent of these needs can be met. To satisfy the remaining 70 percent of the needs will require elimination or modification of these constraints and a greater degree of Federal participation. The projected recreation needs also include fishing and hunting activities.

Water-based recreation needs will climb to 193 million recreation days annually by 2020. Maximum water augmentation, development, and use under the framework plan would supply a part of the water-based recreation needs.

An increase of about 300,000 acres of Non-Federal development will be needed by year 2020 to satisfy recreation needs.

Fish and Wildlife

The annual demand for fishing is projected to increase from a 1965 level of 4 million man-days to 26 million man-days in year 2020. Multipurpose developments expected to be constructed by 1980, including the Alamo, Dixie,

and Central Arizona Projects, have the potential to provide about 1.2 million man-days of fishing annually. Primary-purpose fishing developments expected by 1980 would provide 2.0 million man-days of fishing annually. In addition, the program includes the construction of primary-purpose developments by 2020 that would provide about 16.0 million man-days of fishing annually. The framework program's multipurpose projects proposed for development during the 1981 to 2020 period would create new fishing waters and provide 1 million man-days of fishing annually.

A vital concern in satisfying the wildlife-oriented recreational demand through the year 2020 is the preservation of the resource itself. The preservation of many important areas could be assured by the designation and management of about 12 million acres primarily for wildlife purposes. The program also includes construction of access roads to inaccessible areas and numerous watering facilities in the water-short areas. The demand for hunting is expected to increase from a 1965 level of 1.3 million man-days to 5.1 million man-days in 2020. The nonhunting wildlife-oriented activities such as photography or general observation are becoming of increasing importance.

Electric Power

Electric power requirements are expected to increase by 40-fold between 1965 and 2020. These requirements would need to be met partially by construction of power facilities within the Region and partially by imports from other areas, largely, the Upper Colorado Region. The regional water requirement for power production would increase from 10,000 acre-feet in 1965 to an estimated 750,000 acre-feet by year 2020. The increased water use would be supplied largely by imported water supplies.

Environmental Considerations

The comprehensive nature and interrelationship of environmental problems have recently become widely recognized. The Region's rapid population growth rate, its concentration in only a few locations, the fragile nature of the desert environment, and the extremely limited water supplies, require particular attention to the environmental impacts which may occur as the result of development necessary to insure the well-being of the people of the Region. Such considerations have been of paramount concern to planners in nearly every phase of the framework studies. Main items of concern include: preservation of cultural, scenic, and natural values; protection and mangement of land resources; safeguarding the quality of water supplies; maintenance of agricultural areas; enhancement of fisheries; the preservation of wildlife habitat; and prevention of air pollution.

Summary of Projected Demands and Framework Program

Table 1 summarizes the Region's water requirements and how they could be met. Table 2 summarizes the regional framework program for the development of water and related land resources needed to satisfy projected requirements.

Table 1
Summary of Water Requirements and Supply

	1965 Base 1/	1980	2000	2020
Water Requirements (1,000 A.F.)				
Withdrawals (1,000 A.F.)				
Reservoir Evaporation	230	286	328	359
Municipal and Industrial	450	863	1,703	2,778
Irrigation	8,903	9,244	8,338	8,260
Recreation	11	21	41	70
Fish and Wildlife	196	210	321	551
Electric Power Cooling	10	58	203	750
Mining	105	176	263	360
Total	9,905	10,858	11,197	13,128
Depletions (1,000 A.F.)				
Reservoir Evaporation	230	286	328	359
Municipal and Industrial	198	358	677	1,149
Irrigation	4,529	5,272	5,223	5,292
Recreation	4	7	14	24
Fish and Wildlife	110	122	215	406
Electric Power Cooling	10	58	203	750
Mining	52	88	134	184
Losses Associated with Recycling and Reuse	600	640	460	580
Total	5,733	6,831	7,254	8,744
Water Supply Without Augmentation (Unit: Million Acre-Feet)				
Colorado River Water Available for Use in Lower Colorado Region	2.63 2/	2.25	1.33	0.90
Local Water Supply	3.12	3.12	3.12	3.12
Total Supply Available for Use in the Lower Colorado Region 2/	5.75	5.37	4.45	4.02
Lower Colorado Region Depletion Requirements	5.73	6.83	7.25	8.74
Regional Water Deficiency	0 2/	1.46	2.80	4.72

Table 1 (Continued)
Summary of Water Requirements and Supply

	1965 Base 1/	1980	2000	2020
Water Supply With Augmentation (Unit: Million Acre-Feet)				
Colorado River Water Available for Use in Lower Colorado Region	2.63	2.25	1.33	0.90
National Obligation to Mexican Water Treaty 3/	--	--	1.80	1.80
Local Water Supply	3.12	3.12	3.12	3.12
Total Supply Available for Use in the Lower Colorado Region 4/	5.75	5.37	6.25	5.82
Lower Colorado Region Depletion Requirements	5.73	6.83	7.25	8.74
Regional Water Deficiency	0	1.46	1.00	2.92
Regional Augmentation 5/	0	0.05	0.59	2.55
Remaining Deficiency 6/	0	1.41	0.41	0.37

1/ 1965 base water requirement exceeded actual use due to water deficiencies in local areas.

2/ Lack of facilities prevented utilization of the Region's full share of Colorado River water resulting in a ground-water overdraft of about 2.5 million acre-feet. In the future to limit the water supply deficiency to that tabulated would require: distribution of the available supply to areas of shortage, total utilization of the resource including recycling, and that no allowance be made for transporting salts from the Region.

3/ Consists of 1.5 million acre-feet per annum for delivery to Mexico plus 0.3 million acre-feet associated losses. In accordance with Public Law 90-537, Section 202, "The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty from the Colorado River constitutes a national obligation which shall be the first obligation of any water augmentation project planned pursuant to Section 201 of this Act and authorized by Congress."

4/ Excluding ground-water overdraft.

5/ As recommended in the Lower Colorado Region framework program.

6/ It is not expected that ground-water overdraft would be entirely eliminated. There are many small, scattered communities, rural uses, and irrigation of land utilizing outlying ground-water basins that would likely continue a limited overdraft of ground-water reservoirs.

For assistance with additional questions or general information about the Lower Colorado Region Comprehensive Framework Study, write:

Chairman
Lower Colorado Region State-Federal Interagency Group
P. O. Box 427
Boulder City, Nevada 89005

Table 2
Framework Program for Development of Water and Related Land Resources
Lower Colorado Region

	UNITS	1966-1980 Amount	1966-1980 Cost (Million Dollars)	1981-2000 Amount	1981-2000 Cost (Million Dollars)	2001-2020 Amount	2001-2020 Cost (Million Dollars)
WATER RESOURCE PROGRAM (streamflow control and inplace use)							
1. Reservoir storage for withdrawal and inplace use	million acre-feet	3.71	46	1.32	132	0.28	30
2. Flood Control			356		331		240
(a) Reservoir and detention storage	million acre-feet	3.15	(228)	0.60	(98)	0.65	(147)
(b) Levees and channel improvement	miles	860	(110)	455	(205)	245	(56)
(c) Nonstructural measures		--	(18)	--	(28)	--	(37)
3. Augmentation of Regional Water Supply	million acre-feet per yr.		789		4,225		3,373
(a) Imports to the Region	million acre-feet per yr.	--	--	2.25	(3,600)	1.90	(3,000)
(b) Water salvage	million acre-feet per yr.	0.30	(42)	--	--	--	--
(c) Precipitation management 1/	million acre-feet per yr.	--	--	--	--	--	--
(d) Water yield improvement	million acre-feet per yr.	0.05	(18)	0.09	(33)	0.06	(35)
(e) Intraregional transfers	million acre-feet per yr.	1.67	(729)	3.00	(592)	1.08	(338)
4. Water Quality, Pollution Control, and Health Factors	million gallons per day		126		108		327
(a) Waste water treatment	million gallons per day	270	(91)	440	(102)	530	(165)
(b) Quality and pollution control	million gallons per day	268	(35)	320	(6)	510	(2)
(c) Drainage water treatment	million gallons per day	--	--	--	--	150	(160)
5. Single-purpose M&I Water Supply Development	million acre-feet per yr.	0.41	109	0.83	279	1.07	140
6. Hydroelectric Power (pumped storage)	million kilowatts	0.8	76	3.7	377	9.1	924
TOTALS, WATER RESOURCE PROGRAM COSTS			1,502		5,452		5,034
RELATED PROGRAMS							
1. Land Treatment and Management	thousand acres	18,658	162	27,306	315	17,010	170
(a) For water yield improvement(see item A.3.(d) above)	thousand acres	(295)	(--)	(600)	(--)	(450)	(--)
(b) For erosion, sediment, and runoff control	thousand acres	(18,363)	(162)	(26,706)	(315)	(16,560)	(170)
2. Irrigation and Drainage	thousand acres		248		277		162
(a) Land preparation, onfarm facilities	thousand acres	573	(56)	801	(78)	779	(76)
(b) New distribution systems	thousand acres	347	(108)	596	(184)	132	(41)
(c) Rehabilitation of existing distribution systems	thousand acres	429	(70)	--	--	--	--
(d) Drainage developments	thousand acres	68	(14)	32	(15)	88	(45)
3. Outdoor Recreation (water-based developments)	million recreation days	0	0	26	107	9	38
4. Fish and Wildlife	thousand man-days	4,022	51	7,014	114	11,794	208
5. Wild and Scenic Rivers 1/	miles	280	--	400	--	400	--
TOTALS, RELATED PROGRAM COSTS			461		813		578
OTHER ASSOCIATED PROGRAMS							
1. Land Treatment and Management	thousand acres	7,409	43	9,410	99	6,840	48
2. Outdoor Recreation (additional development and land acquisition)	million recreation days	51	194	93	338	106	275
3. Fish and Wildlife	thousand acres	331	1	3,629	1	7,845	1
4. Preservation of Cultural and Scenic Values 1/ Wilderness Areas	thousand acres	1,458	--	1,700	--	300	--
5. Other Electric Power	million kilowatts		739		5,700		17,800
(a) Thermal power	million kilowatts	1.9	(229)	22.8	(3,300)	77.8	(11,500)
(b) Transmission facilities	million kilowatts	--	(510)		(2,400)	--	(6,300)
TOTALS, OTHER ASSOCIATED PROGRAM COSTS			987		6,138		18,124

1/ Areas requiring further study to define required scope of development.