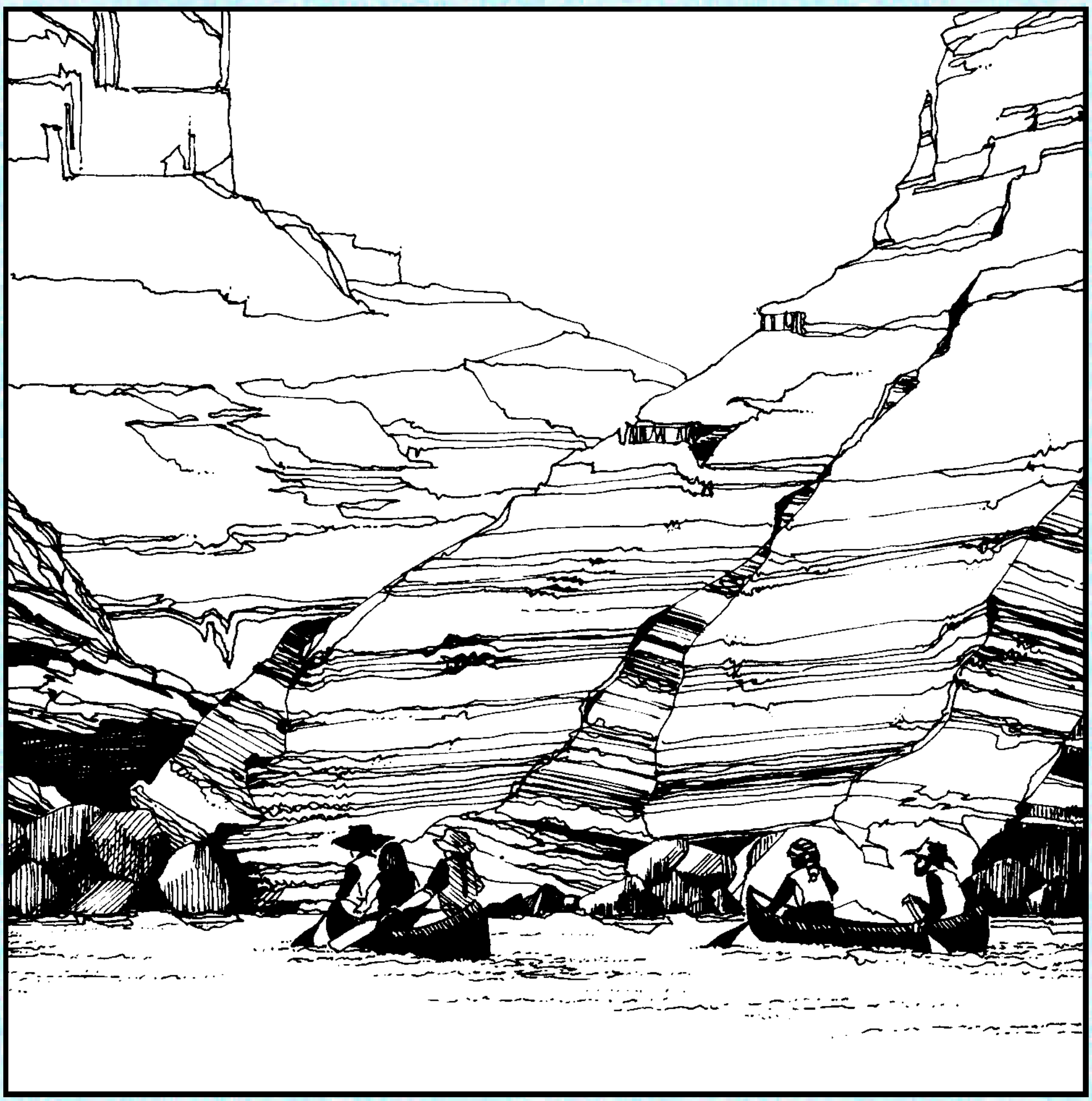
COLORADO RIVER SYSTEM CONSUMPTIVE USES AND LOSSES REPORT 1971-1975



COLORADO RIVER SYSTEM CONSUMPTIVE USES AND LOSSES REPORT

1971 - 1975

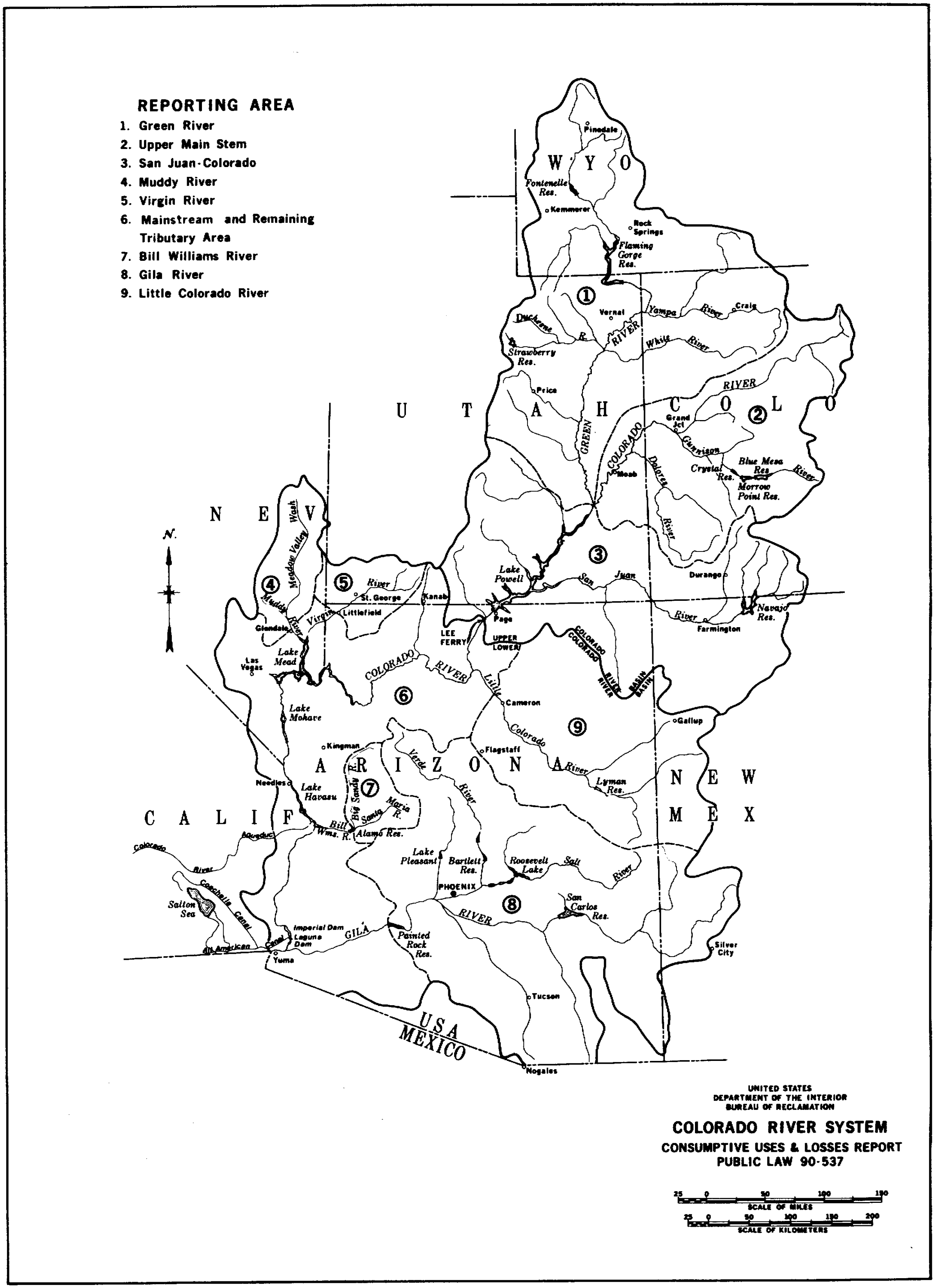
UNITED STATES DEPARTMENT OF THE INTERIOR
Cecil D. Andrus, *Secretary*
BUREAU OF RECLAMATION
R. Keith Higginson, *Commissioner*
UPPER COLORADO REGION
David L. Crandall, *Regional Director*
LOWER COLORADO REGION
Manuel Lopez, Jr., *Regional Director*

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

This report was prepared pursuant to the Colorado River Basin Project Act of 1968, Public Law 90-537. The act directs the Secretary of the Interior to "make reports as to the annual consumptive uses and losses of water from the Colorado River System after each successive five-year period, beginning with the five-year period starting on October 1, 1970. . . . Such reports shall be prepared in consultation with the States of the lower Basin individually and with the Upper Colorado River Commission and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River Compact."

This report reflects the Department of the Interior's best estimate of actual consumptive uses and losses within the Colorado River Basin. The reliability of the estimate is affected by the availability of data and the current capabilities of data evaluation.



REPORTING AREA
1. Green River
2. Upper Main Stem
3. San Juan-Colorado
4. Muddy River
5. Virgin River
6. Mainstream and Remaining Tributary Area
7. Bill Williams River
8. Gila River
9. Little Colorado River
W Y O
U T A H
C O L O
N E V
A R I Z O N A
N E W M E X
C A L I F
USA
MEXICO
Pinedale
Fontenelle Res.
Kemmerer
Rock Springs
Flaming Gorge Res.
Vernal
Yampa River
Craig
Duchesne R.
Strawberry Res.
White River
Price
GREEN RIVER
COLORADO RIVER
Grand Jct
Gunnison River
Blue Mesa Res
Crystal Res.
Morrow Point Res.
Moab
Dolores River
Lake Powell
San Juan River
Durango
Navajo Res.
Farmington
Page
LEE FERRY
UPPER
LOWER
COLORADO RIVER BASIN
Meadow Valley Wash
Muddy River
Glendale
Virgin River
St. George
Littlefield
Kanab
Las Vegas
Lake Mead
Lake Mohave
Little Colorado River
Cameron
Gallup
Flagstaff
Kingman
Verde River
Lyman Res.
Needles
Lake Havasu
Big Sandy R.
Santa Maria R.
Bill Wms. R.
Alamo Res.
Aqueduct
Colorado River
Coachella Canal
Salton Sea
All American Canal
Imperial Dam
Laguna Dam
Yuma
GILA RIVER
Painted Rock Res.
Lake Pleasant
Bartlett Res.
PHOENIX
Roosevelt Lake
Salt River
San Carlos Res.
Silver City
Tucson
Nogales
N.
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER SYSTEM
CONSUMPTIVE USES & LOSSES REPORT
PUBLIC LAW 90-537
SCALE OF MILES
SCALE OF KILOMETERS

SUMMARY

This report presents estimates of the consumptive uses and losses from the Colorado River system for each year from 1971 to 1975. It includes a breakdown of the beneficial consumptive use by major types of use (except mainstream reservoir evaporation), by major tributary streams, and, where possible, by individual States.

The main stem of the Colorado River rises in the Rocky Mountains of Colorado, flows southwesterly about 1,400 miles and terminates in the Gulf of California. Its drainage area of 242,000 square miles in this country represents one-fifteenth of the area of the United States. Water is used for irrigation, municipal and industrial purposes, electric power generation, mineral activities, livestock, fish and wildlife, and recreation. Large amounts are exported from the system to adjoining areas. The following table summarizes annual water use from the system by basins and States, including water use supplied by ground water overdraft. Distribution of water use by types of use from the various reporting areas is contained within the body of the report.

SUMMARY—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Water Use By States, Basins, and Tributaries [1]

(1,000 A.F.)

STATE AND BASIN OF USE	WATER YEAR 1971	1972	1973	1974	1975	Average 1971–75
Arizona	4756	5040	5128	5464	5514	5180
Upper Basin	(11)	(12)	(11)	(19)	(25)	(16)
Lower Basin Mainstream	(1181)	(1129)	(1068)	(1185)	(1208)	(1154)
Lower Basin Tributaries	(3564)	(3899)	(4049)	(4260)	(4281)	(4010)
California	5122	5328	5068	5475	4937	5186
Lower Basin	(5122)	(5328)	(5068)	(5475)	(4937)	(5186)
Colorado	1700	1775	1536	1855	1778	1729
Upper Basin	(1700)	(1775)	(1536)	(1855)	(1778)	(1729)
Nevada	131	148	154	160	154	149
Lower Basin Mainstream	(34)	(60)	(65)	(76)	(68)	(60)
Lower Basin Tributaries	(97)	(88)	(89)	(84)	(86)	(89)
New Mexico	213	218	357	237	322	270
Upper Basin	(180)	(183)	(320)	(200)	(290)	(235)
Lower Basin Tributaries	(33)	(35)	(37)	(37)	(32)	(35)
Utah	794	823	823	874	698	803
Upper Basin	(729)	(749)	(730)	(785)	(615)	(722)
Lower Basin Tributaries	(65)	(74)	(93)	(89)	(83)	(81)
Wyoming	334	304	304	364	291	319
Upper Basin	(334)	(304)	(304)	(364)	(291)	(319)
Other	1916	1919	2066	2175	2087	2033
Upper Basin Colorado River Storage Project Reservoir Evaporation	(458)	(477)	(502)	(596)	(607)	(528)
Lower Basin Mainstream Reservoir Evaporation and Channel Loss	(1458)	(1442)	(1564)	(1579)	(1480)	(1505)
Total—Colorado River System						
Upper Basin	2954	3023	2901	3223	2999	3021
Lower Basin Mainstream	6337	6517	6202	6736	6213	6400
Lower Basin Tributaries	3759	4096	4268	4470	4482	4215
Other—Reservoir Evaporation and Channel Loss	1916	1919	2066	2175	2087	2033
	14966	15555	15437	16604	15781	15669
Water Passing to Mexico	1561	1600	1594	1720	1656	1626
Treaty	(1501)	(1515)	(1444)	(1563)	(1429)	(1490)
Minutes 218, 241, and 242	(55)	(79)	(120)	(151)	(214)	(124)
Regulatory Waste	(5)	(6)	(30)	(6)	(13)	(12)
Total—Colorado River System and Water Passing to Mexico	16527	17155	17031	18324	17437	17295

[1] Onsite consumptive uses and losses; includes water uses satisfied by ground water overdraft.

CONTENTS

Foreword III
Summary V
General Location Map VI
Introduction 3
Authority 3
Plan of Study 3
Study Areas.. 5
Terminology 9
Methodology and Data Collection 10
Adequacy of Data.. 14
Beneficial Consumptive Uses and Losses 16

TABLES

Colorado River Sys tern

Table		Page
Summary-Colorado River System Consumptive Uses and Losses Report		vi
C-l	Drainage Areas of States and Major Tributary Systems	4
C-2	Water Use by States, Basins, and Types of Use, 1971	19
C-3	Water Use by States, Basins, and Types of Use, 1972	20
C-4	Water Use by States, Basins, and Types of Use, 1973	21
C-5	Water Use by States, Basins, and Types of Use, 1974	22
C-6	Water Use by States, Basins, and Types of Use, 1975	23

Upper Colorado River

UC-1	Main-stem Reservoir Evaporation, 1971-75	23
UC-2	Change in Contents-Major Reservoirs, 1971-75	24
UC-3	Water Uses in Tributary Areas by States, 197 1	25
U C 4	Water Uses in Tributary Areas by States, 1972	26
UC-5	Water Uses in Tributary Areas by States, 1973	27
UC-6	Water Uses in Tributary Areas by States, 1974	28
UC-7	Water Uses in Tributary Areas by States, 1975	29

Lower Colorado River

LC-1	Mainstream Reservoir Evaporation and Channel Loss, 1971-75	30
LC-2	Change in Contents-Major Reservoirs, 1971-75	30
LC-3	Mainstream Water Uses and Exports by States and Mexico, 1971-75	31
LC-4	Water Uses in Tributary Areas by States, 197 1	32
LC-5	Water Uses in Tributary Areas by States, 1972	33
LC-6	Water Uses in Tributary Areas by States, 1973	34
LC-7	Water Uses in Tributary Areas by States, 1974	35
LC-8	Water Uses in Tributary Areas by States, 1975	36
LC-9	Mainstream Channel Losses, Davis Dam to International Boundary, 1971-75	37

COLORADO RIVER SYSTEM
CONSUMPTIVE USES AND LOSSES REPORT
1971-1975

Introduction

The Colorado River system is composed of portions of seven States-Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. It has a drainage area of about 242,000 square miles and represents about one-fifteenth of the area of the United States. This report incorporates annual estimates of consumptive uses and losses of water from the system from 1971 to 1975. Wherever available, water use reports prepared in accordance with legal requirements concerning the operation of the Colorado River were utilized. Base data needed to estimate onsite consumptive uses were taken largely from existing reports and studies and from ongoing programs. Where current data were not available, estimated values were developed by various techniques and reasoned judgment. No new surveys or special studies were undertaken for this initial report. In general, methodology followed the techniques normally used within the system for estimating water use. Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994; 59 Stat. 1219), the decree entered by the Supreme Court of the United States in Arizona v. California, et al. (376 U.S. 340), the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a), the Colorado River Storage Project Act, (70 Stat. 105; 43 U.S.C. 620), or the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501).

Authority

The authority for this report is contained in Public Law 90-537, the Colorado River Basin Project Act of 1968. Title VI, section 601(b)(1) of the act reads as follows:

(b) The Secretary is directed to-

(1) Make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1970. Such reports shall include a detailed breakdown of the beneficial consumptive use of water on State-by-State basis. Specific figures on quantities consumptively used from the major tributary streams flowing into the Colorado River shall also be included on a State-by-State basis. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River Compact.

Plan of Study

After initial meetings with representatives of the Lower Basin States and the Upper Colorado River Commission, a proposed plan of study was presented for comment. Comments received largely concerned water accounting procedures, particularly the lack of uniformity. and consistency within the system. This issue is longstanding and is related to the interpretation and implementation of the legal documentary controlling the operation of the Colorado River. In November 1974, a preliminary report was prepared which included estimates of beneficial consumptive use. Comments received from the States were essentially the same as for the plan of study. In the Upper Basin, the principal comment concerned the use of 1965 data bases developed for the Upper Colorado Region Comprehensive Framework Study, particularly irrigated acreage. In the Lower Basin, the main concerns were the lack of credit for unmeasured return flows originating from mainstream diversions and the failure to quantitatively recognize that ground water overdraft in the River Basin satisfies a major portion of the beneficial consumptive use. To t,he degree possible, these concerns are addressed within this report.

UPPER COLORADO RIVER

The major tributary streams selected as reporting areas in the Upper Colorado River Basin are: Green River (Wyoming, Utah, Colorado); Upper Main Stem (Colorado, Utah), and San Juan-Colorado (Colorado, New Mexico, Utah, Arizona).

The outflow point and drainage area for each is shown in table C-I. The boundaries of the reporting areas are shown on the frontispiece map.

The largest consumptive use of water in the Upper Colorado River Basin results from the irrigation of about 1.5 million acres of pasture and harvested cropland. In the Upper Basin, there is little opportunity for measuring irrigation consumptive use directly by inflow-outflow methods. Therefore it was necessary to determine this use empirically. Specifically, irrigation consumptive use rates were computed from recorded climate data for each of the reporting years and applied against the best estimates of irrigation acreage. The modified Blaney-Criddle consumptive use equation was selected for use in the Upper Basin.

Irrigated acreage is the most important variable in the determination of irrigation consumptive use. Therefore, most of the data collection effort of this study was devoted to determining this item.

It was also necessary to compute reservoir evaporation losses empirically, by developing equations of net evaporation rates for each of the reporting years and applying these rates against the best estimates of reservoir surface area. For the Upper Basin portion of this study, evaporation losses are reported under the item of use most closely associated with the principal reservoir function.

Export of water out of the Colorado River system accounts for nearly one-quarter of the total uses and losses in the Upper Basin. For the purpose of this report, water exported across the basin divide was treated as an immediate loss to the river system. The values reported for the Upper Basin are composed of flows recorded at the diversion facilities and evaporation from reservoirs associated with export.

TABLE C-I-Colorado River System Consumptive Uses and losses, P.L. 90-537
Drainage Areas by States (and Mexico) and Major Tributary Streams

Units= 1,000 Square Miles

Major Tributary Streams and Their Selected Outflow Points	Wyoming	Colorado	Utah	New Mexico	Arizona	Nevada	California	Mexico	Total
Green River at Colorado River Confluence, Utah	17.1	10.6	17.0	—	—	—	—	—	44.8
Upper Main Stem at Green River Confluence, Utah	—	22.2	4.0	—	—	—	—	—	26.2
San Juan-Colorado at Lee Ferry, Arizona	—	5.8	16.2	9.7	6.9	—	—	—	38.6
Little Colorado River near Cameron, Arizona	—	—	—	5.3	21.2	—	—	—	26.5
Virgin River at Littlefield, Arizona	—	—	3.0	—	1.9	0.2	—	—	5.1
Muddy River near Glendale, Nevada	—	—	—	—	—	6.8	—	—	6.8
Bill Williams River below Alamo Dam, Arizona	—	—	—	—	4.7	—	—	—	4.7
Gila River below Painted Rock Dam, Arizona	—	—	—	5.6	44.2	—	—	(1.1)	49.8
Mainstream and Remaining Areas in Lower Basin	—	—	0.6	—	28.3	6.9	3.6	(0.1)	39.4
Colorado River System at Southerly International Boundary	17.1	38.6	40.9	20.6	107.2	13.9	3.6	(1.2)	241.9
Colorado River System above Lee Ferry	17.1	38.6	37.3	9.7	6.9	—	—	—	109.6
Colorado River System below Lee Ferry	—		3.6	10.9	100.3	13.9	3.6	(1.2)	132.3

For the determination of municipal and industrial uses, diversion and return flow records were obtained where readily available. However, because of the relatively small magnitude of these items in the Upper Basin, many of the reported values are estimated.

Throughout this study, considerable use was made of the techniques and data bases developed for the Upper Colorado Region Comprehensive Framework Study.

No attempt was made to deal with the question of channel losses and salvage. The values of consumptive use presented herein for the Upper Basin represent onsite uses and losses and are not necessarily equivalent to the corresponding depletion of flow at Lee Ferry, Arizona.

LOWER COLORADO RIVER

The consumptive use of water from the Colorado River mainstream and the New Mexico portion of the Gila River Basin was taken from annual reports prepared pursuant to articles V and VII of the decree of the Supreme Court of the United States in *Arizona v. California,* dated March 9, 1964. In response to the State's request for credit of unmeasured subsurface flows returning to the mainstream, a preliminary estimate has been made and credited arbitrarily to Arizona and California. A joint study is currently being conducted by the Geological Survey and the Bureau of Reclamation with the advice and guidance of the Task Force on Ground-Water Return Flows, which consists of State and Federal representatives, to determine the location and amounts of subsurface return flow. Until these studies are completed, any estimate of subsurface return flows must be considered preliminary and subject to revision. Surface water return flows through Las Vegas Wash from Lake Mead diversions were estimated and shown in the 1975 Article V accounting of mainstream use. Based on the same method, the 1971-74 return flows are included in this report. Other unmeasured return flows from Nevada diversions also occur but have not been accounted for herein.

In addition to the mainstream, six tributary areas were selected for the study: Little Colorado River, Arizona-New Mexico; Virgin River, Utah-Arizona; Muddy River, Nevada; Bill Williams River, Arizona; Gila River, Arizona-New Mexico; and remaining areas in Arizona, Nevada, and Utah.

Selected outflow points monitored by gaging stations and drainage areas are shown in table C-l. Within these selected areas, particularly in the Gila River Basin, numerous records of diversions are available; however, few return flows are recorded. For the most part, return flows are subsurface and not amenable to direct measurement. It is usually necessary to estimate consumptive use in these areas by empirical means. The land use, population, and production data from which estimates were made are from various current and past reports. This data base is believed to be generally adequate for the tributary areas of the Lower Colorado River system. Since much of this routinely published data follows political subdivision, considerable disaggregation of data is necessary to conform to the reporting areas selected. Certain types of water use, such as recreation, fish and wildlife, etc., are difficult to estimate because of a lack of current information and methodology.

Ground water overdrafts occur in Arizona and Nevada. For the purpose of this report, tributary consumptive use has not been modified to take into account that a major portion of these uses are supplied by ground water overdraft, nor were channel losses and salvage evaluated. Values of tributary consumptive use presented are for onsite uses and losses. It is recognized that under undepleted conditions significant losses occurred on the tributaries by evaporation from water surfaces and transpiration from native vegetation prior to their confluence with the Colorado River mainstream.

Study Areas

The estimated drainage area of the Colorado River system in the United States is about 242,000 square miles, of which

109,660 square miles are above Lee Ferry. The river rises in the Rocky Mountains of Colorado and Wyoming, flows southwest about 1,400 miles, and terminates in the Gulf of California. he system consists of portions of seven States: California, Colorado, New Mexico, Nevada, Utah, Wyoming, and nearly all of Arizona. The drainage area was divided into ten reporting areas: three above Lee Ferry; the Lower Colorado River mainstream; and six tributary areas draining to the mainstream below Lee Ferry (see general location map). A brief description of the reporting areas follows.

UPPER COLORADO RIVER

Green River: The Green River reporting area comprises about 44,800 square miles in southwestern Wyoming, northwestern Colorado, and northeastern and east-central Utah.

Principal tributaries of the Green River are Blacks Fork, Henry's Fork, Hams Fork and Big Sandy Creek in southwestern Wyoming; Yampa and White Rivers on the western slope of the Continental Divide in northwestern Colorado; and the Price, Duchesne, and San Rafael Rivers in eastern Utah. These streams are fed by numerous headwater lakes.

The largest towns in the reporting area are Rock Springs and Green River in Wyoming; Vernal and Price in Utah; and Craig, Steamboat Springs, and Meeker in Colorado.

Mineral production is the major industry. Oil and natural gas are of primary importance, as are coal, gilsonite, asphalt, and trona (soda ash). Thermal electric power production is becoming an increasingly important industry.

Agriculture ranks near mineral production in importance to the local economy. Agricultural development is centered around livestock production, primarily beef cattle and sheep. Because of a short growing season, crop production is limited largely to small grain, hay, and pasture. These crops are used as winter livestock feed and complement the vast areas of public grazing lands.

Irrigation consumptive use accounts for nearly 80 percent of the total water use in the Green River reporting area. Nearly 690,000 acres of land are irrigated in an average year. Large exports of water are made to the Great Basin in Utah.

Upper Main Stem: The Upper Main Stem reporting area is drained by the Colorado River and its tributaries above the mouth of-the Green River. Principal tributaries are the Roaring Fork, Gunnison, and Dolores Rivers. The Upper Main Stem reporting area consists of 26,200 square miles, with about 85 percent of the area in Colorado and the remainder in Utah.

Grand Junction, Montrose, and Glenwood Springs are the principal towns in Colorado. Moab is the only major community in Utah.

Mineral production is the predominant industry. This area is the Nation's chief source of molybdenum and is a major source of vanadium, uranium, lead, zinc, coal, and gilsonite.

In the Upper Main Stem reporting area, as in that of the Green River, agriculture centers around production of livestock which feeds on irrigated lands to complement the large areas of rangeland. There is somewhat more diversification of crops in the Upper Main Stem, however, with some major land-areas devoted to sugar beets, beans, potatoes, table vegetables, and fruit. This diversification is made possible by climatic and topographic conditions which create favorable air drainage and minimize frost damage.

Irrigation consumptive use accounts for over half the water use in the Upper Main Stem reporting area. In an average year nearly 550,000 acres of land are irrigated. A considerable amount (almost one-third of the total basin use) of water is exported to serve agricultural and municipal needs on the eastern slope of the Continental Divide in Colorado.

San Juan-Colorado: The San Juan-Colorado reporting area is drained by the Colorado River and its tributaries below the mouth of the Green River and above Lee Ferry, Arizona. The largest of the tributary streams is the San Juan River which heads on the western slope of the Continental Divide in southwestern Colorado. Principal tributaries of the San

Juan River are the Navajo, Los Pinos, Animas, and La Plata Rivers. The other main tributaries in the basin are the Dirty Devil, Escalante, and Paria Rivers which drain a portion of the eastern slope of the Wasatch Plateau in Utah. The reporting area includes about 38,600 square miles in portions of Utah, New Mexico, Arizona, and Colorado.

The largest towns are Durango and Cortez in Colorado; Monticello and Blanding in Utah; and Farmington in New Mexico. Page, near Glen Canyon Dam, is the only community of significant size in Arizona. Most of the remaining Arizona portion is in the Navajo Indian Reservation.

Mining and agriculture form the economic base for the San Juan-Colorado reporting area. The agricultural development is similar to that of the Upper Main Stem with most of the cropland devoted to livestock feeds but with production of diversified market crops on lands with favorable air drainage. The main market crops are fruit, vegetables, and dry beans. Oil, natural gas, and coal are the most important minerals produced. Thermal electric power production is increasingly important to the economy of the area.

Irrigation accounts for the largest use of water, nearly 80 percent of the total basin use. About 240,000 acres of land are irrigated in an average year.

LOWER COLORADO RIVER

Mainstream below lee Ferry, Arizona-California-Nevada: The Colorado River has a length of over 700 miles and a drainage area of 132,300 square miles within the Lower Colorado River system in the United States. From Lee Ferry to the headwaters of Lake Mead, the river flows through the spectacular canyons of northern Arizona, including the Grand Canyon. At Lake Mead, diversions are made to the rapidly expanding North Las Vegas-Las Vegas-Henderson-Boulder City area for municipal and industrial purposes. Below Lake Mead, the river courses through broad alluvial valleys interspersed with mountain chains. Lakes Mohave and Havasu provide flood control and regulatory storage below Lake Mead. In addition, Lake Havasu provides a forebay for pumped export to the Metropolitan Water District of Southern California and Lake Mohave reregulates Hoover Dam releases for power production and for deliveries to Mexico. Lesser structures downstream include Headgate Rock, Palo Verde, Senator Wash, Imperial, and Laguna Dams. Laguna and Senator Wash Dams provide reregulation capacity while the others are used principally for diversion.

Diversions below Lake Mead for agriculture, municipal and industrial, power, export, and other purposes are of the magnitude of 9 to 9.5 million acre-feet annually. A considerable portion of these diversions is satisfied from upstream return flows. Yuma and Lake Havasu City in Arizona, and Needles and Blythe in California are the major cities along the mainstream below Lake Mead. Current irrigated land adjacent to the mainstream is estimated to be about 351,000 acres. There has been a significant annual increase in the diversions for municipal and industrial purposes, particularly to Nevada.

little Colorado River, Arizona-New Mexico: The Little Colorado River drainage area occupies a large part of northern Arizona and a portion of west-central New Mexico. It rises on the north slopes of the White Mountains about 20 miles above Springerville, Ariz.; has a mainstream length of about 356 miles; and joins the Colorado River on the east boundary of Grand Canyon National Park about 78 miles downstream from Glen Canyon Dam.

A series of saline springs near the mouth produce an estimated 160,000 acre-feet of water annually. The Geological Survey gaging station near Cameron is located in the Navajo Indian Reservation about 45 miles upstream from the mouth. Streamflow is undependable and erratic, subject to flash floods of considerable magnitude. During the period 1971-75, water year outflow at the gaging station near Cameron varied from the floodflow of 815,900 acre-feet in 1973 to 28,300 acre-feet in 1974. Only a minor development of the ground water has occurred because of low yields and poor quality. Excessive erosion and sediment deposition plague the area. Agriculture is concentrated along the mainstream in the upper reaches of the river, on Silver Creek-a southern tributary-and on the Zuni River in New Mexico. Current irrigated acreage is estimated to be about 32,000; however, it is subject to variation because of frequent water shortages and inadequate storage facilities. Population is predominantly rural with a relatively large Indian segment. Principal cities include Flagstaff, Winslow, and Holbrook in Arizona, and Gallup and Zuni Pueblo in New Mexico. Leading industries include tourism, recreation, manufacturing, mining, and forest products.

Virgin River, Arizona-Utah: The Virgin River rises in western Kane County, Utah; flows southwesterly through the northwestern corner of Arizona; and empties into the northern extremity of the Overton Arm of Lake Mead in Nevada. The selected outflow point, the long-term Geological Survey gaging station at Littlefield, Ariz., is about 36 miles upstream from Lake Mead and about 10 miles above the Arizona-Nevada State line. The river is fed chiefly from tributaries heading in the southern high plateaus and mountains in Utah. Several springs contribute water to the river at a relatively uniform rate. The most significant of these springs are located near LaVerkin, Utah, and Littlefield, Ariz. Both springs are highly saline. Agricultural and municipal developments in Nevada below the selected outflow point are included in "remaining areas," as shown on the frontispiece map.

Ground water has been developed to a limited degree. The major irrigated areas are located in the LaVerkin-Hurricane-Santa Clara areas of Washington County, Utah, and in the Littlefield area of Mohave County, Ariz. There are small irrigated areas scattered throughout. Present irrigated area is estimated to be about 28,000 acres. Population is predominantly rural. St. George, Utah, is the principal city in the basin. Zion National Park, located near Springdale, Utah, attracts many visitors each year.

Muddy River, Nevada: The Muddy River, formerly a tributary of the Virgin River prior to the existence of Lake Mead, rises in the warm springs area of Clark County, Nev., about 10 miles northwest of Glendale. The river flows southeasterly for about 30 miles, and terminates at the northern extremity of the Overton Arm of Lake Mead. Meadow Valley Wash, the major tributary of Muddy River, rises in northeastern Lincoln County and flows south to join the parent stream at Glendale. The Geological Survey gaging station near Glendale is about 2.4 miles downstream from Meadow Valley Wash. Outflow varies little from year to year. Meadow Valley Wash, although perennial in the vicinity of Caliente, is normally dry in the last 50-mile reach above Glendale. Estimated irrigated acreage is about 8,900 acres located in the springs area and scattered throughout the upper reaches of Meadow Valley Wash.' The entire basin is sparsely populated.

Bill Williams River, Arizona: The Bill Williams River is formed by the mergence of the Big Sandy and Santa Maria Rivers about 7.5 miles above existing Alamo Dam. The river above Alamo Dam drains an area of about 4,700 square miles from small, rough mountain ranges and intervening valleys in parts of Mohave, Yuma, and Yavapai Counties. Alamo Dam and Reservoir, a flood control structure completed in 1968, was built to protect downstream development along the Colorado River. A minimum pool is maintained for recreation and game management purposes. Releases from Alamo Dam and runoff from the intervening area flow westerly and join the Colorado River at the lower end of Lake Havasu. Estimated irrigated acreage is about 4,500 acres with most crops grown to supplement feed for livestock. The limited development in the basin is dominated by copper mining at the unincorporated town of Bagdad, present population about 2,000. A large portion of the water supply in the basin is obtained from groundwater pumpage. Releases from Alamo Dam during the 1971-75 period varied from 1,500 acre-feet in 1975 to 162,500 acre-feet in 1973.

Gila River, Arizona-New Mexico: The Gila River is the largest tributary to the Colorado River in the Lower Colorado River system. The drainage area extends from the Continental Divide in New Mexico to the river's mouth near Yuma, Ariz. Elevations in the basin range from nearly 12,000 feet in the eastern mountains to about 150 feet at the mouth. The selected outflow point for the basin is at Painted Rock Dam, a flood control structure located about 20 miles west of Gila Bend, Ariz. The drainage area above Painted Rock Dam is about 50,900 square miles, of which 5,600 square miles are in New Mexico and 1,100 square miles in Mexico. The dam was constructed to protect agricultural and urban developments downstream. Major conservation storage reservoirs in the basin include the San Carlos Reservoir on the Gila River; Lake Pleasant on the Agua Fria River; and the six reservoirs of the Salt River Project. Total usable capacity of these reservoirs is about 3,180,OOO acre-feet.

Nearly 75 percent of the population of the Lower Colorado River system lives in the Gila River Basin; most of these reside in the metropolitan Phoenix and Tucson areas. Industry and recreation play a large part in the economy.

About two-thirds of the agricultural development in the Lower Colorado River system is located in the Gila River Basin. This development is concentrated in the central area of Maricopa, Pinal, and Pima Counties and is supported to a large degree by a long-term overdraft of the ground water resources. Nearly all of the surface water resources in the basin have been developed for decades. Except for the infrequent major flood event, such as occurred in 1973, inflows to the Colorado River mainstream are negligible. Releases through Painted Rock Dam in water year 1973 totaled 412,700 acre-feet although only slightly more than 100,000 acre-feet reached the Colorado River. Construction of the Central Arizona Project is in progress. This project, which would divert Colorado River water at Lake Havasu to central Arizona, is intended to reduce ground-water pumpage and partially arrest the large annual increases in the depths to ground water.

Remaining area in Arizona, Nevada, and Utah: Outside of the Colorado River mainstream and flood plain and the selected tributaries, development for the most part is limited by the availability of water and the rugged terrain. In the Boulder City-Las Vegas Valley area there has been a significant increase in the municipal and industrial demand for water. Construction which would complete the Southern Nevada Water Project is scheduled to begin in 1977. Completion of the project would allow Nevada to essentially use its complete entitlement from the Colorado River. Most of the irrigated lands in this area are located in the lower reach of the Virgin River and Las Vegas Valley in Nevada, on Kanab Creek in Arizona and Utah, and the lower portions of the Gila and Bill Williams Rivers in Arizona. North Las Vegas, Las Vegas, Henderson, and Boulder City in Nevada, and Kingman and Williams in Arizona are the leading cities.

Terminology

The Colorado River is not only one of the most highly controlled rivers in the world, but is also one of the most institutionally encompassed. A multitude of legal documents, known collectively as the "Law of the River," affect and sometimes dictate its management and operation. Major documents include:

- Colorado River Compact-1922
- Boulder Canyon Project Act-l 928
- California Limitation Act-1929
- California Seven Party Agreement-1931
- Mexican Water Treaty-1944
- Upper Colorado River Compact-1948
- Colorado River Storage Project Act-1956
- United States Supreme Court Decree in *Arizona v. California-1964*
- Colorado River Basin Project Act-1968
- Minute 242 of the International Boundary and Water Commission, United States and Mexico-1973
- Colorado River Basin Salinity Control Act-1974

The Colorado River system is defined in the Colorado River Compact of 1922 as ". . . that portion of the Colorado River and its tributaries within the United States," whereas the Colorado River Basin is defined as "...all of the drainage area of the Colorado River system and all other territory within the United States of America to which waters of the Colorado River system shall be beneficially applied." The compact divided the Colorado River Basin into two sub-basins-the "Upper Basin" and the "Lower Basin," with Lee Ferry as the division point on the river. Lee Ferry, located in Arizona, is a point in the mainstream 1 mile below the mouth of the Paria River. For the purpose of this report, the Great Divide Basin, a closed basin in Wyoming, and the White River in Nevada have not been considered as part of the Colorado River system. Diversions from the system to areas outside its drainage area are considered herein as exports and have not been classified as to types of use.

Beneficial consumptive use is normally construed to mean the consumption of water brought about by human endeavors and in this report includes use of water for municipal, industrial, agricultural, power generation, export, recreation, fish and wildlife, and other purposes, along with the associated losses incidental to these uses.

The storage of water and water in transit may also act as losses on the system although normally such water is recoverable in time. Qualitatively, what constitutes beneficial consumptive use is fairly well understood; however, an inability to exactly quantify these uses has led to various differences of opinion. The practical necessity of administering the various water rights, apportionments, etc., of the Colorado River has led to definitions of consumptive use or depletions generally in terms of "how it shall be measured." The Upper Colorado River Compact provides that the Upper Colorado River Commission is to determine the apportionment made to each State by "... the inflow-outflow method in terms of manmade depletions of the virgin flow at Lee Ferry. ..." There is further provision that the measurement method can be changed by unanimous action of the Commission. In contrast, article 1(A) of the decree of the Supreme Court of the United States in *Arizona v. California* defines, for the purpose of the decree, "Consumptive use means diversions from the stream less such return flows thereto as are available for consumptive use in the United States or in satisfaction of the Mexican Treaty obligation." Nearly all the water exported from the Upper Colorado River system is measured; however, the remaining beneficial consumptive use, for the most part, must be estimated using theoretical methods and techniques. In the Lower Colorado River system tributaries to the mainstream, similar methods must be employed to determine the amount of water consumptively used.

Reservoir evaporation loss is a consumptive use associated with the beneficial use of water for other purposes. For the purpose of this report, main stem reservoir evaporation is carried as a separate item for the Upper and Lower Basins.

Channel losses within the system are normally construed to be the consumptive use by riparian vegetation along the stream channel (or conveyance route) and the evaporation from the stream's water surface and wetted materials. Seepage from the stream normally appears again downstream or reaches a ground water aquifer where it may be usable again. A decided lack of data and acceptable methodology along with the intermittent flow characteristics of many Southwest streams combine to make a reasonable determination of channel loss difficult. Channel losses have not been estimated for this report within the Upper Basin nor on the tributaries of the Lower Colorado River mainstream. Channel losses on the mainstream below Lee Ferry have been estimated primarily by the inflow-outflow method.

Methodology and Data Collection

This initial report is based almost entirely on data obtained from ongoing programs and current reports. No new land use surveys were initiated. Available quantitative measurements of water were used wherever their use aided or complemented the determination of consumptive use.

UPPER COLORADO RIVER

Irrigation Consumptive Use: The determination of annual irrigated acreage and crop distribution during the reporting period was made using the 1969 National Census of Agriculture, annual State Agricultural Statistics Reports, Bureau of Reclamation Crop inventory Reports, and various inventory and planning reports issued by the Upper Basin States. Since most of these data were presented on a county basis, it was necessary to separate them into reporting areas and smaller sub-basins for computational purposes. This was accomplished by using land inventory maps and relationships developed for the comprehensive framework study.

For purposes of computing irrigation consumptive use, the Upper Colorado River Basin was divided into 58 sub-basins to account for local consumptive use requirements. These sub-basins generally follow tributary stream basin and State boundaries. A representative climatic station was selected for each sub-basin. Using historical records of temperature, precipitation, and frost dates, a consumptive use rate was computed for each major crop in each of the reporting years. For the purpose of this report, the consumptive use rates were computed using the modified Blaney-Criddle evapotranspiration formula in the version described in the Soil Conservation Service Technical Release No. 21, "Irrigation Water Requirements," revised September 1970. Irrigation consumptive use rates were determined by subtracting the effective precipitation from the consumptive use rates. Effective precipitation was computed using criteria described in the U.S. Department of Agriculture, Agricultural Research Service, Technical Bulletin No. 1275.1 The values of irrigation consumptive use rates were applied against the estimates of irrigated acreage to yield the final values of irrigation consumptive use.

The theoretical consumptive use determinations are based on the assumption of full water supply during the crop growing season. However, it is estimated that in an average year about 37 percent of the irrigated lands in the Upper Basin receive less than a full supply of water, either due to lack of distribution facilities or inferior water rights. The degree to which these lands suffer shortages varies widely from year to year, depending in large part on the magnitude of runoff. For this study, an estimate of the short supply service lands was made for each sub-basin, primarily on the basis of reports and investigations collected for the framework study. A streamflow gaging station was selected within each sub-basin and the magnitude of the recessional portion of the hydrograph was used as an index to select the date at which consumptive use calculations should be terminated for the short supply lands.

Comprehensive framework studies of the incidental consumptive use of water associated with irrigation indicated that this use amounted to a magnitude ranging from 5 to 28 percent of the irrigation consumptive use depending upon location of the study area within the Upper Basin. Lacking an up-to-date inventory of incidental use lands, these percentage adjustments were retained for use in this study and applied against the annual estimates of irrigation consumptive uses. The total irrigation consumptive use and incidental consumptive use associated with irrigation are reported in tables UC-3 to UC-7.

Reservoir Evaporation: A comprehensive listing of all reservoirs and stockponds in the Upper Basin was developed. This listing included information about major reservoir use, location, elevation, total capacity, and surface area at total capacity. The listing was brought up to date and is now kept current.

Monthly content records were obtained for those reservoirs for which records are available. The average annual water-surface area was determined for each year of the reporting period. For those reservoirs lacking records, a "fullness factor" was estimated on the basis of reservoir use and historical hydrologic conditions. These "fullness factors" were then used to obtain estimates of average annual water-surface area for the unreported reservoirs.

Regression equations relating gross annual reservoir evaporation to elevation, latitude, and geographic location were developed for each of the reporting years. Account was taken of precipitation and runoff salvage to determine net evaporation rates. The net evaporation rates were applied against the estimates of average annual water-surface area to yield the values of annual reservoir and stockpond evaporation.

An exception to this procedure was the determination of evaporation from the main stem reservoirs. Predetermined evaporation rates were applied against historical surface areas to yield values of evaporation on a monthly basis.

Exports: Over 99 percent of the water exported from the Upper Basin is gaged and reported on by the Geological Survey or water user organizations. The remainder was estimated on the basis of past records or capacity of facilities.

Thermal Electric Uses: Records of water consumptively used at thermal powerplants were obtained from the power utility companies.

Other Uses: These include livestock usage (excluding stockpond evaporation), municipal, urban, rural, recreation, and industrial (other than thermal powerplant). These items represent only 3 percent of the total Upper Basin use. The values presented in this report were estimated by interpolating between 1965 and 1980 levels of use as reported and estimated in the Comprehensive Framework Study.

LOWER COLORADO RIVER

Mainstream: The annual consumptive use of water from the Colorado River mainstream by the States and exports from the system were taken from the Bureau of Reclamation annual report entitled "Compilation of Records in Accordance with Article V of the Decree of the United States in *Arizona v. California,*" dated March 9, 1964. To these data were credited unmeasured subsurface return flows below Davis Dam, and surface return flows from Las Vegas Wash. Estimated subsurface return flows were based partly on preliminary information supplied by the Task Force on Ground-Water Return Flows. Return flows through Las Vegas Wash as a result of Lake Mead diversions into Las Vegas Valley were estimated by the same procedures used in the derivation of the 1975 return flow, as shown in the Article V compilation. For the purpose of this report, all unmeasured subsurface return flow was credited to irrigation use and divided between California and Arizona based on their respective irrigated areas. Surface water return flow through Las Vegas Wash was credited to Nevada's municipal and industrial water uses.

Gross evaporation from Lake Mead is estimated by the Geological Survey and published in its annual Water Resource Data reports. Deductions for precipitation on the lake surface were made on the basis of precipitation at Boulder City, Nev. Net evaporation from Lakes Mohave and Havasu and Senator Wash Reservoir were derived from available evaporation and precipitation records and operating data. Since surface-water levels of the remaining small impoundments remain relatively constant throughout the year, an annual allowance of 36,000 acre-feet for evaporative losses was used throughout the report period.

Annual channel losses were estimated as the outflow necessary to balance a simplified budget of inflow and outflow below Davis Dam. Apparent channel losses averaged 280,000 acre-feet annually, using 200,000 acre-feet per year as unmeasured subsurface return flow. Above Davis Dam, an annual channel loss of 100,000 acre-feet was assigned, based in part on information in the Geological Survey Professional Paper 486-D.

Releases from Davis Dam are used throughout this report rather than those from Hoover Dam because of an apparent error in the measurement of Hoover Dam releases. Remedial measures are underway to correct this deficiency.

Tributaries: Records of measured diversions, return flows, and consumptive use comparable to the mainstream are not available in the tributary areas. Although diversion records are kept by a number of water-using entities, return flows are seldom measured. Most return flows are subsurface in nature and are not amenable to direct measurement. Theoretical and indirect methods of estimating consumptive use must be relied upon in the tributary areas. In the New Mexico portion of the Gila River Basin, the annual consumptive use of water is reported by the New Mexico Interstate Stream Commission, pursuant to article VII of the March 9, 1964, decree of the United States Supreme Court in Arizona v. California, et al.

Agriculture: About 85 percent of the consumptive use in the tributary area to the Colorado River mainstream is for irrigated agriculture. The annual irrigated acreage and crops grown within each reporting area were estimated principally from information in the yearly State Agriculture Statistics. Irrigated pasture and some minor crops not reported by the statistics were estimated from information in the 1969 Census of Agriculture, supporting information from framework studies, and various other local reports including county farm-agent interviews. In essence, the county data from the statistics were disaggregated into the reporting areas and subareas for computational purposes. The Blaney-Criddle empirical formula was utilized to compute the annual rate of crop consumption use. The formula is based on the assumption of a full water supply, among other things, and results in a theoretical water requirement rather than actual use. Seasonal crop consumptive use factors' "K" for the lower elevation desert areas were selected from Technical Bulletin 169 "Consumptive Use of Water by Crops in Arizona," issued September 1965 by the University of Arizona and the U.S. Department of Agriculture. In the higher areas, seasonal factors from the Soil Conservation Service Technical Release No. 21 were utilized. Effective precipitation, that amount of rainfall which satisfies a portion of consumptive use, is accounted for by criteria developed for this area by Wayne D. Criddle, former Utah State Engineer. Among the many variables affecting the actual use of water, the most important is individual farm water supply and its management. There is no adequate method to adjust computed annual requirements to actual water use over broad areas.

Past studies of the incidental consumptive use of water associated with irrigation (water surfaces and vegetative areas on rights-of-way for canals, laterals, drains, roads, etc.) suggest that this use may be accounted for by adding 10 to 20 percent of the computed crop consumptive use. A factor of 15 percent is used herein to represent this use. In the heavily irrigated central Arizona area of the Gila River Basin, in-transit water may sometimes be considered a depletion. In-transit water is potential ground water recharge which, due to declining water tables, interception by impervious beds (perched water), etc., is presently irrecoverable. Although this water is not truly consumed, it is not available for use. This temporary loss of water has not been included in this report because of the lack of pertinent information to estimate its. present magnitude.

Evaporation from Reservoirs, lakes, and Stockponds: Adequate data are available at most of the major reservoirs in the tributaries to estimate annual lake evaporation. Monthly net evaporation rates were derived from nearby climatic stations recording pan evaporation and precipitation. Stockpond evaporation was taken directly from framework study supporting data which were prepared by the Soil Conservation Service. In addition to major reservoirs and stockponds, there are many other reservoirs about which little information exists. For the most part, these reservoirs are small and are used for a number of joint purposes. Using available listings of these impoundments and other data, a total average surface area and a representative evaporative loss were estimated. No attempt was made to vary these losses or those from stockponds on a year-by-year basis.

Municipal and Industrial: The base for estimating municipal and industrial uses is the urban and rural population within the reporting areas. Preparation of annual population estimates was guided by the 1970 Census, and various State and county statistical reviews and reports which include population estimates for local areas. The 1975 population of the Lower Colorado River system is estimated at about 2.6 million and increasing at an annual rate of nearly 5 percent. A large portion of the population resides within Maricopa and Pima Counties in Arizona, and in Clark County, Nev. Net water use rates for domestic, urban, and rural uses in the various reporting areas were derived from available studies in the metropolitan areas, State Water Plan reports, and appropriate appendices of the Comprehensive Framework Study, Lower Colorado Region.

Mineral Resources: Arizona leads the Nation in the production of copper, producing more than half of the supply. Following in copper production are Utah, New Mexico, Montana, and Nevada. Most of the copper production, however, in Utah, New Mexico, and Nevada is produced outside of the Lower Colorado River system. The net water use for the production of copper represents about 90 percent of the total water use for the production of minerals within the Lower Colorado River system. The net water use for copper and other mineral production, composed principally of the byproducts and coproducts of copper production (gold, silver, molybdenum, lead, zinc) sand and gravel, lime, coal, stone, pumice, and cement, was estimated from available production data and nominal water use rates. A large part of the information used to estimate current water uses by the mineral industry comes from the Bureau of Mines. This information includes preliminary figures of annual gross value and quantities of mineral production by State. Basic data available from the Bureau of Mines include published figures of gross value of mineral production in relation to amount of water consumed and is expressed as gallons consumed per dollar of production. Figures are available for many mineral types mined and produced in Arizona and Nevada. A continued updating of unit price for each mineral in relation to quantity produced is maintained to arrive at current consumptive use figures based on current gallons consumed per dollar of production figures.

Electric Power: The net use of water for the production of thermal electric energy from the tributaries of the Lower Colorado River system was estimated from diversions to powerplants and from information contained in State water plan reports.

Fish and Wildlife: The many multipurpose lakes, stockponds, and impoundments in the tributaries are used extensively for fishing and recreation activities, as well as for preservation of wildlife. Water consumption in the form of evaporation from these facilities has been included as lake evaporation in this report. There is little information concerning the remaining water consumption for fish and wildlife purposes which may occur at fish hatcheries, marshes, and on croplands administered by the United States or various State Fish and Wildlife Agencies. These remaining uses are believed to be relatively small in the tributary areas and have not been included in this report.

Recreation: At many of the lakes, reservoirs, and impoundments, recreation may be one of the important functions or purposes. Other minor water uses for recreation purposes have not been included herein.

Exports: The relatively minor exports of tributary water outside the Lower Colorado River system are measured by the Geological Survey or water-using organizations. Similarly, most of the exports between tributaries or reporting areas are measured. Water used to transport coal from the Black Mesa (Arizona) to the Mohave Steam Plant (Nevada) is estimated from records of coal burned at the plant.

Adequacy of Data

The adequacy of data is judged on the basis for which it is to be used. Methods of estimating consumptive use are normally established by theoretical or indirect approaches. A formula may be dependent on a number of variables. The relationship and achievable accuracy of each variable must be weighed carefully with the results to justify any significant upgrading of data with respect to accuracy and adequacy.

To a degree, this report makes use of the 1965 development year estimates of consumptive use prepared for the Upper and Lower

Colorado Region's Comprehensive Framework Studies. The sources of readily available and published data are essentially the same for both reports. The report relies, in some cases, on the results of special studies prepared for the framework study.

UPPER COLORADO RIVER

irrigation Consumptive Use: Annual irrigated acreage and cropping patterns are the most important items of data required for a proper determination of consumptive uses and losses in the Upper Colorado River Basin. The annual State agricultural statistics reports of Wyoming, Colorado, and New Mexico provide good estimates of irrigated harvested cropland. (This item of data is not collected or reported on in the Utah statistics report.) These data are presented on a county basis and must be disaggregated into tributary basins. Generally, this does not present too much of a problem except in Wyoming, where county lines and the Colorado River Basin divide are considerably dissimilar. More timely issuance of the reports would be helpful.

The determination of irrigated nonharvested cropland (mostly irrigated pasture lands) is an area of data collection which needs to be considerably strengthened. This item is not reported on in the State statistics reports. The acreage used to develop the estimates of irrigated pasture consumptive use for this study are based very strongly on acreage values reported in the 1969 National Census of Agriculture. Other areas of data collection which need to be improved are (1) the determination of irrigated lands which receive less than a full seasonal supply of irrigation water and improvement of techniques for estimating water use on these lands, and (2) up-to-date inventories of seeped and phreatophyte areas associated with irrigated lands. The present level of climate data acquisition is adequate for the proper application of the evapotranspiration formula.

Reservoir Evaporation: The techniques and data used to compute reservoir evaporation were generally satisfactory. Of course, additional pan evaporation and reservoir content records would strengthen the estimates.

Other Uses: The records of transbasin exports and thermal powerplant uses are excellent. The estimates of municipal and mineral resource uses could be enhanced through the collection of additional diversion and return flow records. However, extensive data acquisition programs for these items do not seem warranted in light of their small magnitude in comparison to the possible error of estimate of the larger water-use items (e.g., irrigation, evaporation).

LOWER COLORADO RIVER

Mainstream: The annual land use, water supply, and water use information being gathered for the operation, maintenance, and administration of the Colorado River mainstream below Lee Ferry is believed to be generally adequate in quantity, quality, and extent. Under more or less constant review, these data are being continually upgraded wherever deficient. Studies and programs are in progress to remedy a lack of data on return flows from mainstream diversions and to correct the apparent inaccuracies of the recorded releases from Hoover Dam.

Tributaries: For the purpose of this report, there are adequate data, for the most part, in the tributary areas of the Lower Colorado River system to make reasonably accurate estimates of the overall beneficial consumptive use of water by the major types of use. Major uses are agriculture, municipal and industrial, and reservoir evaporation. Although most of the data could be enhanced to some extent, upgrading would entail the collection of supplementing data which would be both expensive for fieldwork and instrumentation and for the office work to assimilate these additional data. Whether supplementing data would actually improve the accuracy of the net water use must be carefully weighed, since most theoretical techniques consider only a small fraction of the factors involved.

Agriculture: County information is available in most of the area to aid in the estimation of irrigated crop acreage. In general, these data are adequate although some difficulty is encountered in disaggregating the data into tributary areas and into smaller subareas for estimating and computational purposes. A sufficient number of climatic stations are operated to obtain the necessary temperature and precipitation information required for the evapotranspiration formula. Research programs in developing techniques for automatically identifying and measuring irrigated acreage through computer manipulation of satellite digital data may ultimately aid in the assessment of cropped acreage. A weak link in estimating the beneficial consumptive use by agriculture over broad areas is in assessing the actual water supply available, its adequacy as a full supply, and its relationship to consumptive use.

Municipal and Industrial: Most of the population residing within the boundaries of the Lower Colorado River system live in metropolitan Phoenix, Tucson, and Las Vegas. These cities and their surrounding environs have the mutual problem of providing an adequate current and future water supply for a growing community in 'a water-short area. In addition to an almost continuous flow of studies concerning these problems, adequate production and effluent records are usually available to adequately assess water use. Less than 20 percent of the total population is classified as rural having a significantly lesser per capita use of water. In general, the rural population was considered to have a net water use rate of about 30 gallons per capita per day. Consumptive use of water for thermal power generation and the mineral resource industries constitutes about 2.5 percent of the total estimated beneficial consumptive use within the tributary areas. In general, information regarding the annual use of water by the mineral resource industry is inadequate. The increasing trend for recycling and the methods of achieving compliance with quality of water standards are changing. Unit water-quantity requirements for mineral production and processing may have been modified significantly as compared to a decade ago.

Reservoir Evaporation: There are adequate records available to estimate the annual evaporation from the major reservoirs in the tributary areas. Information on the fluctuation of water levels in the smaller reservoirs and stockponds is nearly nonexistent. Evaporation from these smaller impoundments has been estimated on the basis of either "full" or "average" capacity prevailing throughout the year. Monitoring water-surface areas through remote sensing techniques may remedy this condition to some extent.

Beneficial Consumptive Uses and losses

Summaries of the Colorado River system annual water uses, 1971-75, by States and type of use are shown in tables C-2 through C-6. Water use within the selected reporting areas is discussed below.

UPPER COLORADO RIVER

Summaries of estimated annual consumptive uses and losses in the Upper Colorado River Basin for each of the reporting years, broken down by State, reporting area, and type of use are shown in tables UC-3 through UC-7. Estimated main stem reservoir evaporation is shown in table UC-l.

Agricultural uses accounted for over 60 percent of the total Upper Basin consumptive uses and losses. Irrigated acreage during the 5-year period averaged about 1,470,000 acres, with apparently little variation from year to year. Irrigation consumptive use did, however, show large variations from year to year due to climatic conditions. In 1971 and 1972, precipitation, temperature, and runoff were at or slightly below normal over the Upper Basin as a whole. In 1973, the basin experienced exceptionally large amounts of precipitation along with below-average temperatures. This combination resulted in decreased irrigation needs. Conditions completely reversed in 1974, when near drought conditions prevailed over most of the basin. Irrigation requirements that year were the highest of the 5-year reporting period. A large portion of the irrigation requirement was met with carry-over reservoir storage. As table UC-2 shows, major reservoir storage (excluding main stem reservoirs) decreased in 1974 by about 730,000 acre-feet. In 1975, precipitation and runoff returned to nearly normal. However, cool temperatures during the growing season reduced irrigation demands. Reservoir storage recovered from the previous year's drawdown.

Reservoir evaporation, also primarily affected by climatic conditions, demonstrated a pattern of variation similar to that of irrigation consumptive use.

Transbasin exports, the second largest Upper Basin use, showed the greatest year-by-year variation and also the greatest net increase during the reporting period. In 1971, exports totaled 583,000 acre-feet. In 1975, exports had risen to 815,500 acre-feet primarily due to the opening of the Boustead Tunnel in Colorado and Azotea Tunnel, which outlets in New Mexico.

Thermal power water uses in the Upper Basin more than doubled in the 5-year reporting period as four major powerplants went into operation: San Juan (New Mexico) in 1973; Navajo (Arizona) in 1974; Jim Bridger (Wyoming) in 1974; and Huntington (Utah) in 1975.

During the 5-year reporting period, main stem regulating reservoirs recorded an increase of 9,906,000 acre-feet of surface storage. As storage increased, main stem reservoir evaporation rose from 458,000 acre-feet in 1971 to 607,000 acre-feet in 1975.

LOWER COLORADO RIVER

Water use within the Lower Colorado River system is increasing as a result of additional irrigated acreage and a fast-growing population. Irrigated land has increased from about 1,285,000 acres in 1971 to 1,440,000 acres in 1975. Population in 1970 was estimated to be-about 2.1 million, and 2.6 million in 1975.

Mainstream

Table LC-1 shows water-surface evaporation from mainstream reservoirs and channel losses; table LC-2, the change in surface-water contents of the reservoirs; and table LC-3, water uses along the Lower Colorado River mainstream and flood plain including water passing to Mexico. Water passing to Mexico is made up of deliveries in satisfaction of the Treaty, deliveries made pursuant to Minutes 218, 241, and 242, and regulatory waste. Mainstream reservoirs gained about 3.4 million acre-feet of surface storage during the 5-year reporting period. Water supplies necessary to meet the mainstream water use, including reservoir surface and bank storage, came principally from the regulated releases at Glen Canyon Dam.

Annual reservoir evaporation and channel losses consumed about 1.5 million acre-feet. Table LC-9, a water budget below Davis Dam, results in an estimate of the overall channel losses in the reach to the International Boundary. Irrigated land has increased from about 331,000 acres in 1971 to 351,000 acres in 1975-most of the increase occurring in the Colorado River Indian Reservation. Municipal and industrial water use, including thermal powerplants in Nevada and Arizona, doubled during the 5-year period. Much of this demand is within southern Nevada. Pursuant to Minutes 218 and 242, saline return flows from the Wellton-Mohawk Irrigation and Drainage District near Yuma, Ariz., were bypassed around Morelos Dam at the International Boundary resulting in a substantial increase in the water passing to Mexico in excess of the Treaty requirements. Project plans to implement the United States measures required by Minute 242 call for reduction of bypassed water through improved irrigation efficiencies, reduced acreage to be irrigated on Wellton-Mohawk Project lands, and the construction of a desalting plant converting drainage water to an acceptable quality for de-

Water Year	Colorado River at Compact Point, near Lee Ferry, Arizona (MAF)	Estimated Tributary Inflow to Mainstream (MAF)	Total (MAF)
1971	8.61	0.97	9.58
1972	9.33	0.78	10.11
1973	10.14	2.12	12.26
1974	8.28	0.85	9.13
1975	9.27	0.94	10.21
Average 1971-1975	9.13	1.13	10.26

livery to Mexico. The interim deficit of water to the system will be replaced by water savings resulting from the construction of a concrete-lined canal generally parallel to the first 49-mile reach of the existing unlined Coachella Canal. The water saved, estimated at about 132,000 acre-feet annually, will represent a part of California's entitlement. However, until the water saved is required by these users, it can supplement or replace water from storage that has been released to Mexico and not counted as part of the scheduled treaty deliveries. Plans also call for the permanent replacement of reject brine water from the desalting plant.

Tributaries

Tables LC-4 through LC-8 show water uses by selected tributary areas, by States, and by type of use. Onsite consumptive use in 1971 was estimated to be about 3.8 million acre-feet. By 1975, consumptive use was about 4.5 million acre-feet as a result of a substantial increase in both irrigated acreage and population. Over half of the consumptive use is satisfied from ground water overdraft. Irrigated land was estimated to be about 954,000 acres in 1971, and 1,090,000 acres in 1975. Gain in population has been on the magnitude of about 100,000 new residents for each year during the period. Most of the increase in water use, irrigated land, and population has occurred in the Gila River Basin.

Gila River

Consumptive use for the irrigation of crops represents about 85 percent of the total water use in the Gila River Basin. Estimated annual consumptive use per area for the entire basin during the 5-year period averaged about 3.5 acre-feet, varying from less than 1 acre-foot per acre in parts of New Mexico to over 4 acre-feet in the western portion of the basin. Crop consumptive use varied considerably from year to year on the basis of climatic conditions. Favorable economic conditions for farming led to an increase in irrigated land of about 127,000 acres.

The consumptive use of water for municipal and industrial purposes is estimated to have increased about 42,000 acre-feet during the 5-year period.

Water supply conditions were characterized by exceptionally poor runoff in 1971 and 1974, near normal runoff in 1972 and 1975, and the occurrence of a major flood in 1973. In addition to replenishing storage reservoirs in the basin, the 1973 runoff produced an outflow below Painted Rock Dam of 412,700 acre-feet during the water year. About 100,000 acre-feet of the outflow reached the Colorado River mainstream. Estimated diversions during the 5-year period averaged about 5.6 million acre-feet, of which 4.1 million acre-feet were from ground-water pumpage. The recent "Inventory of Resources and Uses, Arizona State Water Plan, Phase I-July 1975," prepared by the Arizona Water Commission and based on 1970 development conditions, estimated annual ground-water overdraft to exceed 1.8 mill ion acre-feet. In general, increased water uses within the basin since 1970 have added to the overdraft. The Central Arizona Project, scheduled for completion in 1985, would divert the remaining portion of the Arizona entitlement of Colorado River water to central Arizona, reducing ground-water pumpage and consequently the overdraft.

Other Tributary Areas

Outside the Gila River Basin, and within the remaining tributary areas to the Colorado River mainstream, water resources are generally limited and their development is less intensive. As shown in tables LC-4 through LC-8, total estimated consumptive use within the area increased from about 437,000 acre-feet in 1971 to 475,000 acre-feet in 1975. A lack of adequate surface-water storage facilities tends to make irrigated acreage subject to fluctuation from year to year based on the variable and somewhat undependable runoff. Localized ground water overdrafts occur in parts of the area. With the exception of Las Vegas Valley, population is predominantly rural. In Las Vegas Valley, municipal and industrial demands are increasing rapidly; however, these demands are being met by increased diversion from Lake Mead, as shown in table LC-3, and reliance on ground-water pumpage is being reduced.

TABLE C-2—Colorado River System Consumptive Uses and Losses Report, P.L. 90-537
Summary of Estimated Water Use by States, Basins, and Types of Use 1971

(1,000 A.F.)

State	Basin	Estimated Beneficial Consumptive Uses and Losses [1] Reservoir Evaporation [2]	Irrigated Agriculture [3]	Municipal and Industrial [4]	Fish and Wildlife, Recreation	Export Outside System	Export Within System	Total
Arizona	Upper	—	6.6	2.9	1.6	—	—	11
	Lower	160.1	4,216.7	334.6	32.8	—	0.5	4,745
	Total	160.1	4,223.3	337.5	34.4	—	0.5	4,756
California	Lower	—	484.8	7.2	—	4,630.0	—	5,122
Colorado	Upper	—	1,236.8	41.3	7.3	415.0	—	1,701
Nevada	Lower	1.1	62.5	66.9	0.8	—	(-0.5)	131
New Mexico	Upper	—	102.6	22.0	0.6	54.4	—	180
	Lower	5.5	19.9	7.5	—	—	—	33
	Total	5.5	122.5	29.5	0.6	54.4	—	213
Utah	Upper	—	596.1	18.0	7.8	107.6	—	729
	Lower	0.7	61.6	1.1	—	1.3	—	65
	Total	0.7	657.7	19.1	7.8	108.9	—	794
Wyoming	Upper	—	307.4	20.1	0.2	6.0	—	334
Other	Upper	458.0	—	—	—	—	—	458
[5]	Lower	1,458.0	—	—	—	1,560.8	—	3,019
	Total	1,916.0	—	—	—	1,560.8	—	3,477
Colorado River System	Upper	458	2,250	104	18	583	0	3,413
	Lower	1,625	4,846	417	34	6,193	0	13,115
	Total	2,083	7,096	521	52	6,776	0	16,528

[1] From tables UC-1, -3 and LC-1, -3, and -4.
[2] In the Upper Basin, reservoir evaporation other than main stem has been assigned to the principal reservoir function.
[3] Includes livestock water use and stockpond evaporation.
[4] Includes water uses for thermal electric power and mineral resources.
[5] Mainstream reservoir evaporation includes estimated channel loss below Lee Ferry. For the purpose of this report water passing to Mexico (not used in basin) is shown as an export.

TABLE C-3—Colorado River System Consumptive Uses and Losses Report, P.L. 90-537
Summary of Estimated Water Use by States, Basins, and Types of Use 1972

(1,000 A.F.)

State	Basin	Estimated Beneficial Consumptive Uses and Losses [1]						
		Reservoir Evaporation [2]	Irrigated Agriculture [3]	Municipal and Industrial [4]	Fish and Wildlife, Recreation	Export Outside System	Export Within System	Total
Arizona	Upper	—	6.9	3.6	1.7	—	—	12
	Lower	153.4	4,483.9	355.9	33.5	—	1.7	5,028
	Total	153.4	4,490.8	359.5	35.2	—	1.7	5,040
California	Lower	—	500.3	7.6	—	4,820.4	—	5,328
Colorado	Upper	—	1,236.8	42.0	6.2	490.5	—	1,775
Nevada	Lower	1.1	68.3	79.4	0.9	—	(−1.7)	148
New Mexico	Upper	—	114.2	27.5	0.7	41.1	—	183
	Lower	5.5	19.2	10.0	—	—	—	35
	Total	5.5	133.4	37.5	0.7	41.1	—	218
Utah	Upper	—	595.3	18.0	8.1	127.2	—	749
	Lower	0.7	71.6	1.2	—	0.6	—	74
	Total	0.7	666.9	19.2	8.1	127.8	—	823
Wyoming	Upper	—	274.8	19.9	0.2	8.7	0	304
Other	Upper	477.0	—	—	—	—	—	477
[5]	Lower	1,442.0	—	—	—	1,600.5	—	3,042
	Total	1,919.0	—	—	—	1,600.5	—	3,519
Colorado River System	Upper	477	2,228	111	17	667	0	3,500
	Lower	1,603	5,143	454	34	6,421	0	13,655
	Total	2,080	7,371	565	51	7,088	0	17,155

[1] From tables UC-1, -4 and LC-1, -3, and -5.
[2] In Upper Basin, reservoir evaporation other than main stem has been assigned to the principal reservoir function.
[3] Includes livestock water use and stockpond evaporation.
[4] Includes water uses for thermal electric power and mineral resources.
[5] Mainstream reservoir evaporation includes channel loss below Lee Ferry. For the purpose of this report water passing to Mexico (not used in basin) is shown as an export.

TABLE C-4—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Summary of Estimated Water Use by States, Basins, and Types of Use 1973

(1,000 A.F.)

		Estimated Beneficial Consumptive Uses and Losses [1]						
State	Basin	Reservoir Evaporation [2]	Irrigated Agriculture [3]	Municipal and Industrial [4]	Fish and Wildlife, Recreation	Export Outside System	Export Within System	Total
Arizona	Upper	—	7.3	3.2	0.9	—	—	11
	Lower	260.8	4,441.3	370.2	42.9	—	1.9	5,117
	Total	260.8	4,448.6	373.4	43.8	—	1.9	5,128
California	Lower	—	483.2	6.8	—	4,578.4	—	5,068
Colorado	Upper	—	1,043.8	43.3	6.0	443.1	—	1,536
Nevada	Lower	1.1	72.5	81.4	0.8	—	(−1.9)	154
New Mexico	Upper	—	116.9	27.3	0.5	174.9	—	320
	Lower	5.7	19.9	11.0	—	—	—	37
	Total	5.7	136.8	38.3	0.5	174.9	—	357
Utah	Upper	—	603.6	18.5	7.1	100.8	—	730
	Lower	0.7	83.0	1.3	—	8.1	—	93
	Total	0.7	686.6	19.8	7.1	108.9	—	823
Wyoming	Upper	—	270.8	23.9	0.2	8.7	—	304
Other	Upper	502.0	—	—	—	—	—	502
5	Lower	1,564.0	—	—	—	1,593.7	—	3,158
	Total	2,066.0	—	—	—	1,593.7	—	3,660
Colorado	Upper	502	2,043	116	15	727	0	3,403
River	Lower	1,832	5,100	471	44	6,180	0	13,627
System	Total	2,334	7,143	587	59	6,907	0	17,030

[1] From tables UC-1, -5 and LC-1, -3, and -6.
[2] In Upper Basin, reservoir evaporation other than main stem has been assigned to the principal reservoir function.
[3] Includes livestock water use and stockpond evaporation.
[4] Includes water uses for thermal electric power and mineral resources.
[5] Mainstream reservoir evaporation includes channel loss below Lee Ferry. For the purpose of this report water passing to Mexico (not used in basin) is shown as an export.

TABLE C–5—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Summary of Estimated Water Use by States, Basins, and Types of Use 1974

(1,000 A.F.)

		Estimated Beneficial Consumptive Uses and Losses[1]						
State	Basin	Reservoir Evaporation[2]	Irrigated Agriculture[3]	Municipal and Industrial[4]	Fish and Wildlife, Recreation	Export Outside System	Export Within System	Total
Arizona	Upper	—	8.5	9.0	1.7	—	—	19
	Lower	263.2	4,774.2	378.9	26.5	—	2.1	5,445
	Total	263.2	4,782.7	387.9	28.2	—	2.1	5,464
California	Lower	—	500.1	7.0	—	4,968.0	—	5,475
Colorado	Upper	—	1,304.2	42.0	6.8	502.0	—	1,855
Nevada	Lower	1.1	74.5	85.9	0.9	—	(–2.1)	160
New Mexico	Upper	—	119.5	32.0	0.7	47.7	—	200
	Lower	5.6	19.9	11.3	—	—	—	37
	Total	5.6	139.4	43.3	0.7	47.7	—	237
Utah	Upper	—	633.4	18.5	10.3	122.9	—	785
	Lower	0.7	86.5	1.3	—	0.6	—	89
	Total	0.7	719.9	19.8	10.3	123.5	—	874
Wyoming	Upper	—	327.1	27.5	0.2	8.7	—	364
Other	Upper	596.0	—	—	—	—	—	596
[5]	Lower	1,579.0	—	—	—	1,720.5	—	3,300
	Total	2,175.0	—	—	—	1,720.5	—	3,896
Colorado River System	Upper	596	2,393	129	20	681	0	3,819
	Lower	1,850	5,455	484	28	6,689	0	14,506
	Total	2,446	7,848	613	48	7,370	0	18,325

[1] From tables UC–1, –6 and LC–1, –3, and –7.
[2] In Upper Basin, reservoir evaporation other than main stem has been assigned to the principal reservoir function.
[3] Includes livestock water use and stockpond evaporation.
[4] Includes water uses for thermal electric power and mineral resources.
[5] Mainstream reservoir evaporation includes channel loss below Lee Ferry. For the purpose of this report water passing to Mexico (not used in basin) is shown as an export.

TABLE C-6—Colorado River System Consumptive Uses and Losses Report, P.L. 90-537
Summary of Estimated Water Use by States, Basins, and Types of Use 1975

(1,000 A.F.)

State	Basin	Estimated Beneficial Consumptive Uses and Losses [1]						
		Reservoir Evaporation [2]	Irrigated Agriculture [3]	Municipal and Industrial [4]	Fish and Wildlife, Recreation	Export Outside System	Export Within System	Total
Arizona	Upper	—	8.5	15.3	1.4	—	—	25
	Lower	184.7	4,884.3	381.7	36.2	—	2.2	5,489
	Total	184.7	4,892.8	397.0	37.6	—	2.2	5,514
California	Lower	—	469.3	6.5	—	4,461.5	—	4,937
Colorado	Upper	—	1,166.1	42.9	5.8	562.6	—	1,778
Nevada	Lower	1.1	64.8	89.0	0.8	—	(−2.2)	154
New Mexico	Upper	—	115.0	29.7	0.5	145.2	—	290
	Lower	5.5	16.9	9.9	—	—	—	32
	Total	5.5	131.9	39.6	0.5	145.2	—	322
Utah	Upper	—	482.7	23.9	7.4	101.1	—	615
	Lower	0.7	77.5	1.3	—	3.1	—	83
	Total	0.7	560.2	25.2	7.4	104.2	—	698
Wyoming	Upper	—	253.2	31.3	0.2	6.6	—	291
Other	Upper	607.0	—	—	—	—	—	607
5	Lower	1,480.0	—	—	—	1,655.6	—	3,136
	Total	2,087.0	—	—	—	1,655.6	—	3,743
Colorado River System	Upper	607	2,025	143	15	816	0	3,606
	Lower	1,672	5,513	489	37	6,120	0	13,831
	Total	2,279	7,538	632	52	6,936	0	17,437

[1] From tables UC-1, -7, and LC-1, -3, and -8.
[2] In Upper Basin, reservoir evaporation other than main stem has been assigned to the principal reservoir function.
[3] Includes livestock water use and stockpond evaporation.
[4] Includes water uses for thermal electric power and mineral resources.
[5] Mainstream reservoir evaporation includes channel loss below Lee Ferry. For the purpose of this report water passing to Mexico (not used in basin) is shown as an export.

TABLE UC-1—Upper Colorado River System Consumptive Uses and Losses Report, P.L. 90-537 Estimated Main Stem Reservoir Evaporation [1]

Reservoir Evaporation (1,000 A.F.)

Year	Flaming Gorge	Blue Mesa	Morrow Point	Lake Powell	Total
1971	60	6	2	390	458
1972	73	6	2	396	477
1973	75	7	2	418	502
1974	79	6	2	509	596
1975	79	7	2	519	607
Average	73	6	2	447	528

[1] Undistributed by States.

TABLE UC–2—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 in Upper Basin Change in Contents of Major Reservoirs 1971–75

(1,000 A.F.)

Reporting Area and Reservoir	Usable Capacity	End of Month Contents Sept. 1970	Change in Contents, Water Year 1971	1972	1973	1974	1975	End of Month Contents Sept. 1975
Green River (Wyoming)								
Big Sandy	38	7	12	3	−5	−2	7	22
Eden	7	2	0	1	7	−7	1	4
Fontenelle	344	246	81	15	−6	−21	14	329
	389	255	93	19	−4	−30	22	355
Green River (Utah)								
Huntington North	3	2	1	−1	0	−1	2	3
Joes Valley	50	47	−1	−6	5	−2	7	50
Meeks Cabin	30	0	5	5	6	−6	8	18
Moon Lake	36	4	4	−4	13	−16	14	15
Scofield	66	39	−1	−18	23	−10	11	44
Starvation	152	94	59	−3	3	−94	92	151
Steinaker	33	14	−1	−3	8	−10	10	18
Strawberry	951	164	9	−19	38	17	29	238
	1,321	364	75	−49	96	−122	173	537
Upper Main Stem (Colorado)								
Crawford	13	5	−1	−3	5	−3	3	6
Dillon	251	246	−10	−15	34	−32	15	238
Fruitgrowers	4	2	−1	−1	1	−1	1	1
Green Mountain	147	134	0	−6	1	−19	17	127
Lake Granby	466	425	19	−14	24	−36	3	421
Paonia	18	13	−10	−2	7	−4	2	6
Rifle Gap	11	4	−1	−2	4	−4	3	4
Ruedi	100	100	0	−4	−17	14	2	95
Silver Jack	13	0	9	−4	1	−3	3	6
Taylor Park	106	104	−21	−36	48	−22	18	91
Vega	33	10	−1	−3	4	−6	5	9
Williams Fork	97	76	3	2	−4	−5	2	74
	1,259	1,119	−14	−88	108	−121	74	1,078
San Juan-Colorado (Colorado)								
Jackson Gulch	10	6	−2	−2	4	−4	4	6
Lemon	39	31	−16	−9	15	−17	19	23
Vallecito	126	88	−46	−20	42	−52	52	64
	175	125	−64	−31	61	−73	75	93
San Juan-Colorado (New Mexico)								
Navajo	1,696	1,261	−268	−95	495	−383	384	1,394
Main Stem Regulating Reservoirs								
Blue Mesa	830	810	−278	−21	205	−137	116	695
Morrow Point	116	116	0	0	−1	−3	3	115
Flaming Gorge	3,749	1,791	1,140	535	−285	402	67	3,650
Lake Powell (Surface content)	25,002	12,039	1,570	−1,121	4,796	726	2,192	20,202
Lake Powell (Residual gains & losses) [1]	—	(5,659)	(860)	(247)	(313)	(918)	(941)	(8,938)
	29,697	14,756	2,432	−607	4,715	988	2,378	24,662

[1] Includes bank storage, ungaged inflow, and measurement errors.

TABLE UC–3—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Upper Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use 1971

(1,000 A.F.)

		AGRICULTURE				MUNICIPAL AND INDUSTRIAL[1]					EXPORT[1]		
State	Tributary or Reporting Area	Irrigation	Irrigation Reservoir Evaporation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other[2]	Total	FISH & WILDLIFE RECREATION[1]	Out-side System	With-in System	TOTAL
Arizona	San Juan-Colo.	2.5	3.0	1.1	6.6	0.0	0.0	2.9	2.9	1.6	—	—	11.1
Colorado	Green River	130.0	2.1	6.1	138.2	4.6	4.9	1.9	11.4	3.7	—	—	153.3
	Upper Main Stem	889.7	20.3	11.1	921.1	11.2	0.3	13.3	24.8	2.7	412.8	142.6	1504.0
	San Juan-Colo.	164.3	7.9	5.3	177.5	2.1	0.0	3.0	5.1	0.9	2.2	-142.6	43.1
	Total	1,184.0	30.3	22.5	1,236.8	17.9	5.2	18.2	41.3	7.3	415.0	—	1,700.4
New Mexico	San Juan-Colo.	80.9	18.9	2.8	102.6	2.4	15.7	3.9	22.0	0.6	54.4	—	179.6
Utah	Green River	500.4	25.5	4.2	530.1	7.2	1.9	4.2	13.3	6.9	111.8	—	662.1
	Upper Main Stem	9.6	0.1	0.5	10.2	1.4	0.0	0.8	2.2	0.0	—	—	12.4
	San Juan-Colo.	39.2	14.7	1.9	55.8	1.2	0.0	1.3	2.5	0.9	–4.2	—	55.0
	Total	549.2	40.3	6.6	596.1	9.8	1.9	6.3	18.0	7.8	107.6	—	729.5
Wyoming	Green River	275.2	27.2	5.0	307.4	11.1	5.7	3.3	20.1	0.2	6.0	—	333.7
Upper Basin	Green River	905.6	54.8	15.3	975.7	22.9	12.5	9.4	44.8	10.8	117.8	—	1,149.1
	Upper Main Stem	899.3	20.4	11.6	931.3	12.6	0.3	14.1	27.0	2.7	412.8	142.6	1516.4
	San Juan-Colo.	286.9	44.5	11.1	342.5	5.7	15.7	11.1	32.5	4.0	52.4	-142.6	288.8
	Total	2,091.8	119.7	38.0	2,249.5	41.2	28.5	34.6	104.3	17.5	583.0	—	2,954.3

[1] Includes evaporation from related reservoirs.
[2] Includes urban, rural, and other industrial uses.

TABLE UC–4—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Upper Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use 1972

(1,000 A.F.)

		AGRICULTURE				MUNICIPAL AND INDUSTRIAL [1]					EXPORT [1]		
State	Tributary or Reporting Area	Irrigation	Irrigation Reservoir Evaporation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other [2]	Total	FISH & WILDLIFE RECREATION [1]	Out-side System	With-in System	TOTAL
Arizona	San Juan-Colo.	2.9	2.9	1.1	6.9	0.0	0.0	3.6	3.6	1.7	—	—	12.2
Colorado	Green River	180.8	1.6	5.1	115.5	4.6	4.9	2.0	11.5	2.8	—	—	129.8
	Upper Main Stem	891.1	18.1	12.0	921.2	11.3	0.3	13.6	25.2	2.5	488.8	128.4	1,566.1
	San Juan-Colo.	187.0	7.5	5.6	200.1	2.2	0.0	3.1	5.3	0.9	1.7	−128.4	79.6
	Total	1,186.9	27.2	22.7	1,236.8	18.1	5.2	18.7	42.0	6.2	490.5	—	1,775.5
New Mexico	San Juan-Colo.	93.3	18.0	2.9	114.2	2.6	20.8	4.1	27.5	0.7	41.1	—	183.5
Utah	Green River	504.0	25.6	4.3	533.9	7.3	1.7	4.3	13.3	7.1	130.6	—	684.9
	Upper Main Stem	8.9	0.1	0.4	9.4	1.4	0.0	0.8	2.2	0.0	—	—	11.6
	San Juan-Colo.	34.4	15.6	2.0	52.0	1.1	0.0	1.4	2.5	1.0	−3.4	—	52.1
	Total	547.3	41.3	6.7	595.3	9.8	1.7	6.5	18.0	8.1	127.2	—	748.6
Wyoming	Green River	238.2	31.7	4.9	274.8	12.0	4.5	3.4	19.9	0.2	8.7	—	303.6
Upper Basin	Green River	851.0	58.9	14.3	924.2	23.9	11.1	9.7	44.7	10.1	139.3	—	1,118.3
	Upper Main Stem	900.0	18.2	12.4	930.6	12.7	0.3	14.4	27.4	2.5	488.8	128.4	1,577.7
	San Juan-Colo.	317.6	44.0	11.6	373.2	5.9	20.8	12.2	38.9	4.3	39.4	−128.4	327.4
	Total	2,068.6	121.1	38.3	2,228.0	42.5	32.2	36.3	111.0	16.9	667.5	—	3,023.4

[1] Includes evaporation from related reservoirs.
[2] Includes urban, rural, and other industrial uses.

TABLE UC–5—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Upper Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use 1973

(1,000 A.F.)

State	Tributary or Reporting Area	AGRICULTURE				MUNICIPAL AND INDUSTRIAL [1]				FISH & WILDLIFE RECREATION [1]	EXPORT [1]		TOTAL
		Irrigation	Irrigation Reservoir Evaporation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other [2]	Total		Out-side System	With-in System	
Arizona	San Juan-Colo.	4.0	2.4	0.9	7.3	0.0	0.0	3.2	3.2	0.9	—	—	11.4
Colorado	Green River	95.2	1.5	4.9	101.6	4.7	4.9	2.1	11.7	2.6	—	—	115.9
	Upper Main Stem	732.3	19.0	12.5	763.8	11.4	0.8	13.9	26.1	2.7	439.1	106.6	1,338.3
	San Juan-Colo.	169.1	5.6	3.7	178.4	2.2	0.0	3.3	5.5	0.7	4.0	−106.6	82.0
	Total	996.6	26.1	21.1	1,043.8	18.3	5.7	19.3	43.3	6.0	443.1		1,536.2
New Mexico	San Juan-Colo.	87.8	26.8	2.3	116.9	2.7	20.3	4.3	27.3	0.5	174.9	—	319.6
Utah	Green River	502.1	24.1	3.6	529.8	7.3	1.9	4.3	13.5	6.2	106.8	—	656.3
	Upper Main Stem	9.1	0.1	0.4	9.6	1.4	0.0	0.9	2.3	0.0	—	—	11.9
	San Juan-Colo.	48.2	14.4	1.6	64.2	1.2	0.0	1.5	2.7	0.9	−6.0	—	61.8
	Total	559.4	38.6	5.6	603.6	9.9	1.9	6.7	18.5	7.1	100.8	—	730.0
Wyoming	Green River	235.3	30.8	4.7	270.8	12.8	7.6	3.5	23.9	0.2	8.7	—	303.6
Upper Basin	Green River	832.6	56.4	13.2	902.2	24.8	14.4	9.9	49.1	9.0	115.5	—	1,075.8
	Upper Main Stem	741.4	19.1	12.9	773.4	12.8	0.8	14.8	28.4	2.7	439.1	106.6	1,350.2
	San Juan-Colo.	309.1	49.2	8.5	366.8	6.1	20.3	12.3	38.7	3.0	172.9	−106.6	474.8
	Total	1,883.1	124.7	34.6	2,042.4	43.7	35.5	37.0	116.2	14.7	727.5	—	2,900.8

[1] Includes evaporation from related reservoirs.
[2] Includes urban, rural, and other industrial uses.

TABLE UC–6—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537
Upper Colorado River Basin Estimated Water Uses by State, Major Tributary, and Type of Use 1974

(1,000 A.F.)

		AGRICULTURE				MUNICIPAL AND INDUSTRIAL [1]					EXPORT [1]		
State	Tributary or Reporting Area	Irrigation	Irrigation Reservoir Evaporation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other [2]	Total	FISH & WILDLIFE RECREATION [1]	Out-side System	With-in System	TOTAL
Arizona	San Juan-Colo.	4.3	3.0	1.2	8.5	0.0	5.3	3.7	9.0	1.7	—	—	19.2
Colorado	Green River	112.6	1.7	5.6	119.9	4.7	2.9	2.2	9.8	3.1	—	—	132.8
	Upper Main Stem	946.9	20.2	12.9	980.0	11.6	0.8	14.2	26.6	2.8	500.8	119.9	1,630.1
	San Juan-Colo.	191.8	7.6	4.9	204.3	2.2	0.0	3.4	5.6	0.9	1.2	−119.9	92.1
	Total	1,251.3	29.5	23.4	1,304.2	18.5	3.7	19.8	42.0	6.8	502.0	—	1,855.0
New Mexico	San Juan-Colo.	96.5	20.0	3.0	119.5	2.9	24.6	4.5	32.0	0.7	47.7	—	199.9
Utah	Green River	524.5	31.8	4.8	561.1	7.4	1.8	4.3	13.5	9.2	127.0	—	710.8
	Upper Main Stem	9.9	0.1	0.5	10.5	1.4	0.0	0.9	2.3	—	—	—	12.8
	San Juan-Colo.	41.0	18.8	2.0	61.8	1.1	0.0	1.6	2.7	1.1	−4.1	—	61.5
	Total	575.4	50.7	7.3	633.4	9.9	1.8	6.8	18.5	10.3	122.9	—	785.1
Wyoming	Green River	288.5	33.4	5.2	327.1	13.7	10.1	3.7	27.5	0.2	8.7	—	363.5
Upper Basin	Green River	925.6	66.9	15.6	1,008.1	25.8	14.8	10.2	50.8	12.5	135.7	—	1,207.1
	Upper Main Stem	956.8	20.3	13.4	990.5	13.0	0.8	15.1	28.9	2.8	500.8	119.9	1,642.9
	San Juan-Colo.	333.6	49.4	11.1	394.1	6.2	29.9	13.2	49.3	4.4	44.8	−119.9	372.7
	Total	2,216.0	136.6	40.1	2,392.7	45.0	45.5	38.5	129.0	19.7	681.3	—	3,222.7

[1] Includes evaporation from related reservoirs.
[2] Includes urban, rural, and other industrial uses.

TABLE UC-7—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Upper Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use 1975 [3]

(1,000 A.F.)

State	Tributary or Reporting Area	AGRICULTURE: Irrigation	AGRICULTURE: Irrigation Reservoir Evaporation	AGRICULTURE: Stockpond Evaporation & Livestock	AGRICULTURE: Total	MUNICIPAL AND INDUSTRIAL [1]: Mineral Resources	MUNICIPAL AND INDUSTRIAL [1]: Thermal Electric Power	MUNICIPAL AND INDUSTRIAL [1]: Other [2]	MUNICIPAL AND INDUSTRIAL [1]: Total	FISH & WILDLIFE RECREATION [1]	EXPORT [1]: Out-Side System	EXPORT [1]: With-in System	TOTAL
Arizona	San Juan-Colo.	5.1	2.5	0.9	8.5	0.0	12.4	2.9	15.3	1.4	—	—	25.2
Colorado	Green River	100.2	1.6	5.2	107.0	4.7	3.2	2.2	10.1	2.8	—	—	119.9
	Upper Main Stem	826.1	16.5	10.7	853.3	11.7	0.8	14.5	27.0	2.3	559.8	120.3	1,562.7
	San Juan-Colo.	196.3	5.7	3.8	205.8	2.2	0.0	3.6	5.8	0.7	2.8	−120.3	94.8
	Total	1,122.6	23.8	19.7	1,166.1	18.6	4.0	20.3	42.9	5.8	562.6	—	1,777.4
New Mexico	San Juan-Colo.	89.0	23.6	2.4	115.0	3.0	21.9	4.8	29.7	0.5	145.2	—	290.4
Utah	Green River	393.8	24.0	4.5	422.3	7.4	7.0	4.4	18.8	6.6	107.2	—	554.9
	Upper Main Stem	8.7	0.1	0.4	9.2	1.4	0.0	0.9	2.3	—	—	—	11.5
	San Juan-Colo.	36.9	12.6	1.7	51.2	1.2	0.0	1.6	2.8	0.8	−6.1	—	48.7
	Total	439.4	36.7	6.6	482.7	10.0	7.0	6.9	23.9	7.4	101.1	—	615.1
Wyoming	Green River	207.1	28.1	4.9	253.2	14.6	12.9	3.8	31.3	0.2	6.6	—	291.3
Upper Basin	Green River	714.2	53.7	14.6	782.5	26.7	23.1	10.4	60.2	9.6	113.8	—	966.1
	Upper Main Stem	834.8	16.6	11.1	862.5	13.1	0.8	15.4	29.3	2.3	559.8	120.3	1,574.2
	San Juan-Colo.	327.3	44.4	8.8	380.5	6.4	34.3	12.9	53.6	3.4	141.9	−120.3	459.1
	Total	1,876.3	114.7	34.5	2,025.5	46.2	58.2	38.7	143.1	15.3	815.5	—	2,999.4

[1] Includes evaporation from related reservoirs.
[2] Includes urban, rural, and other industrial uses.
[3] Provisional.

TABLE LC–1—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Colorado River Mainstream Estimated Reservoir Evaporation and Channel Loss [1] 1971–75

(1,000 A.F.)

	Reservoir Evaporation [2]						Channel Loss [3]			
Water Year	Lake Mead	Lake Mohave	Lake Havasu	Senator Wash Reservoir	Other	Total	Assigned Loss, Compact Point to Davis Dam	Apparent Loss, Davis Dam to IB (Table LC–9)	Total	Total Reservoir Evaporation and Channel Loss
1971	739	185	138	2	36	1,100	100	258	358	1,458
1972	724	188	140	2	36	1,090	100	252	352	1,442
1973	800	157	116	2	36	1,111	100	353	453	1,564
1974	813	178	133	2	36	1,162	100	317	417	1,579
1975	814	173	133	2	36	1,158	100	222	322	1,480
Average	778	176	132	2	36	1,124	100	280	380	1,504

[1] Undistributed by States.
[2] Gross evaporation less precipitation on water surface; Lake Mead gross evaporation is from Geological Survey Water Resources Data publications with the exception of 1975 which was estimated. Other impoundments include Palo Verde, Headgate Rock, Imperial, and Laguna diversion dams. These impoundments remain relatively constant throughout the year.
[3] Channel loss above Davis Dam is assigned.

TABLE LC–2—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Colorado River Mainstream and Tributaries Change in Contents—Major Reservoirs [1] 1971–75

(1,000 A.F.)

			Change in Contents, Water Year					
Area and Reservoir	Usable Capacity	End of Month Contents Sept. 1970	1971	1972	1973	1974	1975	End of Month Contents Sept. 1975
Colorado River Mainstream								
Lake Mead	27,377	16,769	117	565	2,725	-818	796	20,154
Lake Mohave	1,810	1,376	65	-37	8	-32	5	1,385
Lake Havasu	619	557	17	-10	-2	1	10	573
Senator Wash Reservoir	14	4	7	-5	-3	3	2	8
	29,820	18,706	206	513	2,728	-846	813	22,120
Gila River								
Salt River Project Reservoirs [2]	2,073	1,137	-431	-157	1,053	-597	63	1,068
San Carlos Reservoir	949	21	18	7	611	-376	-140	141
Lake Pleasant	158	79	-21	-28	80	-52	-38	20
Painted Rock Reservoir (Flood Control)	(2,492)	—	—	—	219	-186	-15	18
	3,180	1,237	-434	-178	1,963	-1,211	-130	1,247
Little Colorado River								
Lyman Reservoir	31	12	-9	-1	22	-13	10	21
Blue Ridge Reservoir	15	11	-9	—	5	-5	3	5
	46	23	-18	-1	27	-18	13	26
Bill Williams River								
Alamo Reservoir (Flood Control)	(1,043)	11	—	—	-1	-1	1	10
Lower Colorado River System	33,046	19,977	-246	334	4,717	-2,076	697	23,403

[1] From Geological Survey Water Resources Data publications and Bureau of Reclamation operational records. Does not include bank storage.
[2] Includes Roosevelt, Apache, Canyon, and Saguaro Lakes on Salt River and Horseshoe and Bartlett Reservoirs on Verde River.

TABLE LC–3—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Colorado River Mainstream Water Uses and Exports by States and Mexico [1] 1971–75

(1,000 A.F.)

Water Year	State	Estimated Consumptive Use [1]: Irrigated Agriculture	Municipal and Industrial	Electric Power	Fish, Widlife and Recreation	Export	Total	Estimated Unmeasured Return Flow [2]	Estimated Consumptive Use Adjusted For Return Flow	Treaty	Minutes 218, 241, and 242	Water Passing to Mexico: Regulatory Waste	Total
1971	Nevada	—	39.2	4.2	0.8	—	44.2	10.3	33.9	—	—	—	—
	Arizona	1,259.2	18.8	0.6	32.8	—	1,311.4	130.5	1,180.9	—	—	—	—
	California	554.3	7.2	—	—	4,630.3	5,191.8	69.5	5,122.3	—	—	—	—
		1,813.5	65.2	4.8	33.6	4,630.3	6,547.4	210.3	6,337.1	1,501.1	55.0	4.7	1,560.8
1972	Nevada	—	65.5	10.7	0.9	—	77.1	17.4	59.7	—	—	—	—
	Arizona	1,204.9	21.5	0.8	33.5	—	1,260.7	131.6	1,129.1	—	—	—	—
	California	568.7	7.6	—	—	4,820.4	5,396.7	68.4	5,328.3	—	—	—	—
		1,773.6	94.6	11.5	34.4	4,820.4	6,734.5	217.4	6,517.1	1,515.5	79.4	5.6	1,600.5
1973	Nevada	—	76.6	11.0	0.8	—	88.4	23.0	65.4	—	—	—	—
	Arizona	1,135.1	21.6	0.8	42.9	—	1,200.4	132.4	1,068.0	—	—	—	—
	California	550.8	6.8	—	—	4,578.4	5,136.0	67.6	5,068.4	—	—	—	—
		1,685.9	105.0	11.8	43.7	4,578.4	6,424.8	223.0	6,201.8	1,444.2	119.8	29.7	1,593.7
1974	Nevada	—	85.5	13.0	0.9	—	99.4	22.9	76.5	—	—	—	—
	Arizona	1,265.9	23.4	1.0	26.5	—	1,316.8	131.9	1,184.9	—	—	—	—
	California	568.2	7.0	—	—	4,968.0	5,543.2	68.2	5,475.0	—	—	—	—
		1,834.1	115.9	14.0	27.4	4,968.0	6,959.4	223.0	6,736.4	1,563.0	151.5	6.0	1,720.5
1975	Nevada	—	80.1	14.3	0.8	—	95.2	27.4	67.8	—	—	—	—
	Arizona	1,282.9	20.5	0.9	36.2	—	1,340.5	132.9	1,207.6	—	—	—	—
	California	536.4	6.5	—	—	4,461.5	5,004.4	67.1	4,937.3	—	—	—	—
		1,819.3	107.1	15.2	37.0	4,461.5	6,440.1	227.4	6,212.7	1,429.1	213.5	13.0	1,655.6

[1] From Bureau of Reclamation calendar year reports "Compilation of Records in Accordance with Article V of the Decree of the Supreme Court of the United States in *Arizona v. California* dated March 9, 1964". Exports to California and water passing to Mexico are demands on system water and consumption is outside system.

[2] Decree accounting does not currently account for certain unmeasured return flows to the mainstream from diversions made therefrom. Estimates of unmeasured return flows shown are for the portion of Las Vegas Wash (Nevada) surface water discharge to Lake Mead from diversions into Las Vegas Valley and for subsurface return flows below Davis Dam. Subsurface return flows were credited to Arizona and California on the basis of irrigated acreage.

TABLE LC-4—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use [1] 1971

(1,000 A.F.)

State	Tributary or Reporting Area	Reservoir Evaporation	Agriculture			Municipal and Industrial				Export		Total
			Irrigation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other [2]	Total	Outside System	Within System	
Arizona	Little Colorado	18.7	52.8	16.7	69.5	0.8	3.1	14.1	18.0	—	10.6	116.8
	Virgin	2.8	3.5	1.0	4.5	—	—	—	—	—	—	7.3
	Bill Williams	3.5	13.2	2.4	15.6	1.5	—	0.4	1.9	—	—	21.0
	Gila	134.0	2,848.0	48.8	2,896.8	56.9	15.3	213.6	285.8	—	(-10.1)	3,306.5
	Remaining Area	1.1	87.2	14.4	101.6	6.1	—	3.4	9.5	—	—	112.2
	Total	160.1	3,004.7	83.3	3,088.0	65.3	18.4	231.5	315.2	—	0.5	3,563.8
Nevada	Muddy	1.1	23.4	0.3	23.7	—	3.5	0.1	3.6	—	—	28.4
	Remaining Area	—	38.3	0.5	38.8	1.5	7.5	55.1	64.1	—	(-34.4) [3]	68.5
	Total	1.1	61.7	0.8	62.5	1.5	11.0	55.2	67.7	—	(-34.4)	96.9
New Mexico	Little Colorado	5.0	6.6	2.9	9.5	1.8	—	2.0	3.8	—	—	18.3
	Gila	0.5	8.6	1.8	10.4	—	—	3.7	3.7	—	—	14.6
	Total	5.5	15.2	4.7	19.9	1.8	—	5.7	7.5	—	—	32.9
Utah	Virgin	0.7	55.1	2.5	57.6	—	—	1.1	1.1	1.3	—	60.7
	Remaining Area	—	3.5	0.5	4.0	—	—	—	—	—	—	4.0
	Total	0.7	58.6	3.0	61.6	—	—	1.1	1.1	1.3	—	64.7
Lower Basin	Little Colorado	23.7	59.4	19.6	79.0	2.6	3.1	16.1	21.8	—	10.6	135.1
	Virgin	3.5	58.6	3.5	62.1	—	—	1.1	1.1	1.3	—	68.0
	Muddy	1.1	23.4	0.3	23.7	—	3.5	0.1	3.6	—	—	28.4
	Bill Williams	3.5	13.2	2.4	15.6	1.5	—	0.4	1.9	—	—	21.0
	Gila	134.5	2,856.6	50.6	2,907.2	56.9	15.3	217.3	289.5	—	(-10.1)	3,321.1
	Remaining Area	1.1	129.0	15.4	144.4	7.6	7.5	58.5	73.6	—	(-34.4)	184.7
	Total	167.4	3,140.2	91.8	3,232.0	68.6	29.4	293.5	391.5	1.3	(−33.9)	3,758.3

[1] Excludes Colorado River mainstream and flood plain. A large portion of the consumptive uses shown herein are satisfied by ground water overdraft.
[2] Includes urban, rural, and other industrial uses.
[3] Includes net export (diversion less return flow) to Nevada from Colorado River mainstream (table LC-3) and from Little Colorado River basin (Arizona) as coal slurry.

TABLE LC-5—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use [1] 1972

(1,000 A.F.)

State	Tributary or Reporting Area	Reservoir Evaporation	AGRICULTURE: Irrigation	AGRICULTURE: Stockpond Evaporation & Livestock	AGRICULTURE: Total	MUNICIPAL AND INDUSTRIAL [1]: Mineral Resources	MUNICIPAL AND INDUSTRIAL [1]: Thermal Electric Power	MUNICIPAL AND INDUSTRIAL [1]: Other [2]	MUNICIPAL AND INDUSTRIAL [1]: Total	EXPORT [1]: Outside System	EXPORT [1]: Inside System	Total
Arizona	Little Colorado	18.1	59.5	16.8	76.3	2.0	3.1	14.4	19.5	—	19.7	133.6
	Virgin	2.8	3.0	1.0	4.0	—	—	—	—	—	—	6.8
	Bill Williams	3.5	12.9	2.3	15.2	1.6	—	0.5	2.1	—	—	20.8
	Gila	127.9	3,153.4	48.8	3,202.2	63.4	15.3	222.8	301.5	—	(-18.0)	3,613.6
	Remaining Area	1.1	98.4	14.5	112.9	6.8	—	3.7	10.5	—	—	124.5
	Total	153.4	3,327.2	83.4	3,410.6	73.8	18.4	241.4	333.6	—	1.7	3,899.3
Nevada	Muddy	1.1	25.7	0.3	26.0	—	3.5	0.1	3.6	—	—	30.7
	Remaining Area	—	41.8	0.5	42.3	1.6	15.1	60.0	76.7	—	(-61.4) [3]	57.6
	Total	1.1	67.5	0.8	68.3	1.6	18.6	60.1	80.3	—	(-61.4)	88.3
New Mexico	Little Colorado	5.0	6.0	2.9	8.9	2.0	—	2.2	4.2	—	—	18.1
	Gila	0.5	8.5	1.8	10.3	—	—	5.8	5.8	—	—	16.6
	Total	5.5	14.5	4.7	19.2	2.0	—	8.0	10.0	—	—	34.7
Utah	Virgin	0.7	64.0	2.5	66.5	—	—	1.2	1.2	0.6	—	69.0
	Remaining Area	—	4.6	0.5	5.1	—	—	—	—	—	—	5.1
	Total	0.7	68.6	3.0	71.6	—	—	1.2	1.2	0.6	—	74.1
Lower Basin	Little Colorado	23.1	65.5	19.7	85.2	4.0	3.1	16.6	23.7	—	19.7	151.7
	Virgin	3.5	67.0	3.5	70.5	—	3.5	1.2	1.2	0.6	—	75.8
	Muddy	1.1	25.7	0.3	26.0	—	3.5	0.1	3.6	—	—	30.7
	Bill Williams	3.5	12.9	2.3	15.2	1.6	—	0.5	2.1	—	—	20.8
	Gila	128.4	3,161.9	50.6	3,212.5	63.4	15.3	228.6	307.3	—	(-18.0)	3,630.2
	Remaining Area	1.1	144.8	15.5	160.3	8.4	15.1	63.7	87.2	—	(-61.4)	187.2
	Total	160.7	3,477.8	91.9	3,569.7	77.4	37.0	310.7	425.1	0.6	(-59.7)	4,096.4

[1] Excludes Colorado River mainstream. A large portion of the consumptive uses shown herein are satisfied by ground water overdraft.
[2] Includes urban, rural, and other industrial uses.
[3] Includes net export (diversion less return flow) to Nevada from Colorado River mainstream (table LC–3) and from Little Colorado River basin (Arizona) as coal slurry.

TABLE LC–6—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin
Estimated Water Use by State, Major Tributary, and Type of Use[1] 1973

(1,000 A.F.)

			Agriculture			Municipal and Industrial				Export		
State	Tributary or Reporting Area	Reservoir Evaporation	Irrigation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other[2]	Total	Outside System	Inside System	Total
Arizona	Little Colorado	19.3	59.1	16.7	75.8	2.3	3.1	14.7	20.1	—	17.6	132.8
	Virgin	2.8	3.1	1.0	4.1	—	—	—	—	—	—	6.9
	Bill Williams	3.2	16.4	2.3	18.7	1.5	—	0.5	2.0	—	—	23.9
	Gila	234.4	3,183.2	50.0	3,233.2	64.8	15.3	234.5	314.6	—	(−15.7)	3,766.5
	Remaining Area	1.1	91.8	15.0	106.8	7.1	—	4.0	11.1	—	—	119.0
	Total	260.8	3,353.6	85.0	3,438.6	75.7	18.4	253.7	347.8	—	1.9	4,049.1
Nevada	Muddy	1.1	28.2	0.3	28.5	—	3.5	0.2	3.7	—	—	33.3
	Remaining Area	—	43.5	0.5	44.0	1.6	15.5	61.4	78.5	—	(−67.3)[3]	55.2
	Total	1.1	71.7	0.8	72.5	1.6	19.0	61.6	82.2	—	(−67.3)	88.5
New Mexico	Little Colorado	5.0	6.1	2.9	9.0	2.0	—	2.3	4.3	—	—	18.3
	Gila	0.7	9.0	1.9	10.9	—	—	6.7	6.7	—	—	18.3
	Total	5.7	15.1	4.8	19.9	2.0	—	9.0	11.0	—	—	36.6
Utah	Virgin	0.7	75.4	2.5	77.9	—	—	1.3	1.3	8.1	—	88.0
	Remaining Area	—	4.6	0.5	5.1	—	—	—	—	—	—	5.1
	Total	0.7	80.0	3.0	83.0	—	—	1.3	1.3	8.1	—	93.1
Lower Basin	Little Colorado	24.3	65.2	19.6	84.8	4.3	3.1	17.0	24.4	—	17.6	151.1
	Virgin	3.5	78.5	3.5	82.0	—	—	1.3	1.3	8.1	—	94.9
	Muddy	1.1	28.2	0.3	28.5	—	3.5	0.2	3.7	—	—	33.3
	Bill Williams	3.2	16.4	2.3	18.7	1.5	—	0.5	2.0	—	—	23.9
	Gila	235.1	3,192.2	51.9	3,244.1	64.8	15.3	241.2	321.3	—	(−15.7)	3,784.8
	Remaining Area	1.1	139.9	16.0	155.9	8.7	15.5	65.4	89.6	—	(−67.3)	179.3
	Total	268.3	3,520.4	93.6	3,614.0	79.3	37.4	325.6	442.3	8.1	(−65.4)	4,267.3

[1] Excludes Colorado River mainstream. A large portion of the consumptive uses shown herein are satisfied by ground water overdraft.
[2] Includes urban, rural, and other industrial uses.
[3] Includes net export (diversion less return flow) to Nevada from Colorado River mainstream (table LC–3) and from Little Colorado River basin (Arizona) as a coal slurry.

TABLE LC–7—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use [1] 1974

(1,000 A.F.)

State	Tributary or Reporting Area	Agriculture				Municipal and Industrial				Export		
		Reservoir Evaporation	Irrigation	Stockpond Evaporation & Livestock	Total	Mineral Resources	Thermal Electric Power	Other [2]	Total	Outside System	Inside System	Total
Arizona	Little Colorado	20.9	55.5	16.7	72.2	2.7	3.1	15.0	20.8	—	14.7	128.6
	Virgin	2.8	3.2	1.0	4.2	—	—	—	—	—	—	7.0
	Bill Williams	3.5	13.0	2.4	15.4	1.4	—	0.6	2.0	—	—	20.9
	Gila	234.9	3,368.9	49.6	3,418.5	60.1	15.3	245.6	321.0	—	(−12.6)	3,961.8
	Remaining Area	1.1	114.9	15.0	129.9	6.6	—	4.1	10.7	—	—	141.7
	Total	263.2	3,555.5	84.7	3,640.2	70.8	18.4	265.3	354.5	—	2.1	4,260.0
Nevada	Muddy	1.1	27.8	0.3	28.1	1.5	3.5	0.2	5.2	—	—	34.4
	Remaining Area	—	45.9	0.5	46.4	1.6	17.4	62.6	81.6	—	(−78.6) [3]	49.4
	Total	1.1	73.7	0.8	74.5	3.1	20.9	62.8	86.8	—	(−78.6)	83.8
New Mexico	Little Colorado	5.0	6.0	2.9	8.9	2.2	—	2.3	4.5	—	—	18.4
	Gila	0.6	9.0	2.0	11.0	—	—	6.8	6.8	—	—	18.4
	Total	5.6	15.0	4.9	19.9	2.2	—	9.1	11.3	—	—	36.8
Utah	Virgin	0.7	79.1	2.6	81.7	—	—	1.3	1.3	0.6	—	84.3
	Remaining Area	—	4.3	0.5	4.8	—	—	—	—	—	—	4.8
	Total	0.7	83.4	3.1	86.5	—	—	1.3	1.3	0.6	—	89.1
Lower Basin	Little Colorado	25.9	61.5	19.6	81.1	4.9	3.1	17.3	25.3	—	14.7	147.0
	Virgin	3.5	82.3	3.6	85.9	—	—	1.3	1.3	0.6	—	91.3
	Muddy	1.1	27.8	0.3	28.1	1.5	3.5	0.2	5.2	—	—	34.4
	Bill Williams	3.5	13.0	2.4	15.4	1.4	—	0.6	2.0	—	—	20.9
	Gila	235.5	3,377.9	51.6	3,429.5	60.1	15.3	252.4	327.8	—	(−12.6)	3,980.2
	Remaining Area	1.1	165.1	16.0	181.1	8.2	17.4	66.7	92.3	—	(−78.6)	195.9
	Total	270.6	3,727.6	93.5	3,821.1	76.1	39.3	338.5	453.9	0.6	(−76.5)	4,469.7

[1] Excludes Colorado River mainstream. A large portion of the consumptive uses shown herein are satisfied by ground water overdraft.
[2] Includes urban, rural, and other industrial uses.
[3] Includes net export (diversion less return flow) to Nevada from Colorado River mainstream (table LC–3) and from Little Colorado River basin (Arizona) as coal slurry.

TABLE LC–8—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Estimated Water Use by State, Major Tributary, and Type of Use [1] 1975

(1,000 A.F.)

State	Tributary or Reporting Area	Reservoir Evaporation	Agriculture: Irrigation	Agriculture: Stockpond Evaporation & Livestock	Agriculture: Total	Municipal and Industrial: Mineral Resources	Municipal and Industrial: Thermal Electric Power	Municipal and Industrial: Other [2]	Municipal and Industrial: Total	Export: Outside System	Export: Inside System	Total
Arizona	Little Colorado	19.4	50.8	16.9	67.7	2.8	3.1	15.0	20.9	—	20.8	128.8
	Virgin	2.8	3.0	1.0	4.0	—	—	—	—	—	—	6.8
	Bill Williams	3.3	13.8	2.4	16.2	1.4	—	0.6	2.0	—	—	21.5
	Gila	158.1	3,477.3	47.0	3,524.3	54.4	15.3	256.9	326.6	—	(−18.6)	3,990.4
	Remaining Area	1.1	107.5	14.5	122.0	6.5	—	4.4	10.9	—	—	134.0
	Total	184.7	3,652.4	81.8	3,734.2	65.1	18.4	276.9	360.4	—	2.2	4,281.5
Nevada	Muddy	1.1	23.5	0.4	23.9	2.2	3.5	0.2	5.9	—	—	30.9
	Remaining Area	—	40.4	0.5	40.9	1.5	18.8	63.9	84.2	—	(−70.0) [3]	55.1
	Total	1.1	63.9	0.9	64.8	3.7	22.3	64.1	90.1	—	(−70.0)	86.0
New Mexico	Little Colorado	5.0	3.2	2.9	6.1	2.3	—	2.3	4.6	—	—	15.7
	Gila	0.5	8.7	2.0	10.7	—	—	5.4	5.4	—	—	16.6
	Total	5.5	11.9	4.9	16.8	2.3	—	7.7	10.0	—	—	32.3
Utah	Virgin	0.7	70.3	2.6	72.9	—	—	1.3	1.3	3.1	—	78.0
	Remaining Area	—	4.1	0.5	4.6	—	—	—	—	—	—	4.6
	Total	0.7	74.4	3.1	77.5	—	—	1.3	1.3	3.1	—	82.6
Lower Basin	Little Colorado	24.4	54.0	19.8	73.8	5.1	3.1	17.3	25.5	—	20.8	144.5
	Virgin	3.5	73.3	3.6	76.9	—	—	1.3	1.3	3.1	—	84.8
	Muddy	1.1	23.5	0.4	23.9	2.2	3.5	0.2	5.9	—	—	30.9
	Bill Williams	3.3	13.8	2.4	16.2	1.4	—	0.6	2.0	—	—	21.5
	Gila	158.6	3,486.0	49.0	3,535.0	54.4	15.3	262.3	332.0	—	(−18.6)	4,007.0
	Remaining Area	1.1	152.0	15.5	167.5	8.0	18.8	68.3	95.1	—	(−70.0)	193.7
	Total	192.0	3,802.6	90.7	3,893.3	71.1	40.7	350.0	461.8	3.1	(−67.8)	4,482.4

[1] Excludes Colorado River mainstream. A large portion of the consumptive uses shown herein are satisfied by ground water overdraft.
[2] Includes urban, rural, and other industrial uses.
[3] Includes net export (diversion less return flow) to Nevada from Colorado River mainstream (table LC–3) and from Little Colorado River basin (Arizona) as coal slurry.

TABLE LC–9—Colorado River System Consumptive Uses and Losses Report, P.L. 90–537 Lower Colorado River Basin Colorado River Mainstream Estimated Channel Losses, Davis Dam to International Boundary [1] 1971–75

(1,000 A.F.)

Item	Drainage Area (1,000 sq. mi.)	Water Year 1971 I	1971 O	1972 I	1972 O	1973 I	1973 O	1974 I	1974 O	1975 I	1975 O	Average 1971–75 I	Average 1971–75 O
Colorado River below Davis Dam, Nev.-Ariz.	169.3	8,266		8,453		7,932		8,844		8,179		8,335	
Lake Evaporation, Lake Havasu-Senator Wash Reservoirs-Others (Table LC–1)			176		178		154		171		171		170
Change in Lake Contents, Lake Havasu-Senator Wash (Table LC–2)			24	15		5			4		12		4
Mainstream Consumptive Use and Exports (Table LC–3)													
Nevada [2]			4		11		11		13		14		11
Arizona [3]			1,181		1,129		1,067		1,184		1,207		1,154
California			5,122		5,328		5,068		5,475		4,937		5,186
Mexico			1,561		1,600		1,594		1,720		1,656		1,626
Estimated Tributary Surface water inflow [4]	73.8	60		30		310		40		40		96	
Apparent Channel Losses below Davis Dam [5]			258		252		353		317		222		280
Totals	243.1	8,326	8,326	8,498	8,498	8,247	8,247	8,884	8,884	8,219	8,219	8,431	8,431

[1] Inflow (I) - Outflow (O). Outflow to Mexico (export) is made up of measured discharge of the Colorado River above Morelos Dam and the various wasteways, drains, and canals flowing to the Colorado River between the northerly and southerly international boundaries and at the Arizona-Sonora boundary.

[2] Includes Mohave Powerplant and minor domestic and agricultural water uses.

[3] Table LC-3 less water use for Lake Mead National Recreation Area and Davis Dam and Government Camp.

[4] Subsurface inflow from tributary area and reduction in ground water storage (Yuma Area) is assumed to balance subsurface outflow to Mexico. Estimated surface water inflow includes Bill Williams and Gila Rivers and a remaining area of about 10,710 square miles.

[5] Computed.