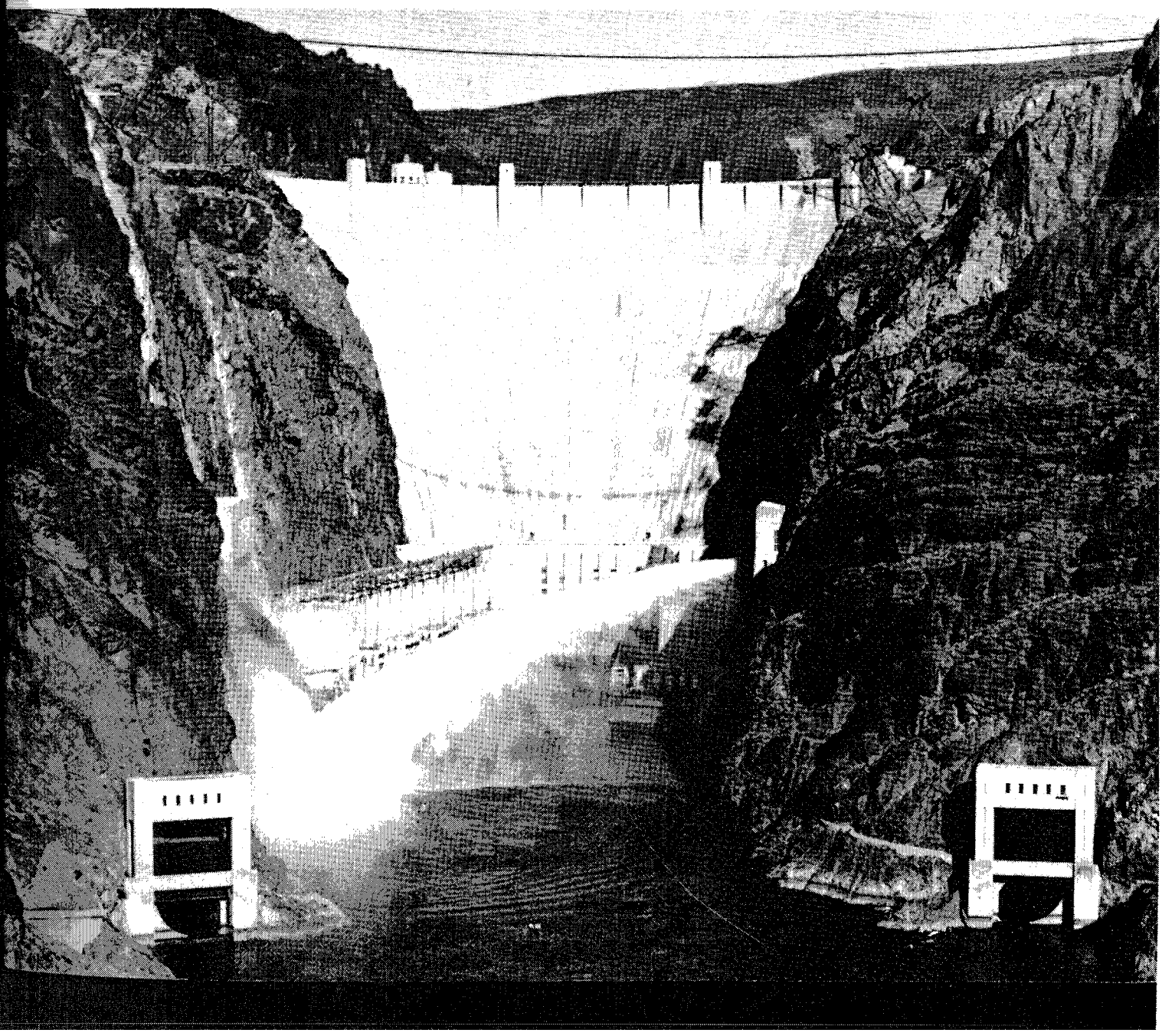
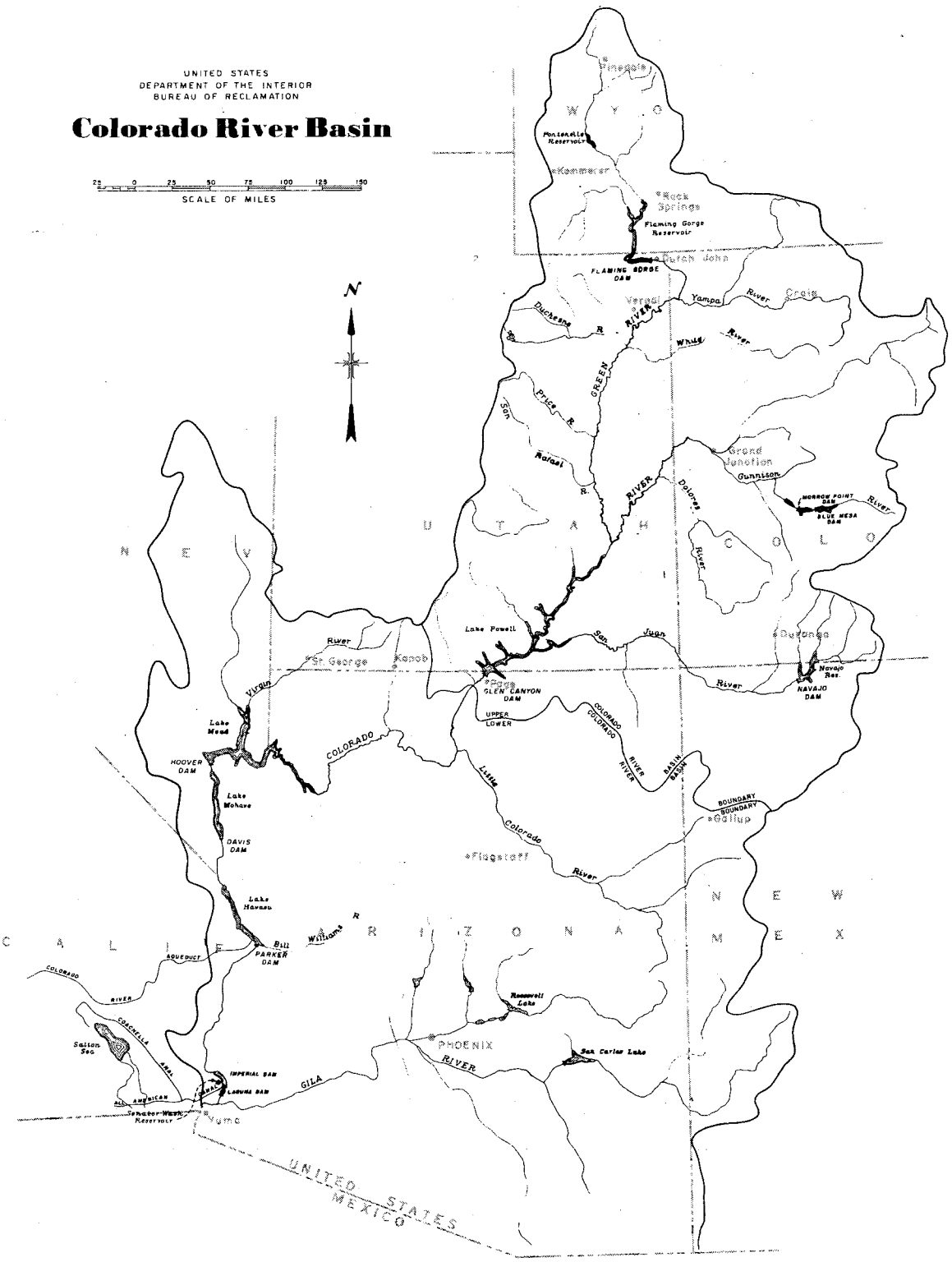
# Annual Report
# Operation of the Colorado River Basin 1978 Projected Operations 1979






Front cover: Unwatering penstocks at Hoover Dam,
Boulder Canyon Project, Arizona-Nevada.

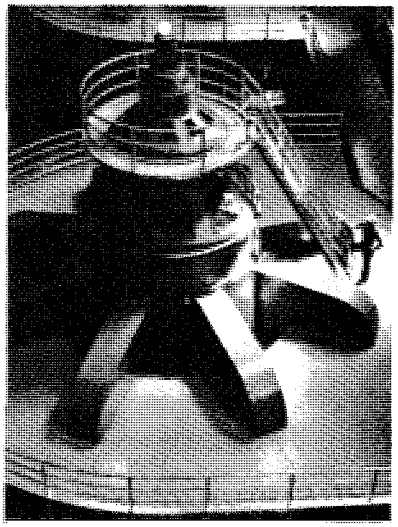
# Annual Report

## Operation of the Colorado River Basin 1978 Projected Operations 1979

**U.S. Department of the Interior**
Cecil D. Andrus, Secretary

**Bureau of Reclamation**
R. Keith Higginson, Commissioner

January 1979



# Contents



(Prepared pursuant to the Colorado River Basin Project Act of 1968, Public Law 90–537)

# Introduction

The operation of the Colorado River Basin during the past year and the projected operations for the current year reflect domestic use, irrigation, hydro-electric power generation, water quality control, fish and wildlife propagation, recreation, flood control, and Colorado River Compact requirements.

Storage and release of water from the Upper Basin reservoirs recognize all applicable laws and relevant factors governing the Colorado River, including the impoundment and release of water in the Upper Basin required by section 602(a) of Public Law 90-537. The operation of the Lower Basin reservoirs reflects Mexican Treaty obligations and Lower Basin contractual commitments.

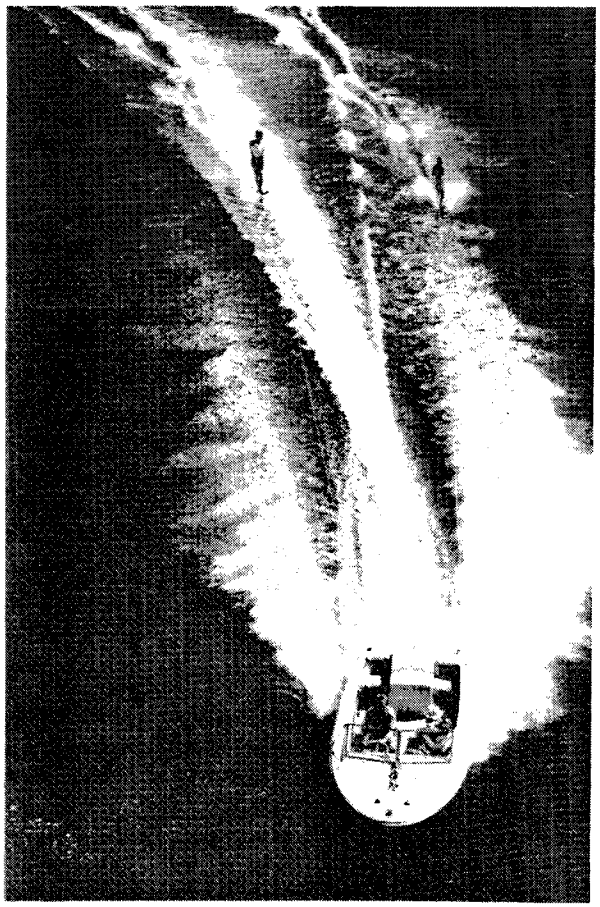
Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219), the decree entered by the Supreme Court of the 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 for Report

Pursuant to the Colorado River Basin Project Act (Public Law 90-537) of 1968, I am pleased to present to the Congress, and to the Governors of the Colorado River Basin States, the eighth annual report on the Operation of the Colorado River Basin.

This report describes the actual operation of the reservoirs in the Colorado River drainage area constructed under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act during water year 1978 and the projected operation of these reservoirs during water year 1979 under the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs," published in the Federal Register June 10, 1970.

Cecil D. Andrus, Secretary
U.S. Department of the Interior



**Water skiing at Blue Mesa Reservoir, Curecanti Unit, Colorado River Storage Project, Colorado.**

# Actual Operations under Criteria—Water Year 1978

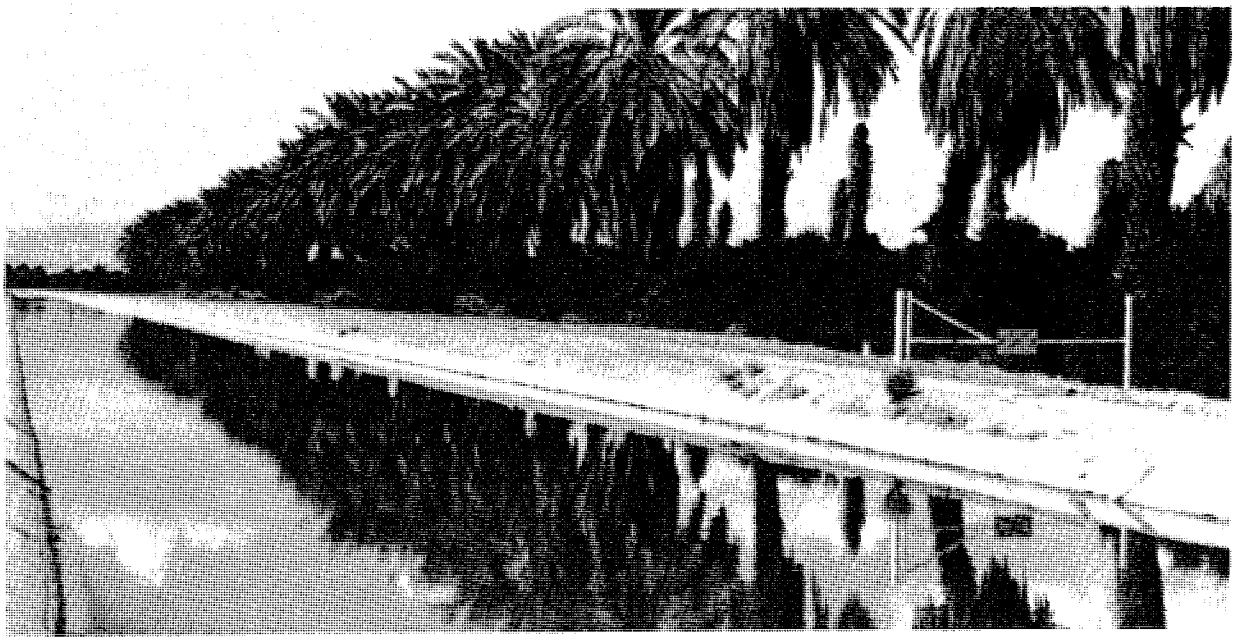
Water supply in the Colorado River system during 1978 returned to near normal, recovering from the general drought conditions of the previous two years. Precipitation accumulations in the Upper Basin for the first 6 months of the water year were 120 percent of normal and snow measurements of April 1, 1978, indicated 130 percent of normal snowpack.

Since the content of Lake Powell was less than the content of Lake Mead 8,214,000 acre-feet were released from Lake Powell. Releases from the other reservoirs through September 1978 were made accordingly to meet the power productions and other multiple purpose requirements of the system. At the beginning of January and each month thereafter, through June, the forecast was revised based on precipitation and snow data collected through the month, and the scheduled operation was revised accordingly.

The Colorado River Basin runoff at Lake Powell for water year 1978 was 11,504,000 acre-feet or 98 percent of the longtime average.

The major storage reservoirs on the Colorado River system stayed within the normal operating range during water year 1978 and downstream water requirements were met from carry over reservoir storage. Aggregate storage at the end of water year 1978 was 44,863,000 acre-feet which represented an increase of 2,722,000 acre-feet from water year 1977.

A description of the actual operations of each of the reservoirs in the Colorado River Basin follows. Charts 1-10 show hydrographs of the monthly outflow from the reservoirs and water surface elevation and active storage in the reservoirs for water year 1978.



**The Coachella Canal near Indio, All-American Canal System, California.**

# Upper Basin Reservoirs

## Fontenelle Reservoir

During the past year, Fontenelle Reservoir was operated for power generation, flood control, fish and wildlife enhancement, and recreation. During the fall and winter of 1977-78, the Reservoir water surface elevation was reduced slowly from elevation 6500 feet at the beginning of the water year to a low elevation of 6486 feet prior to spring runoff in March. The minimum release during the fall and winter was 600 cubic feet per second ($ft^3/s$). Maximum inflow of 11,000 $ft^3/s$ occurred in mid-June. A late spring and cool early summer temperatures combined to extend the spring runoff well into summer. The Reservoir reached maximum capacity of 358,000 acre-feet at elevation 6507 feet on July 4, 1978 and remained full until late August. (Chart 1.)

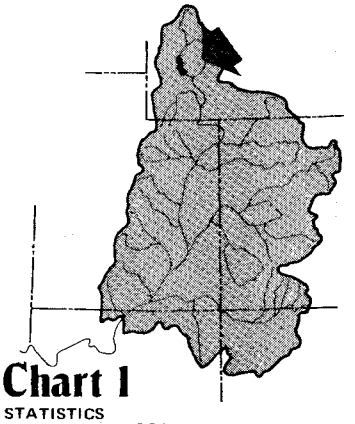


**Chart 1**

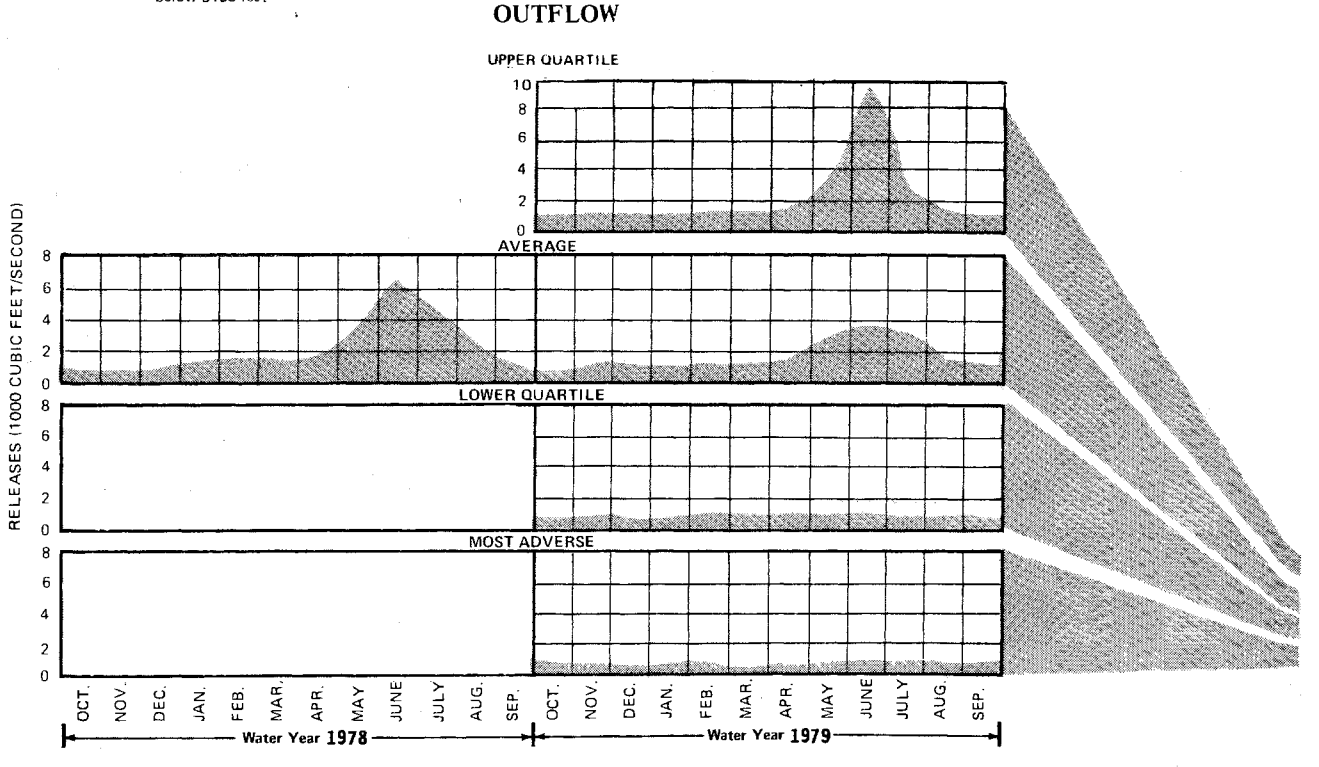
**STATISTICS**
**ACTIVE STORAGE***

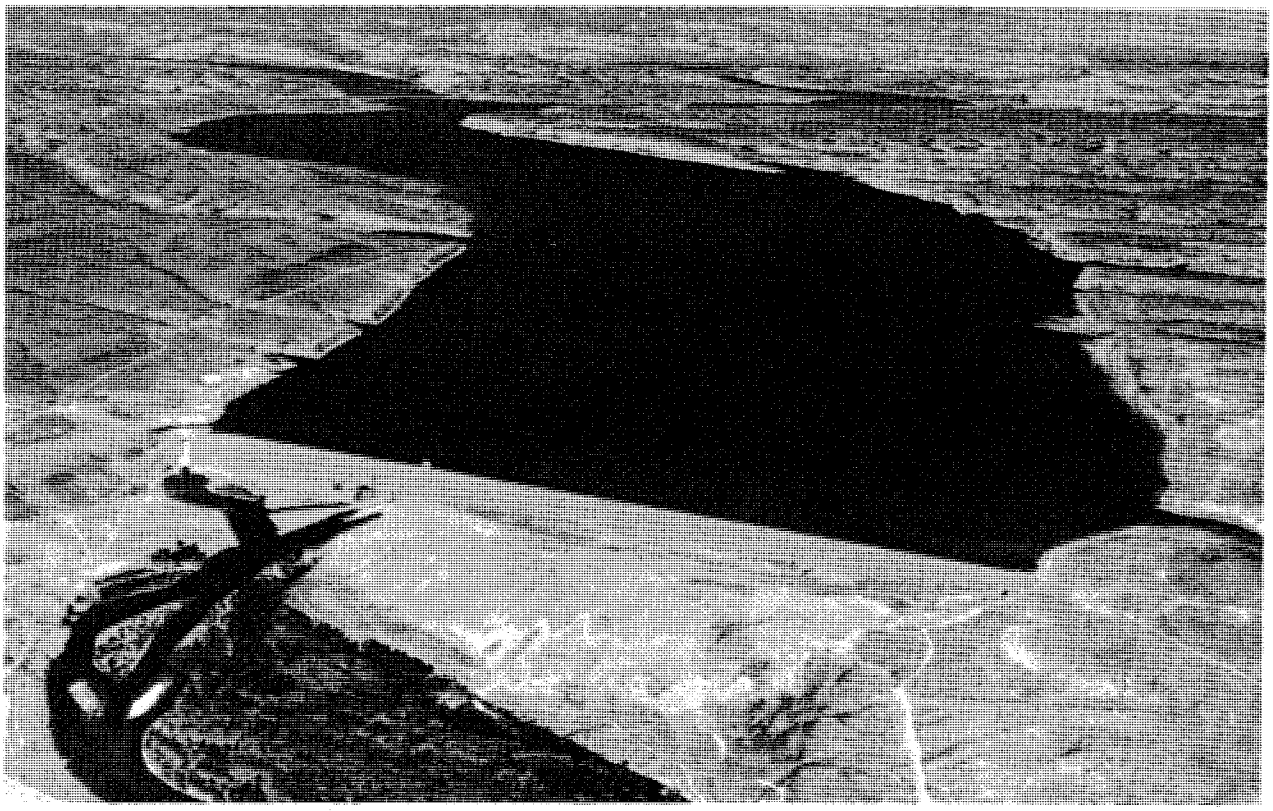
| RESERVOIR | (ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 344,834 | 6506 |
| RATED HEAD | 233,789 | 6491 |
| MINIMUM POWER | 194,962 | 6485 |
| SURFACE AREA (FULL) | 8058 ACRES | |
| RESERVOIR LENGTH (FULL) | 18 MILES | |

**POWER PLANT**

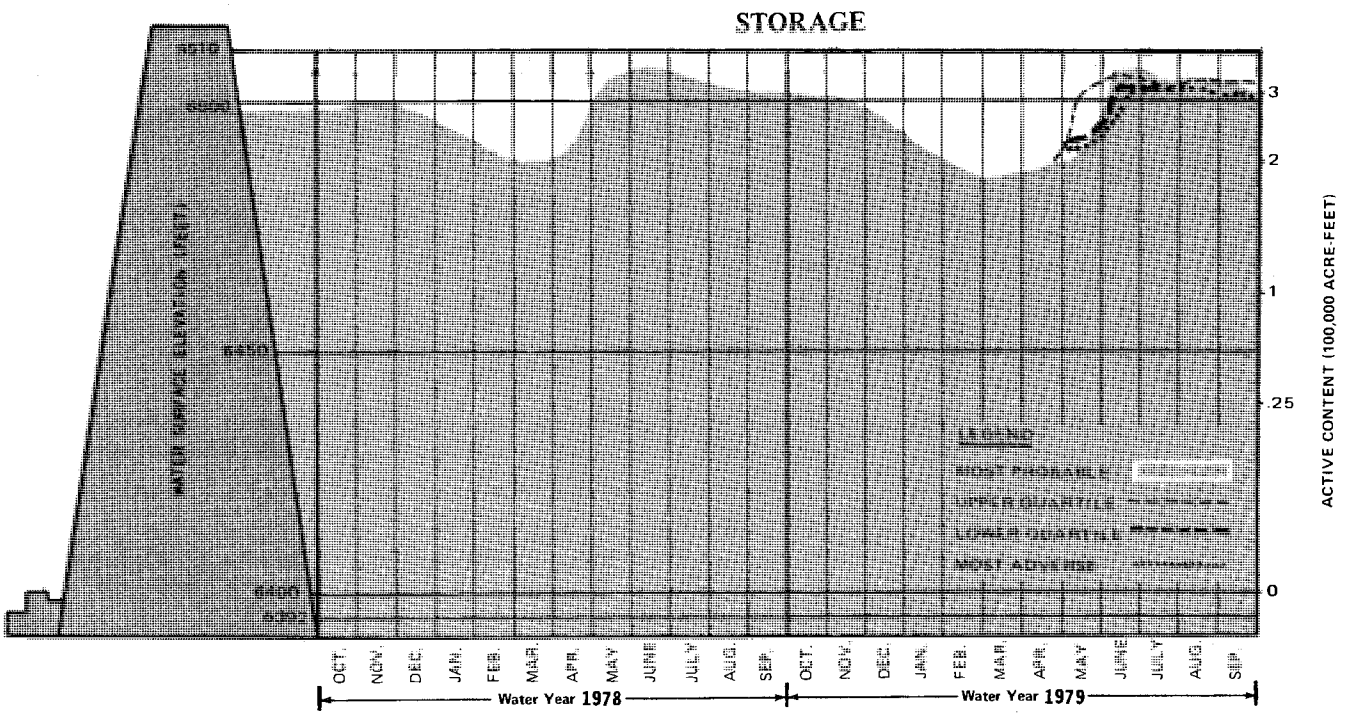
| | |
|---|---|
| NUMBER OF UNITS | 1 |
| TOTAL CAPACITY | 10,000 KILOWATTS |

**does not include 563 acre feet of dead storage below 6408 feet*

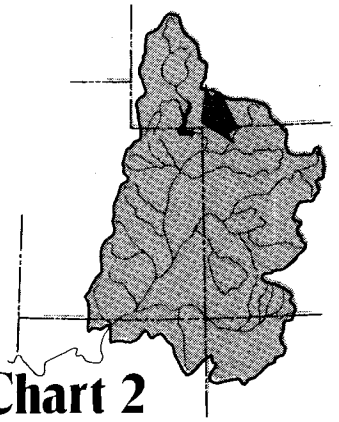




**Fontenelle Dam and Reservoir, Seedskadee Project, Wyoming.**



## Flaming Gorge Reservoir



# Chart 2

**STATISTICS**
**ACTIVE STORAGE***

| RESERVOIR | ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 3,749,000 | 6040 |
| RATED HEAD | 1,062,000 | 5946 |
| MINIMUM POWER | 233,000 | 5871 |
| SURFACE AREA (FULL) | 42,020 ACRES | |
| RESERVOIR LENGTH (FULL) | 91 MILES | |

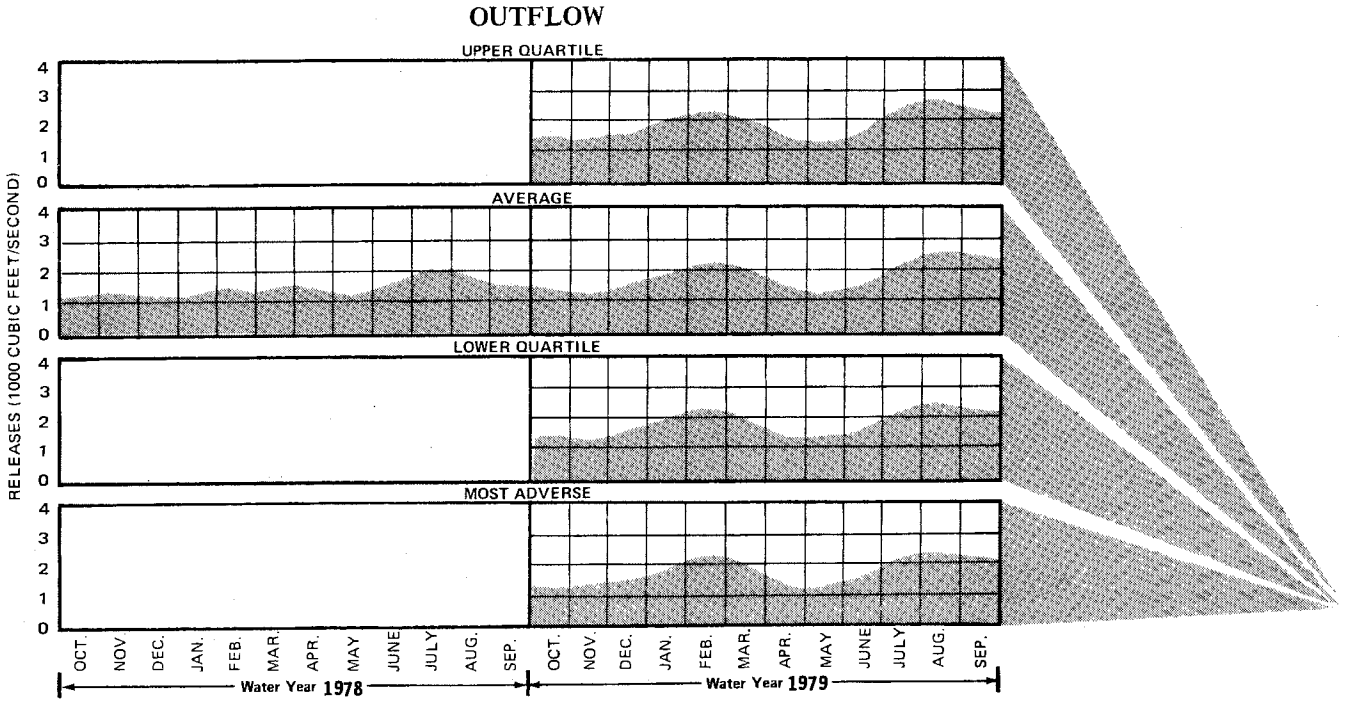
**POWER PLANT**

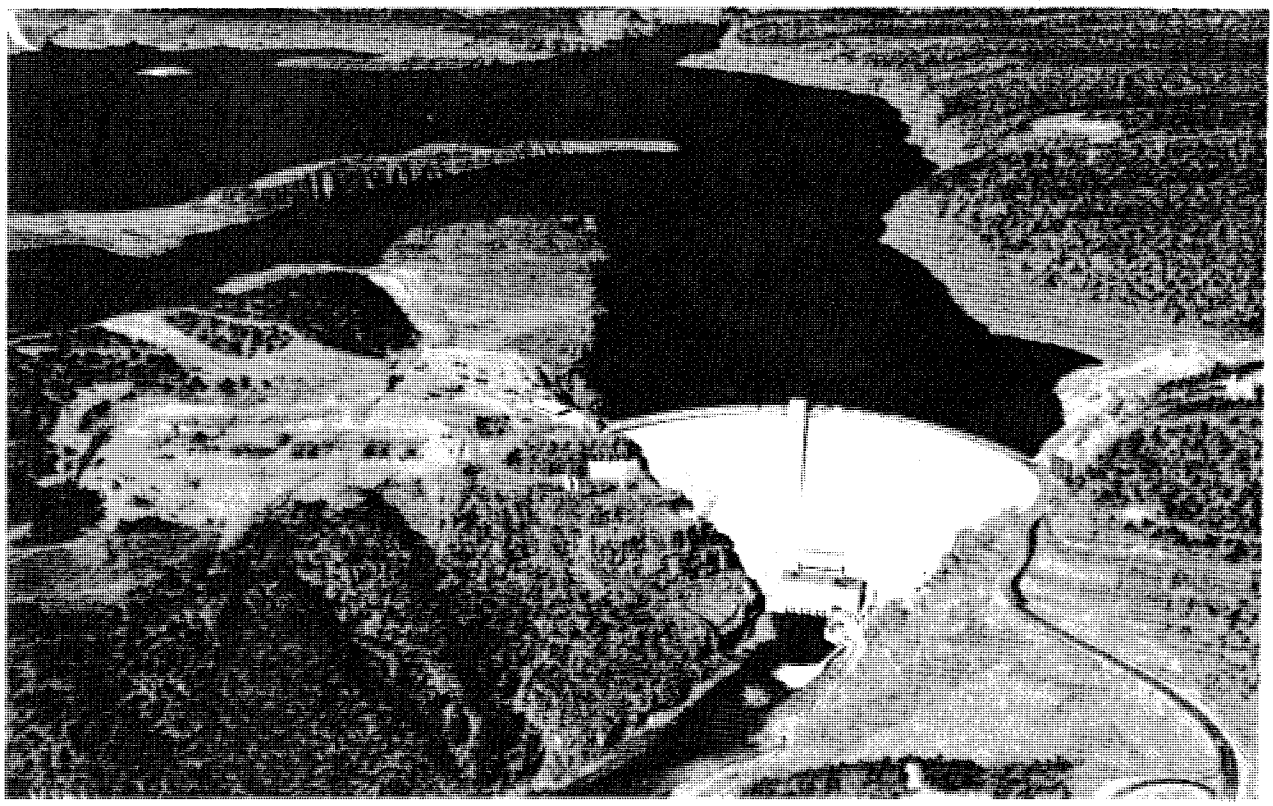
| | |
|---|---|
| NUMBER OF UNITS | 3 |
| TOTAL CAPACITY | 108,000 KILOWATTS |

**does not include 40,000 acre feet of dead storage below 5740 feet*

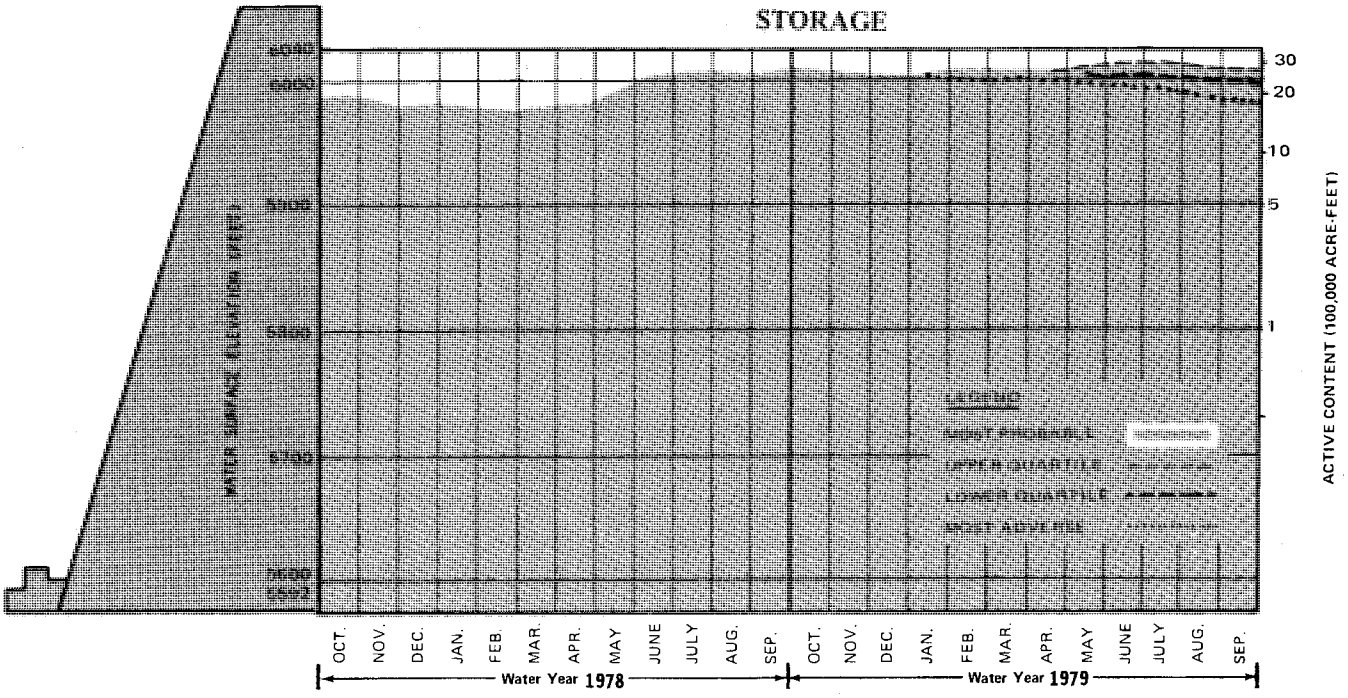
Flaming Gorge Reservoir is operated as part of the Colorado River Storage Project in accordance with governing compacts and laws to provide river regulations, power production, recreation opportunities, and fish and wildlife benefits.

On September 30, 1977, the water surface was at elevation 5991 feet. The active storage was 2,078,000 acre-feet. The April through July 1978 runoff above Flaming Gorge was 1,470,000 acre-feet or 130 percent of the long-time average. With this runoff, the reservoir reached its seasonal maximum elevation of 6016 feet on August 20, 1978, with an active storage of 2,850,000 acre-feet, and remained near this elevation through September 1978. (Chart 2.)

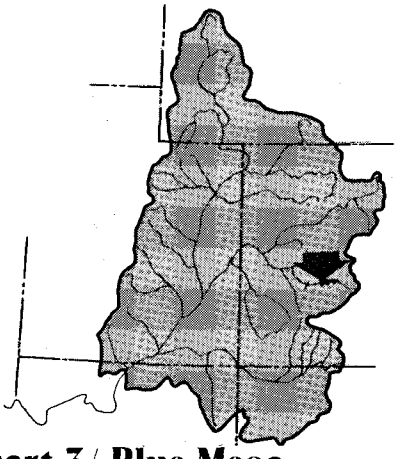




**Flaming Gorge Dam and Reservoir, Flaming Gorge Unit, Colorado River Storage Project, Utah-Wyoming.**



## Curecanti Unit—Blue Mesa Reservoir



# Chart 3/ Blue Mesa Reservoir

**STATISTICS**
**ACTIVE STORAGE***

| RESERVOIR | (ACRE-FEET) | ELEVATION |
|---|---|---|
| MAXIMUM STORAGE | 829,523 | 7519 |
| RATED HEAD | 249,395 | 7438 |
| MINIMUM POWER | 81,070 | 7393 |
| SURFACE AREA (FULL) | 9180 ACRES | |
| RESERVOIR LENGTH (FULL) | 24 MILES | |

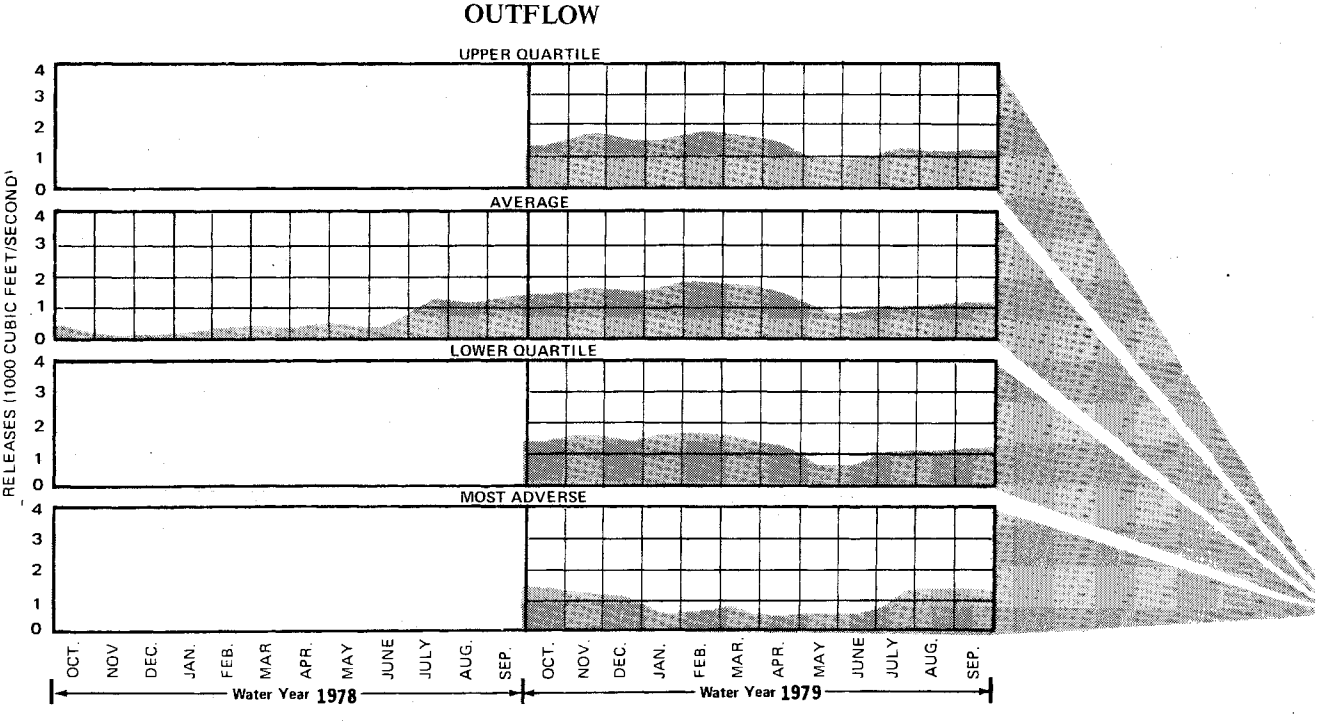
**POWER PLANT**

| | |
|---|---|
| NUMBER OF UNITS | 2 |
| TOTAL CAPACITY OF UNITS | 60,000 KILOWATTS |

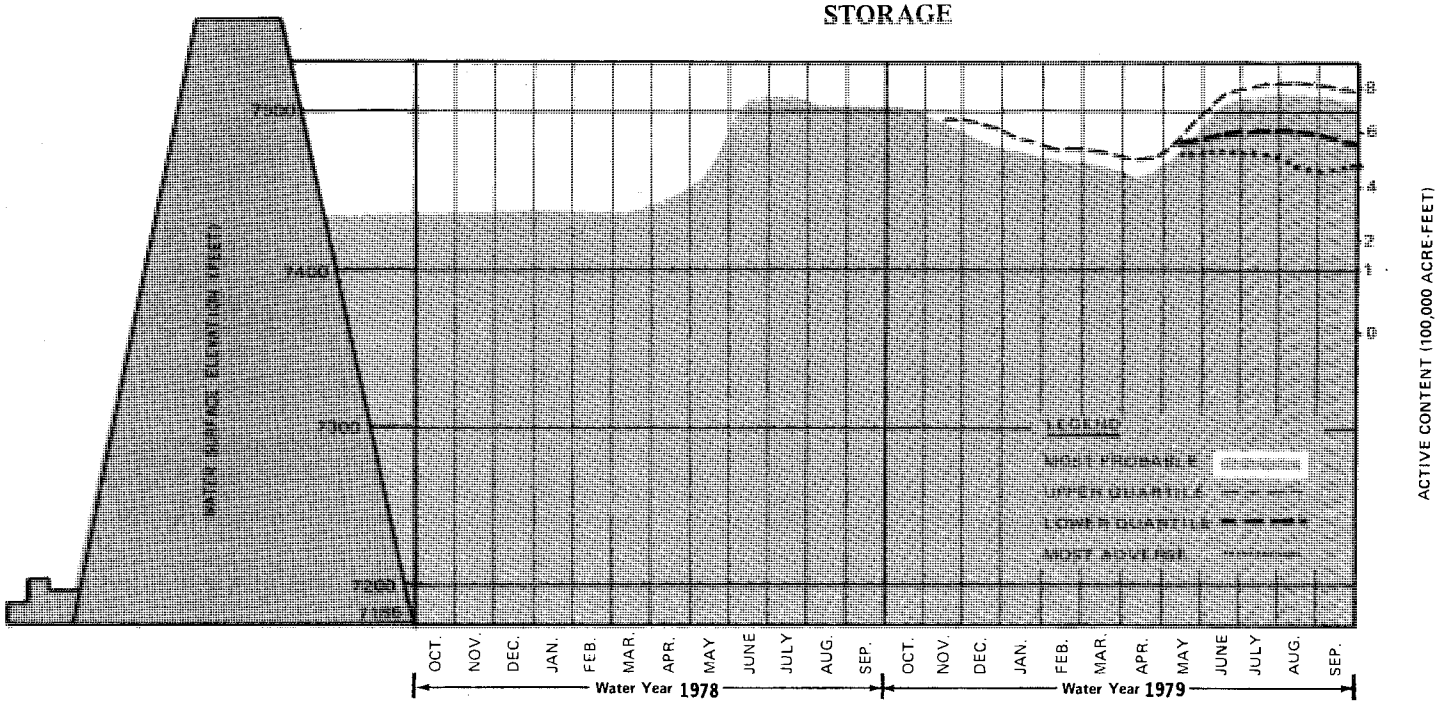
**does not include 111,232 acre feet of dead storage below 7358 feet*

At the end of September 1977 Blue Mesa Reservoir contained 221,000 acre-feet of active water storage with a water surface elevation of 7431 feet. During April and July 1978 inflow to Blue Mesa was 815,000 acre-feet or 103 percent of normal with a 1978 water year total of 1,026,000 acre-feet. Near average inflow caused the Reservoir to rise through the summer to elevation 7508 feet with the content of 729,000 acre-feet by the end of September 1978. During water year 1978, minimum flow of 200 cubic feet per second was maintained below the Gunnison Tunnel Diversion to protect fishery resources in the river.

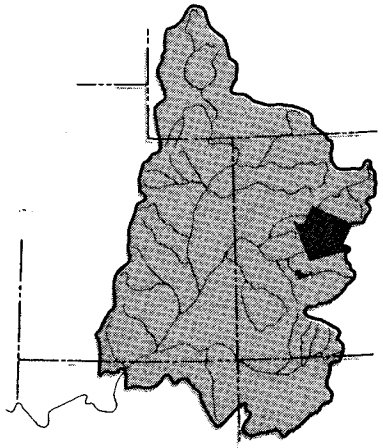
The March 1, 1978, forecast of April through July 1978 inflow to Blue Mesa was 1,000,000 acre-feet. The flood control regulations did not require evacuation space during the snowmelt season; consequently, the operation of Blue Mesa did not include releases for flood control. (Chart 3.)



**Blue Mesa Dam, Curecanti Unit, Colorado River Storage Project, Colorado.**



## Curecanti Unit—Morrow Point Reservoir



Morrow Point Reservoir was essentially full during water year 1978. On September 30, 1977, the Reservoir contained 114,000 acre-feet of actual storage at water surface elevation 7156 feet. Its inflow is extensively controlled by Blue Mesa Reservoir which is upstream.

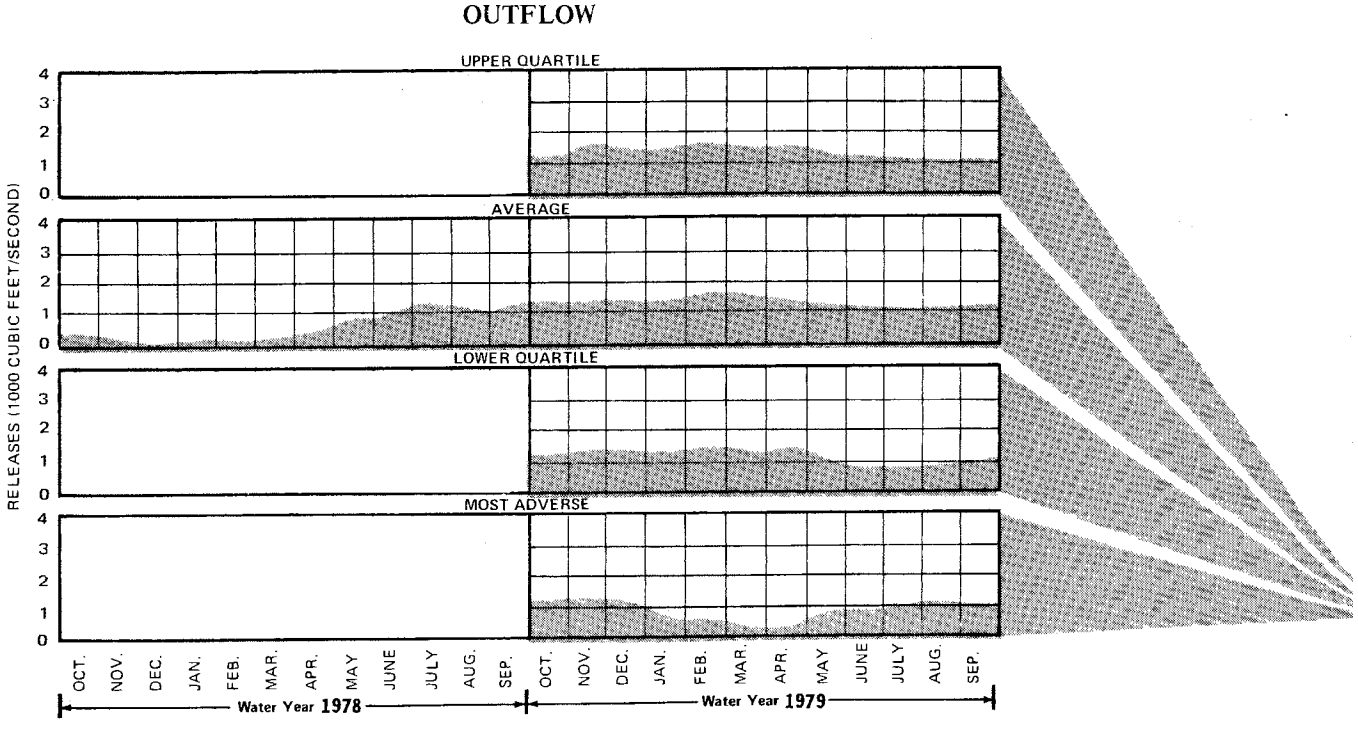
Morrow Point is expected to be operated at or near full capacity regardless of snowmelt runoff. (Chart 4.)

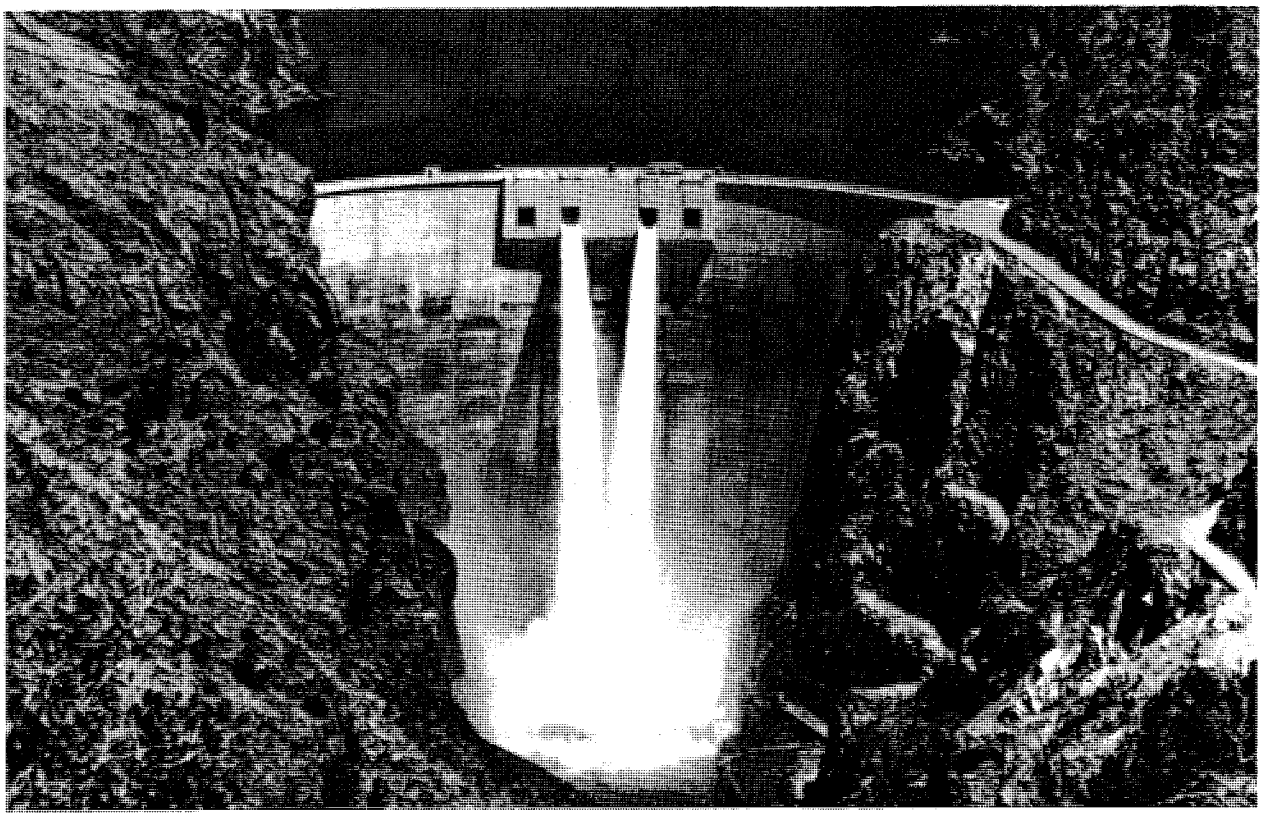
# Chart 4 / Morrow Point Reservoir

**STATISTICS**

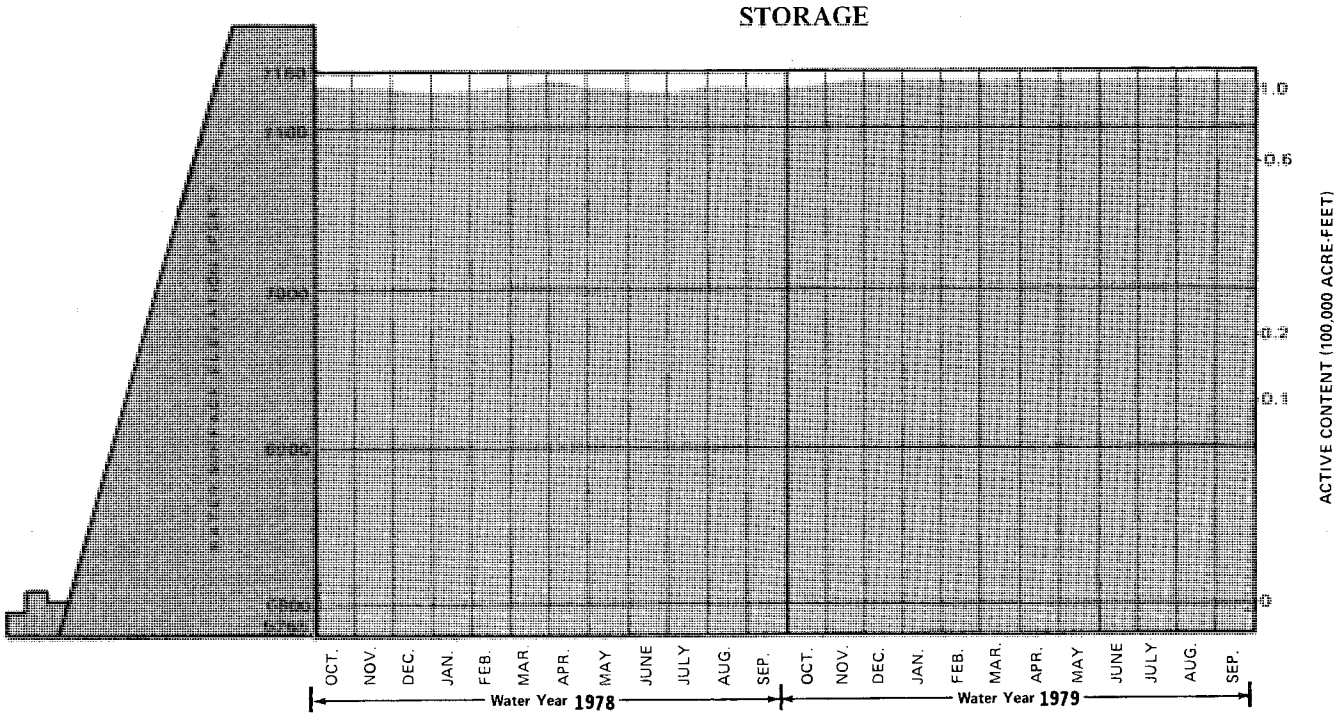
| **ACTIVE STORAGE* RESERVOIR** | **(ACRE-FEET)** | **ELEVATION (FEET)** |
|---|---|---|
| MAXIMUM STORAGE | 117,025 | 7160 |
| RATED HEAD | 79,805 | 7108 |
| MINIMUM POWER | 74,905 | 7100 |
| SURFACE AREA (FULL) | 817 ACRES | |
| RESERVOIR LENGTH (FULL) | 11 MILES | |
| **POWER PLANT** | | |
| NUMBER OF UNITS | 2 | |
| TOTAL CAPACITY OF UNITS | 120,000 KILOWATTS | |

**does not include the 165 acre feet of dead storage below 6808 feet*

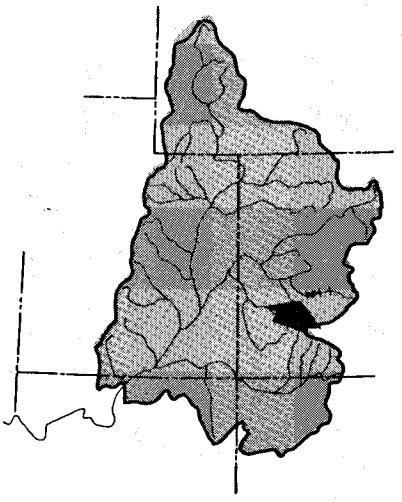




**Morrow Point Dam and Reservoir, Curecanti Unit, Colorado River Storage Project, Colorado.**



## Curecanti Unit—Crystal Dam and Reservoir

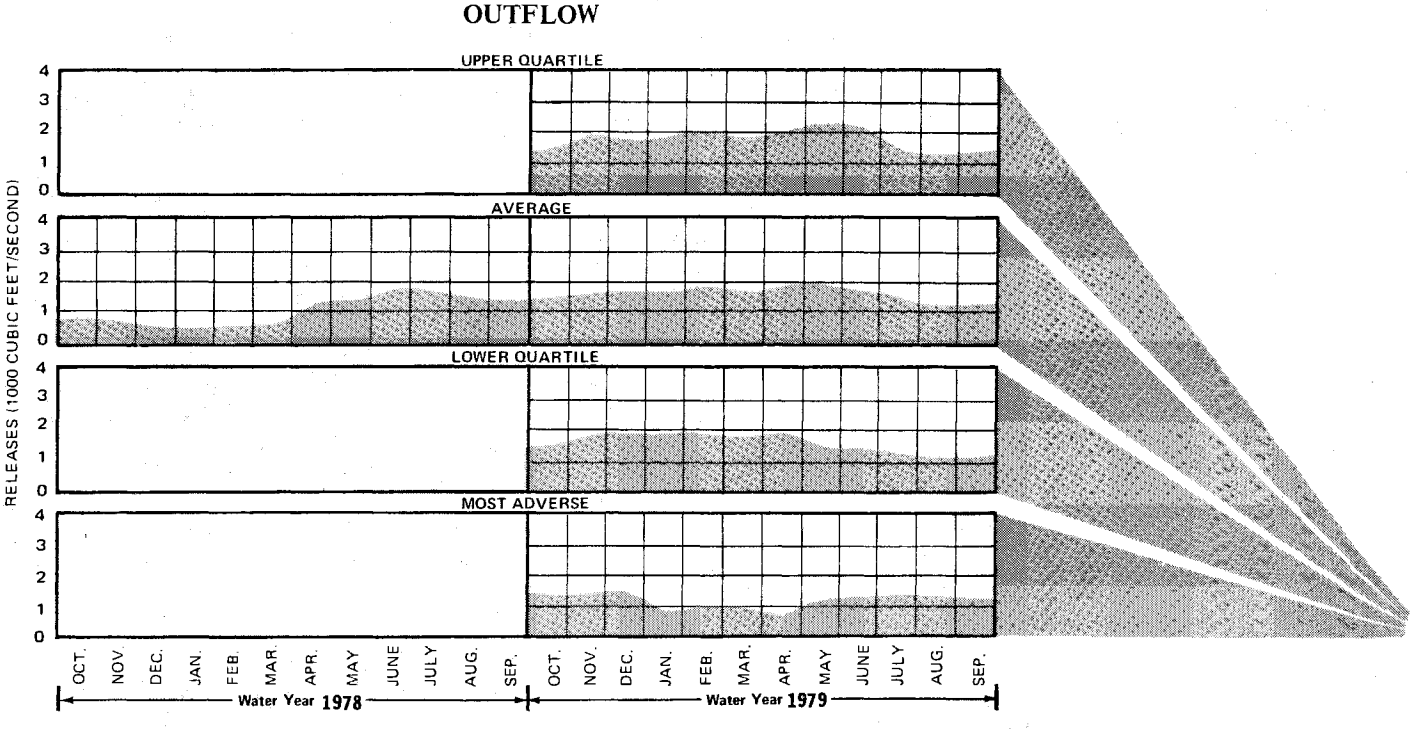


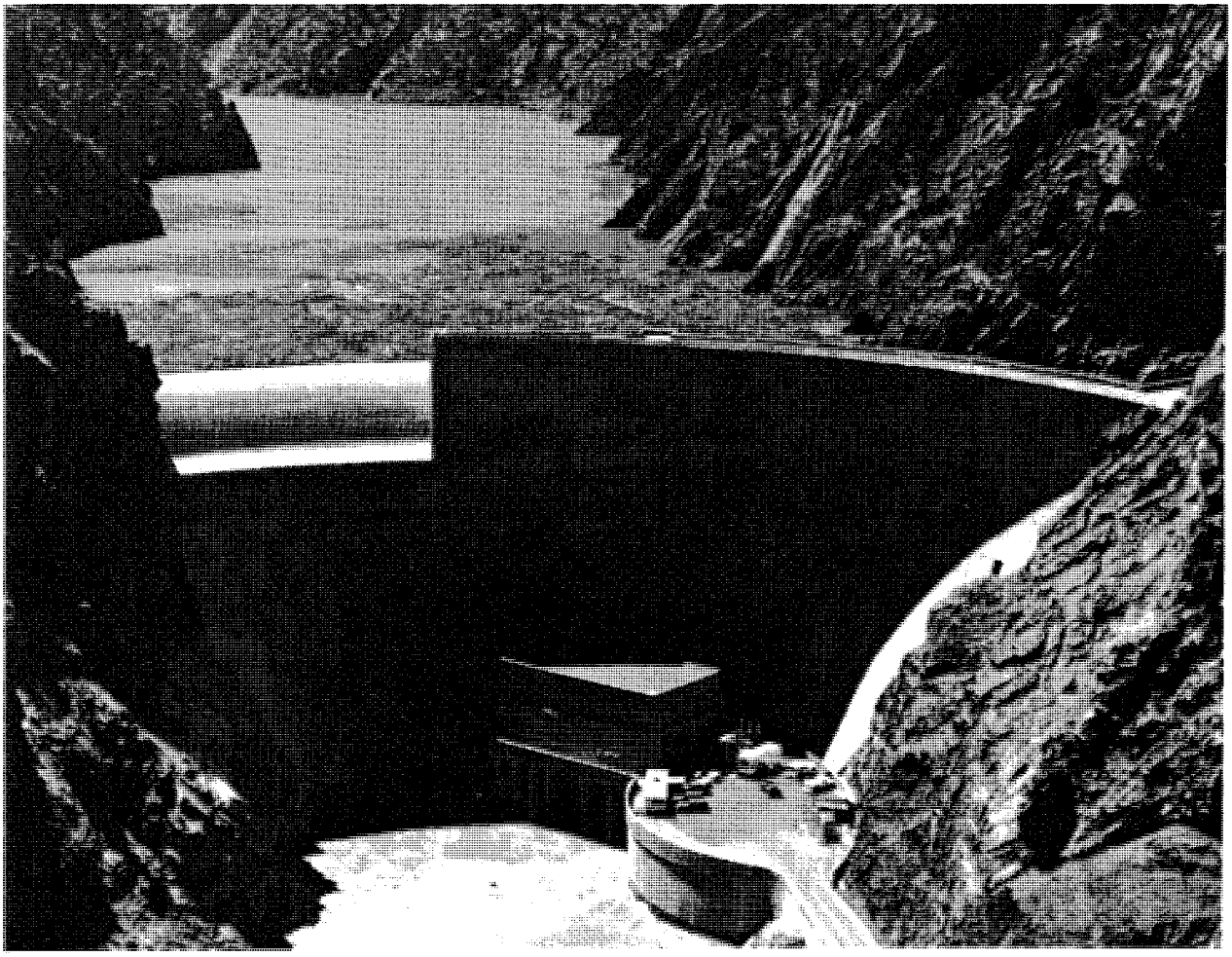
1978 marked the first complete year of operation of Crystal Reservoir since the completion of Crystal Dam. The primary function of this Reservoir is to regulate variable releases from Morrow Point to an even flow in the Gunnison River downstream. On September 30, 1978, Crystal Reservoir had an active content of 14,000 acre-feet at elevation 6753 feet. Maximum elevation for the Reservoir is elevation 6755 feet. Crystal Reservoir is expected to be operated at or near full capacity regardless of the snowmelt runoff. (Chart 5.)

# Chart 5/Crystal Reservoir

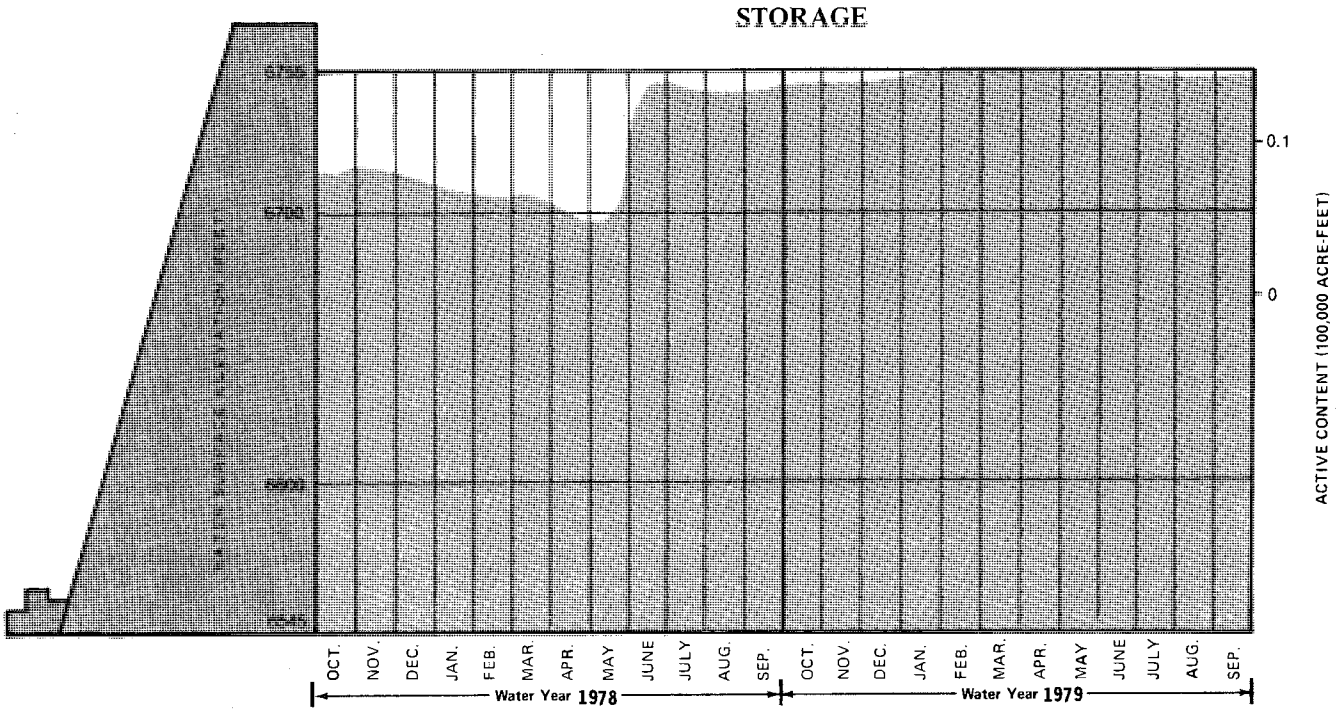
| STATISTICS<br>ACTIVE STORAGE*<br>RESERVOIR | (ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 17,573 | 6755 |
| RATED HEAD | 13,886 | 6742 |
| MINIMUM POWER | 10,619 | 6729 |
| SURFACE AREA (FULL) | 301 ACRES | |
| RESERVOIR LENGTH (FULL) | 7 MILES | |
| **POWER PLANT** | | |
| NUMBER OF UNITS | 1 | |
| TOTAL CAPACITY OF UNITS | 28,000 KILOWATTS | |

**does not include 8,200 acre feet of dead storage below 6670 feet.*





Crystal Dam and Reservoir, Curecanti Unit, Colorado.



## Navajo Reservoir

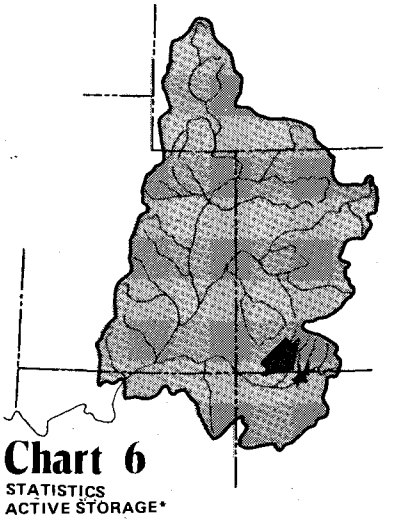


**Chart 6**

STATISTICS
ACTIVE STORAGE*

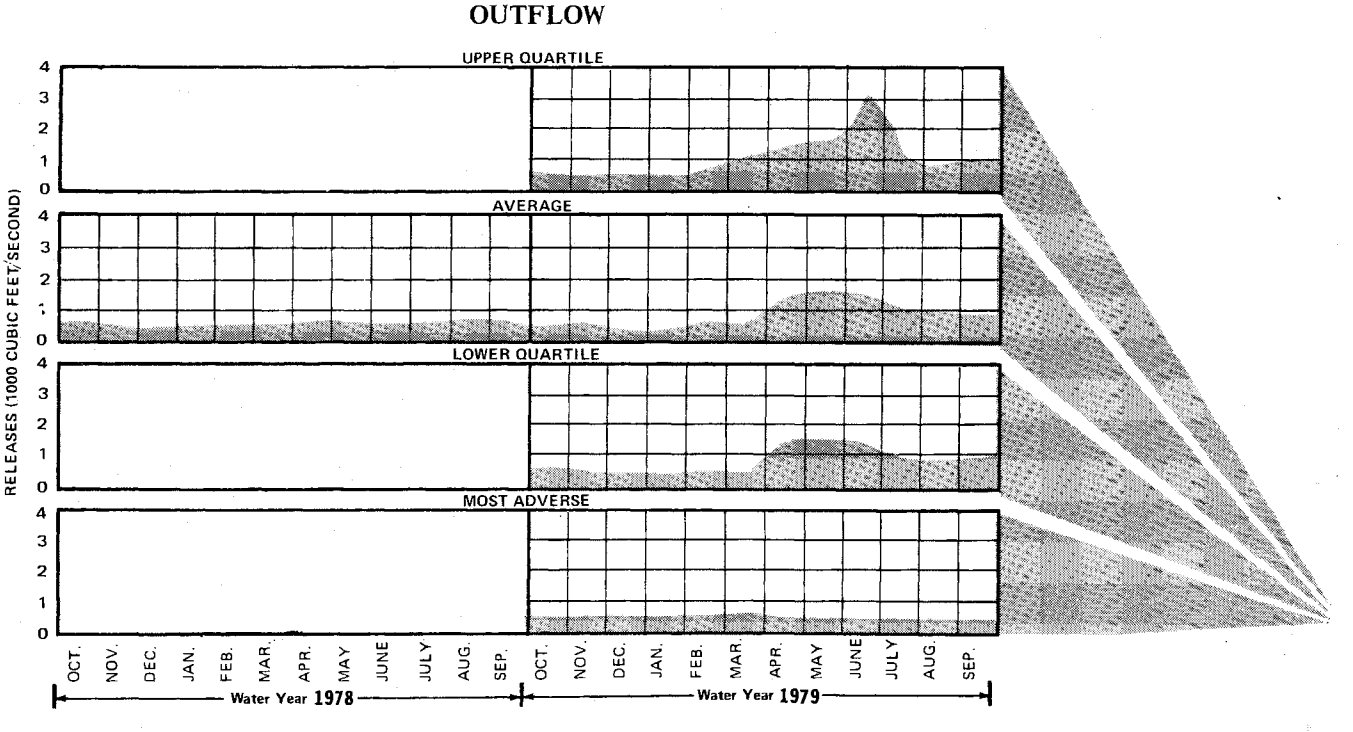
| RESERVOIR | (ACRE FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 1,696,400 | 6085 |
| INACTIVE STORAGE | 660,500 | 5990 |
| SURFACE AREA (FULL) | 15,610 ACRES | |
| RESERVOIR LENGTH (FULL) | 33 MILES | |

**does not include 12,600 acre feet of dead storage below elevation 5775 feet*

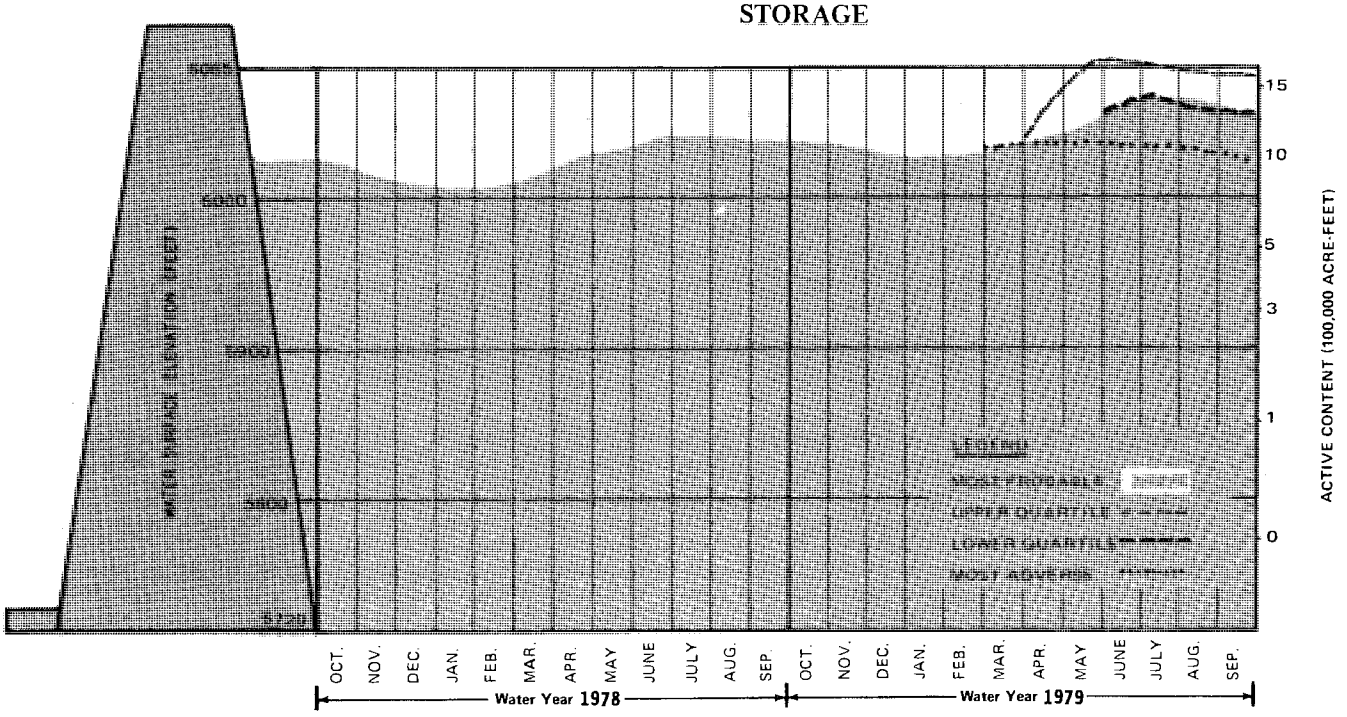
During water year 1978 Navajo Reservoir was kept within the limits specified by the Bureau of Reclamation in its interim operating rules. The Reservoir water surface was lowered to elevation 6022 feet during the winter of 1977 and spring of 1978. The actual April-July inflow to Navajo Reservoir was 528,000 acre-feet or 72 percent of the longtime April through July runoff average.

Navajo Reservoir is operated under a normal flood control plan. On March 1, 1978, Navajo Reservoir had 935,000 acre-feet of water storage. The April-July inflow forecast on March 1 was 700,000 acre-feet. Based on the March 1 forecast the current flood control rules allowed the Reservoir to be full and the scheduled operation of the Reservoir did not include any releases specifically for flood control. (Chart 6.)

Releases were scheduled to conserve water in storage while providing for minimum downstream flows at points of diversion for consumptive use and for maintenance of fish and wildlife resources.



Navajo Dam and Reservoir, Navajo Unit, Colorado River Storage Project, New Mexico-Colorado.



## Glen Canyon Dam, Lake Powell

During water year 1978 Lake Powell was operated as part of the Colorado River Storage Project in accordance with governing contracts and laws to provide river regulation, optimum power production, recreation opportunities, and fish and wildlife benefits.

On September 30, 1977, Lake Powell water surface elevation was at 3637 feet with an active storage of 16,143,000 acre-feet.

During the fall and winter months of 1977-78 the reservoir water level dropped about 14 feet to elevation 3623 feet. Low releases from Glen Canyon during April, May, and June allowed the Bureau to integrate purchased power into the Colorado River Storage Project Systems when it was readily available. The April-July 1978 runoff of the Colorado River at Lees Ferry, Arizona was 8,995,000 acre-feet or 115 percent of the longtime average. By the end of the water year 1978, the level of Lake Powell had risen a total of 3 feet to elevation 3640 feet. (Chart 7.)

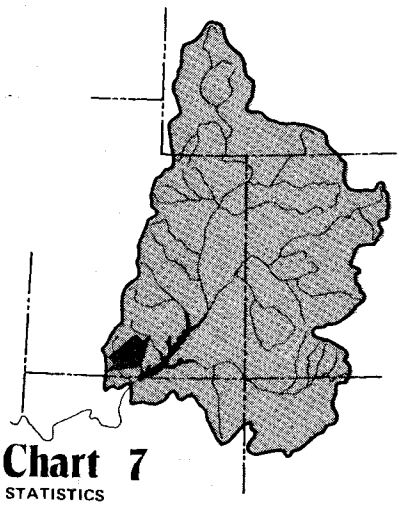
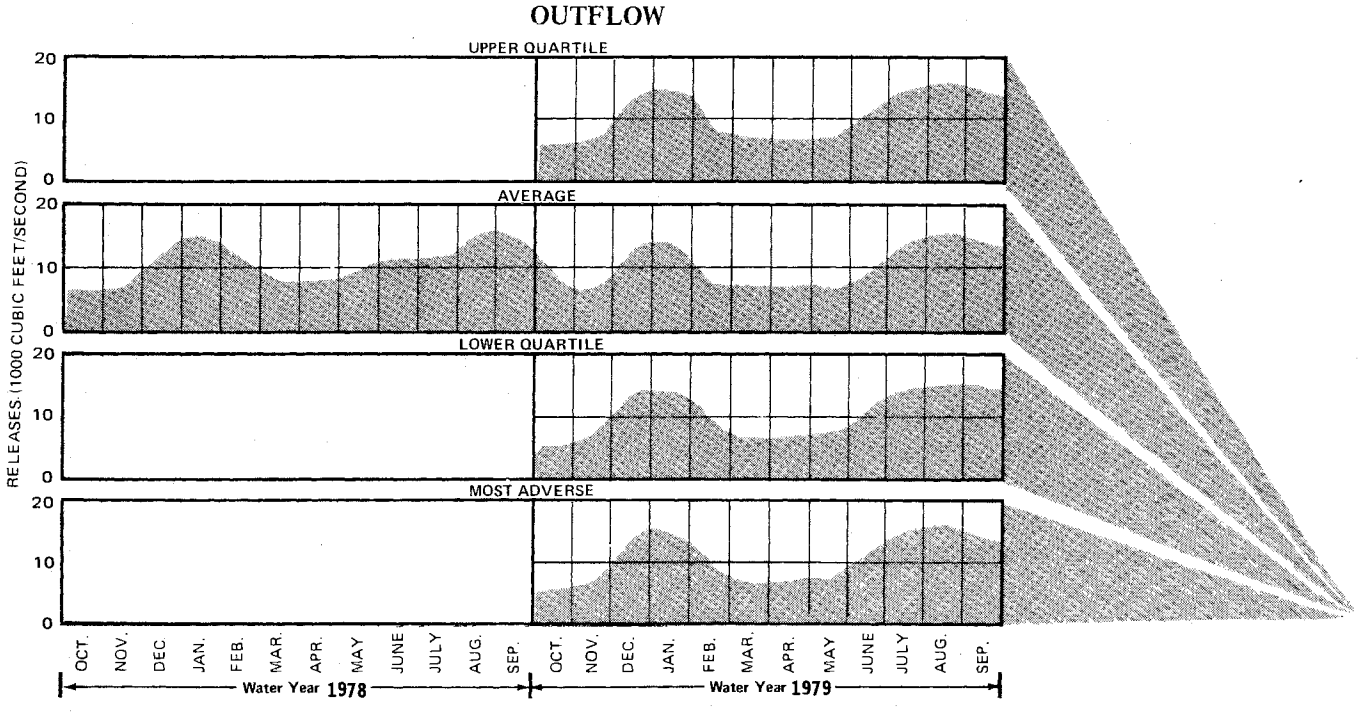


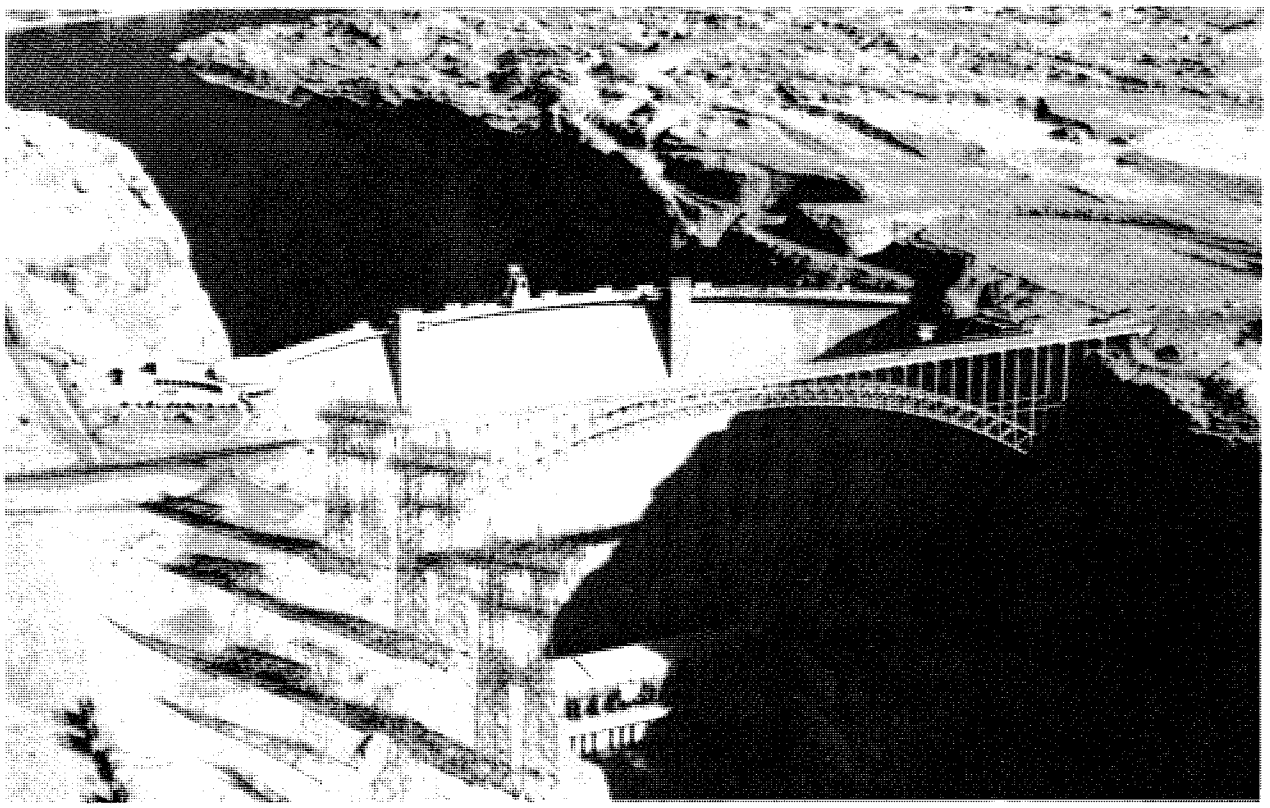
**Chart 7**

**STATISTICS**
**ACTIVE STORAGE***

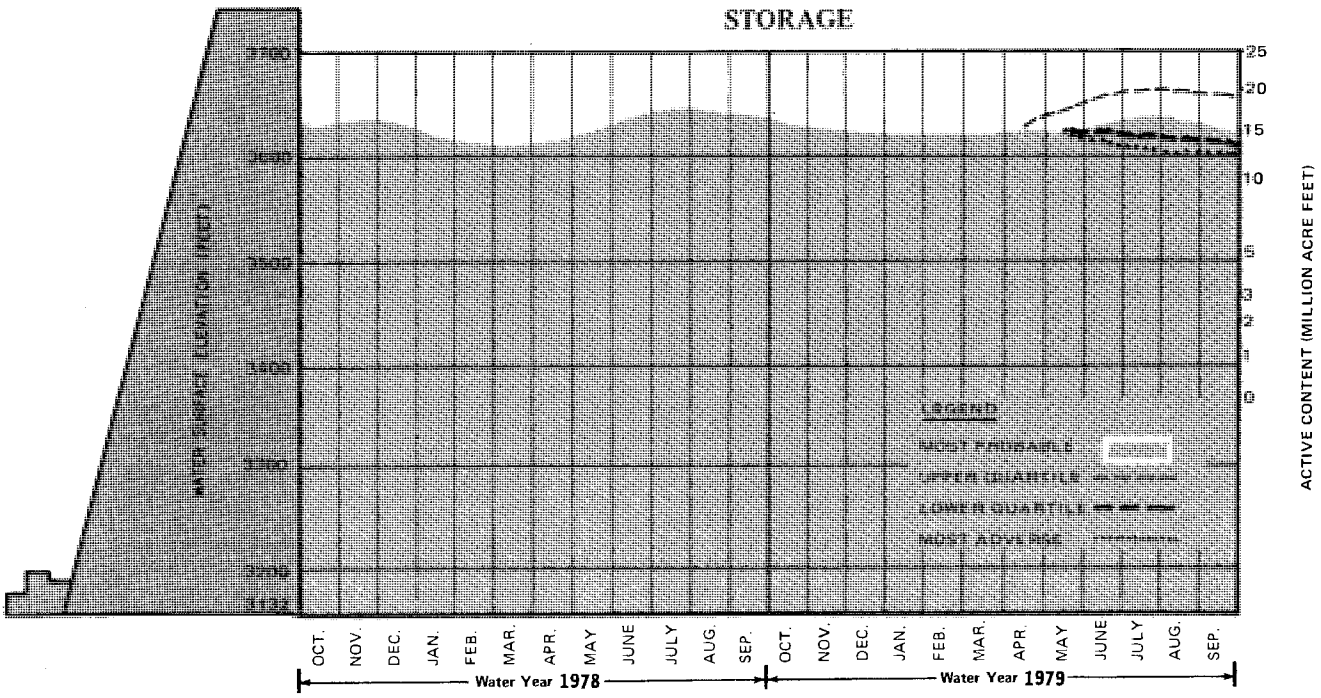
| RESERVOIR | (ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 25,002,000 | 3700 |
| RATED HEAD | 9,428,000 | 3570 |
| MINIMUM POWER | 4,126,000 | 3490 |
| SURFACE AREA (FULL) | 161,390 ACRES | |
| RESERVOIR LENGTH (FULL) | 186 MILES | |
| **POWER PLANT** | | |
| NUMBER OF UNITS | 8 | |
| TOTAL CAPACITY OF UNITS | 900,000 KILOWATTS | |

**does not include 1,998,000 acre feet of dead storage below 3370 feet*





Glen Canyon Dam and Lake Powell, Glen Canyon Unit, Colorado River Storage Project, Arizona-Utah.



# Lower Basin Reservoirs

## Hoover Dam, Lake Mead

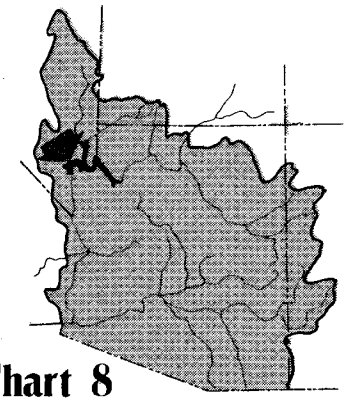


**Chart 8**

**STATISTICS**
**ACTIVE STORAGE***

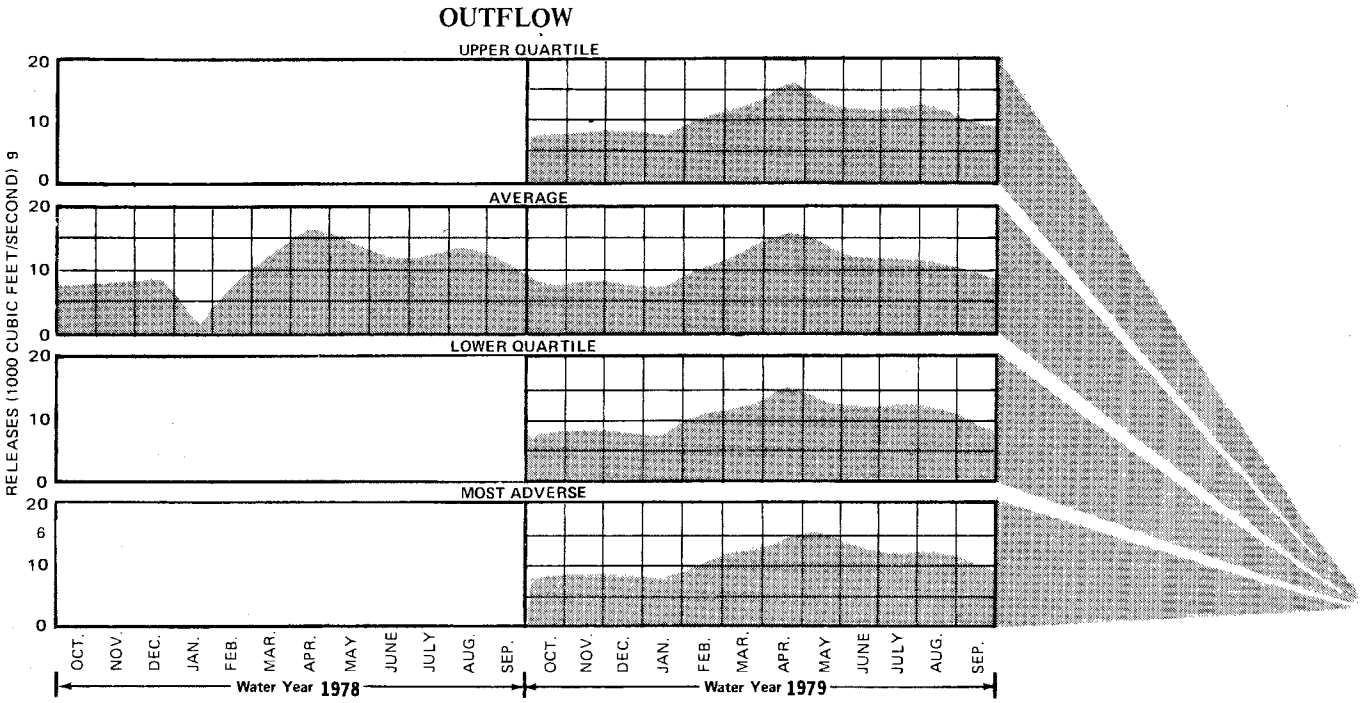
| RESERVOIR | (ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 27,377,000 | 1229 |
| RATED HEAD | 13,653,000 | 1123 |
| MINIMUM POWER POOL | 10,024,000 | 1083 |
| SURFACE AREA (FULL) | 162,700 ACRES | |
| RESERVOIR LENGTH (FULL) | 115 MILES | |
| **POWER PLANT** | | |
| NUMBER OF UNITS | 17 | |
| TOTAL CAPACITY OF UNITS | 1,344,800 KILOWATTS | |

**does not include 2,378,000 acre-feet of dead storage below elevation 895 feet*

At the beginning of water year 1978, Lake Mead had a water-surface elevation of 1180 feet and an active storage of 20,205,000 acre-feet. During the water year, releases were made to meet downstream water use requirements in the United States and Mexico, programmed levels of Lakes Mohave and Havasu, and transit losses which include river and reservoir evaporation, uses by phreatophytes, changes in bank storage, unmeasured inflows, and diversions. The total release from Lake Mead through Hoover Dam was 7,685,000 acre-feet. At the end of the water year, Lake Mead had a water-surface elevation of 1185 feet and an active storage of 20,869,000 acre-feet, which reflect an increase in storage during the water year of 664,000 acre-feet.

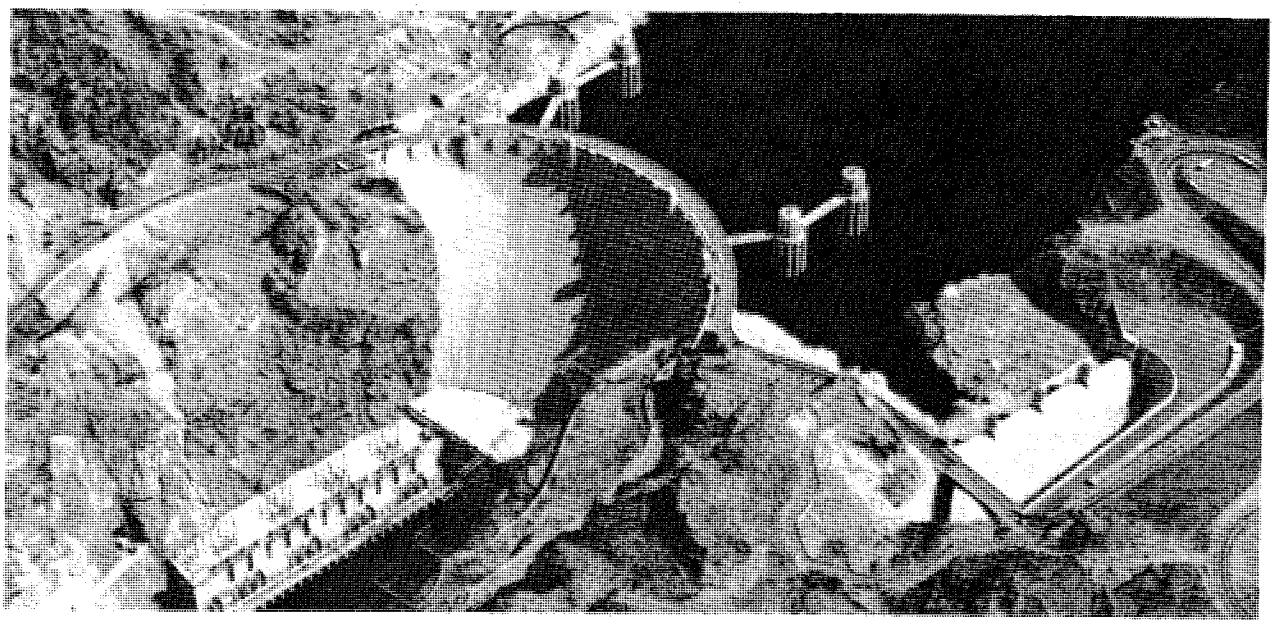
On September 30, 1978, the active storage of Lake Mead was 4,306,000 acre-feet more than the active storage in Lake Powell.

Because adequate space in Lake Mead and CRSP reservoirs was available during water year 1978, no additional releases at Hoover Dam were required pursuant to the flood control regulations. (Chart 8.)

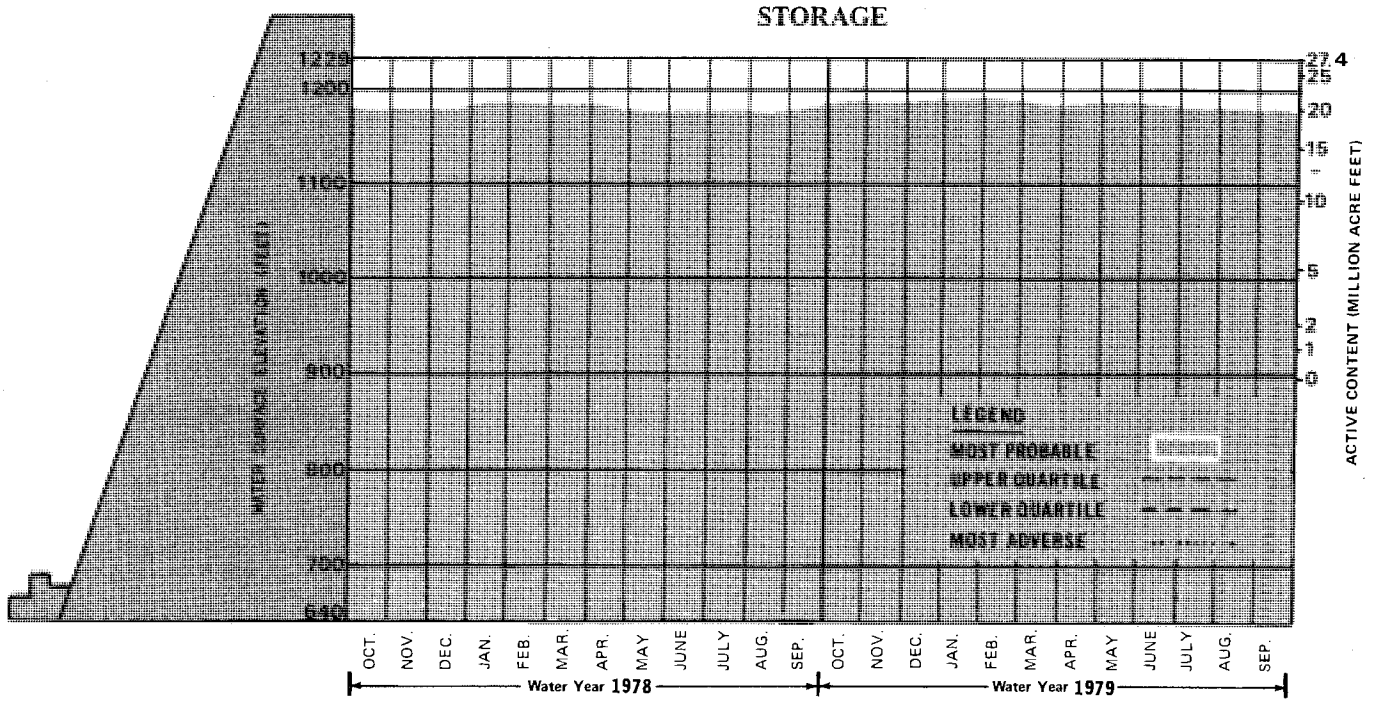


Lake Mead is the only reservoir on the Colorado River in which a specified space is exclusively allocated for mainstream flood control. Flood control regulations for Hoover Dam are being updated and revised by the Bureau of Reclamation and the Army Corps of Engineers with the consultation and advice of State and local interests.

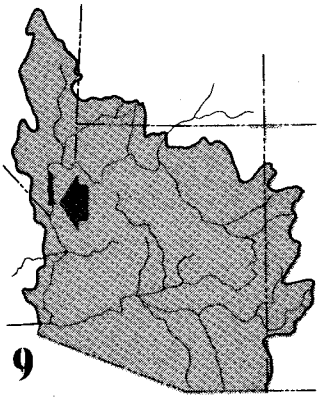
An interim agreement on flood control regulations prior to the formulation and approval of the revised regulations takes into account the available effective space in CRSP reservoirs as well as in Lake Mead.



**Hoover Dam and Lake Mead, Boulder Canyon Project, Arizona-Nevada.**



## Davis Dam, Lake Mohave



# Chart 9

**STATISTICS**
**ACTIVE STORAGE***

| RESERVOIR | (ACRE-FEET) | ELEVATION FEET |
|---|---|---|
| MAXIMUM STORAGE | 1,810,000 | 647.0 |
| RATED HEAD | 1,188,000 | 623.0 |
| MINIMUM POWER | 217,500 | 570.0 |
| SURFACE AREA (FULL) | 28,200 ACRES | |
| RESERVOIR LENGTH (FULL) | 6 7 MILES | |

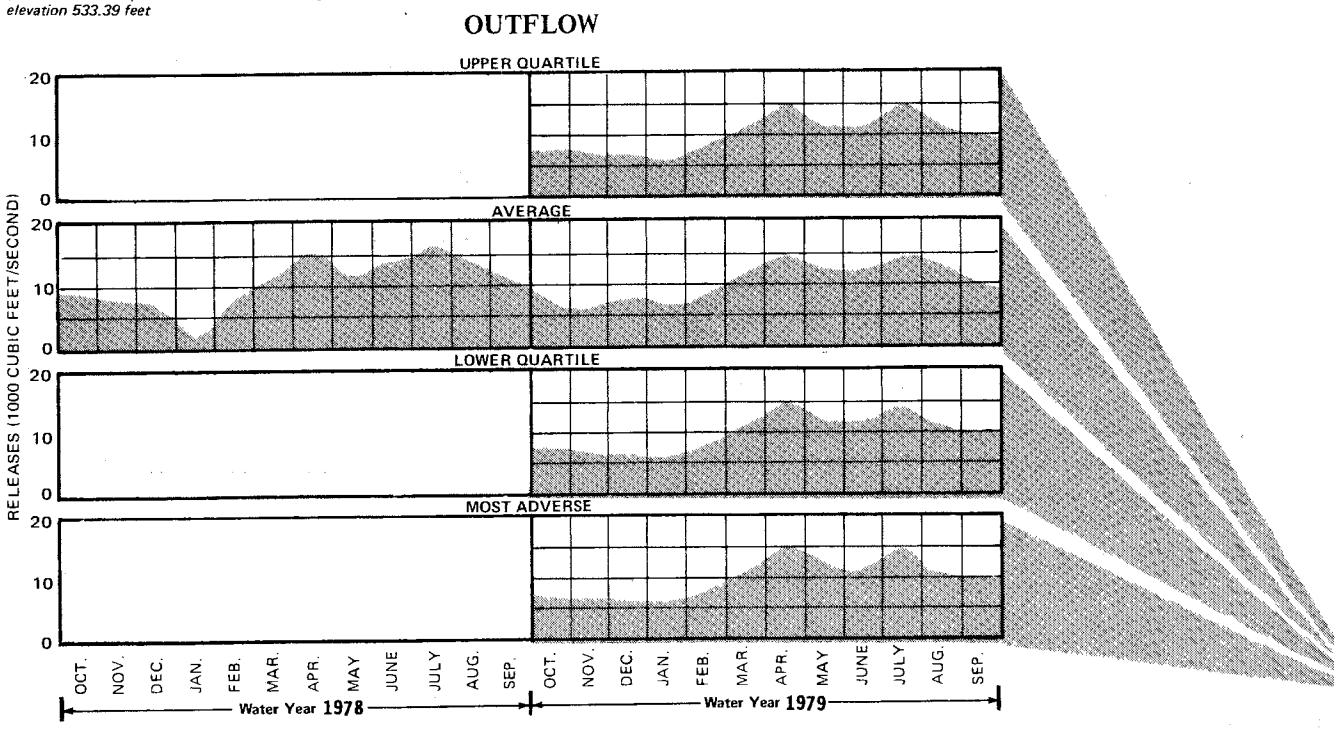
**POWER PLANT**

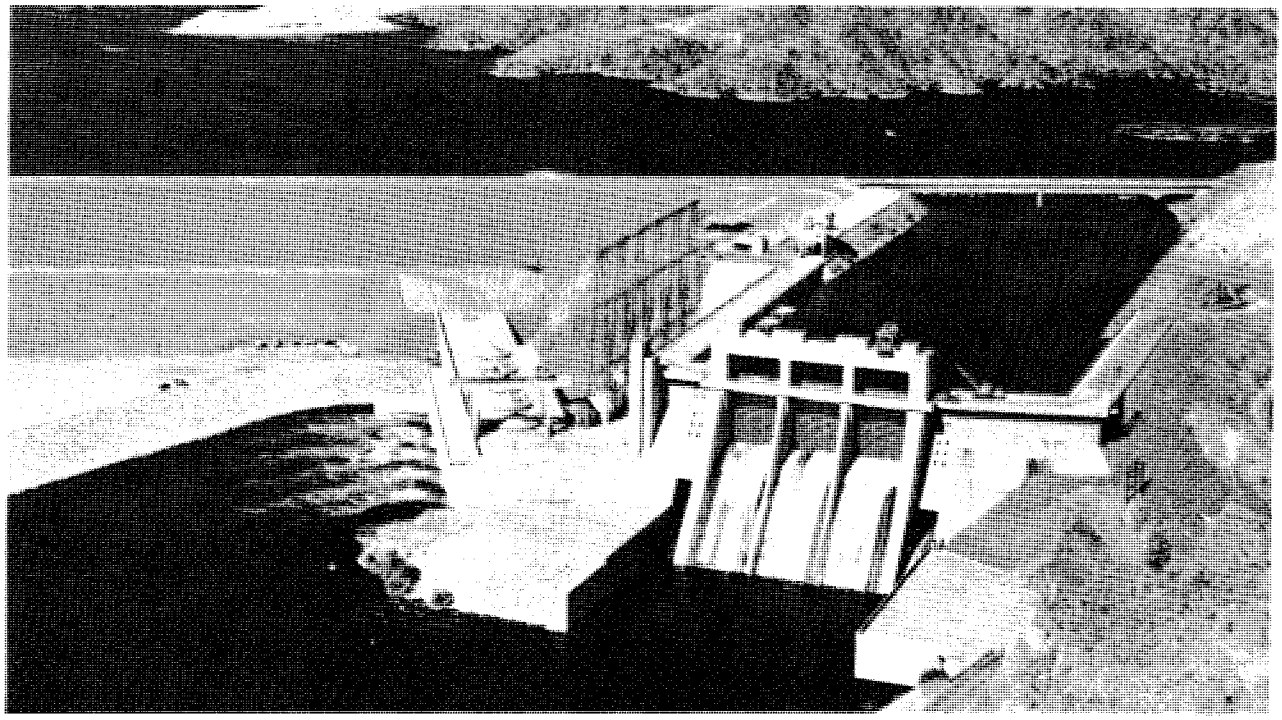
| | |
|---|---|
| NUMBER OF UNITS | 5 |
| TOTAL CAPACITY OF UNITS | 225,000 KILOWATTS |

**does not include 8,530 acre-feet of dead storage below elevation 533.39 feet*

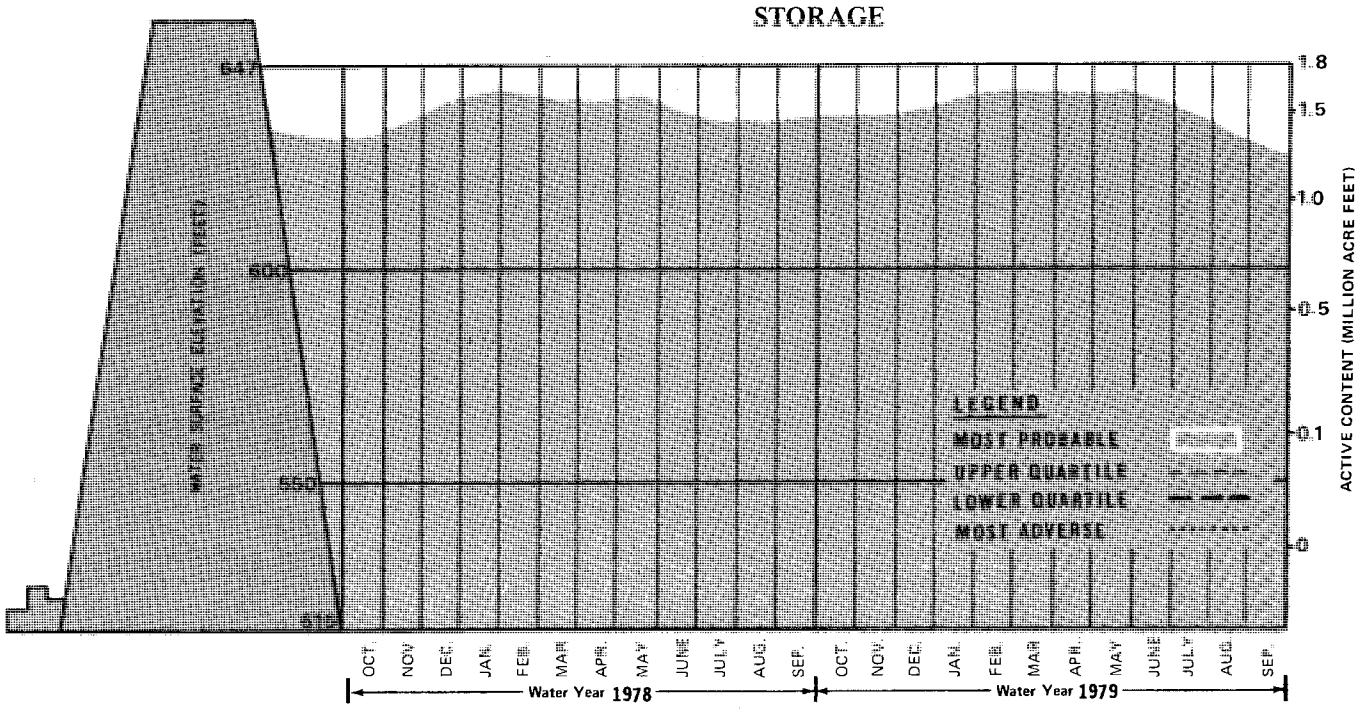
At the beginning of water year 1978, the water surface elevation of Lake Mohave was 634 feet, with an active storage of 1,465,000 acre-feet. During the winter months, the water level was raised to 645 feet, with an active storage of 1,743,000 acre-feet on May 26, 1978, which is about the beginning of the heavy irrigation season. The water level was drawn down during the summer months to its lowest elevation of the year, 630 feet. The reservoir ended the water year at elevation 635 feet with 1,484,000 acre-feet in active storage.

Lake Mohave releases were made monthly to satisfy downstream requirements, with a small amount of reregulation at Lake Havasu. During the water year 7,997,000 acre-feet were released at Davis Dam, all of which passed through the turbines for power production. (Chart 9.)

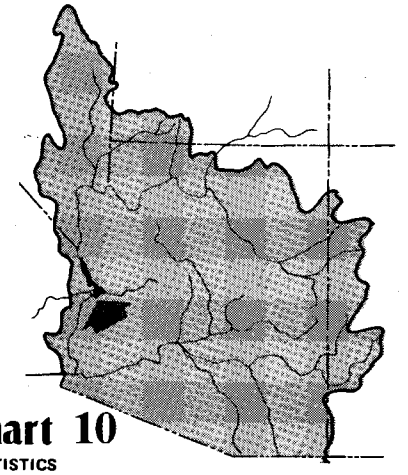




Davis Dam and Lake Mohave, Parker-Davis Project, Arizona-Nevada.



## Parker Dam, Lake Havasu



# Chart 10

**STATISTICS**
**ACTIVE STORAGE***

| RESERVOIP | (ACRE-FEET) | ELEVATION (FEET) |
|---|---|---|
| MAXIMUM STORAGE | 619,400 | 450.0 |
| RATED HEAD | 619,400 | 450.0 |
| MINIMUM POWER | 439,400 | 440.0 |
| SURFACE AREA (FULL) | 20,400 ACRES | |
| RESERVOIR LENGTH (FULL) | 35 MILES | |

**POWER PLANT**

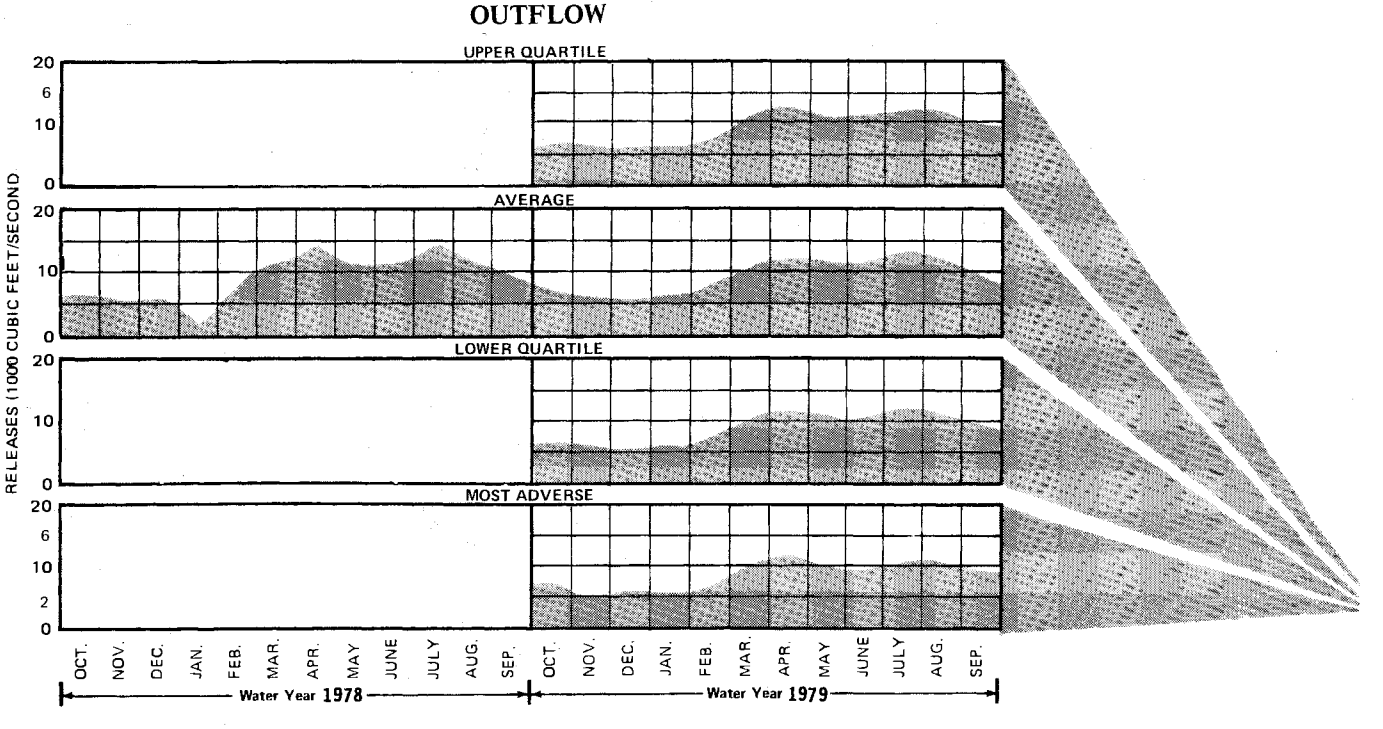
| | |
|---|---|
| NUMBER OF UNITS | 4 |
| TOTAL CAPACITY OF UNITS | 120,000 KILOWATTS |

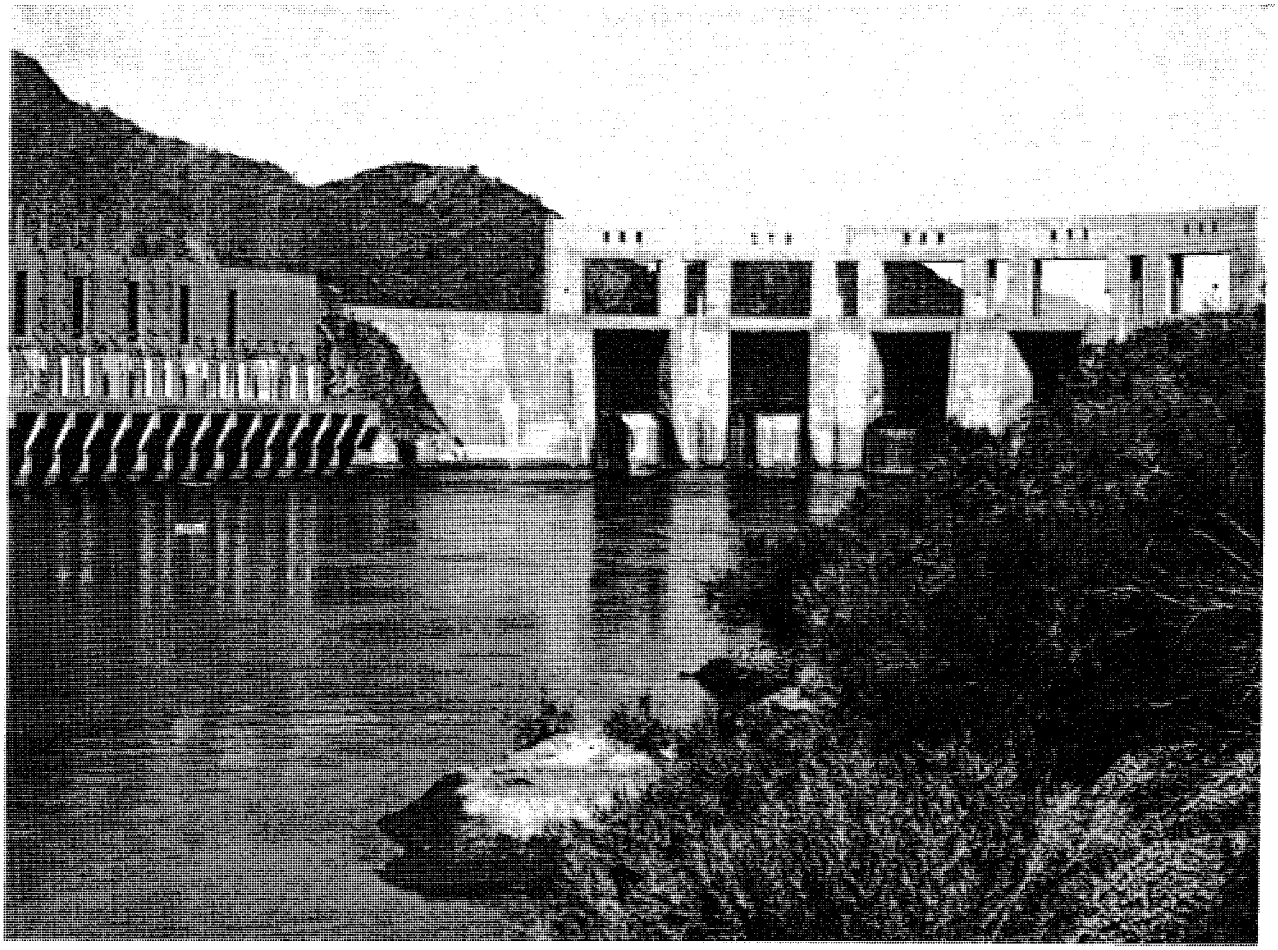
**does not include 28,600 acre-feet of dead storage below elevation 400.0 feet*

At the beginning of water year 1978, the water level of Lake Havasu was at elevation 447 feet, with an active storage of 566,000 acre-feet. The reservoir was drawn down to about elevation 446 feet with an active storage of about 546,000 acre-feet in December, and remained near that level through mid-March to provide flood control space for runoff from the drainage area between Davis and Parker Dams. The water level was then raised to about elevation 449 feet by mid-May. During mid-May through June, the reservoir water level was maintained near maximum, with an active storage of about 605,000 acre-feet, and by the end of the water year was drawn down to 447 feet with an active storage of 567,000 acre-feet.

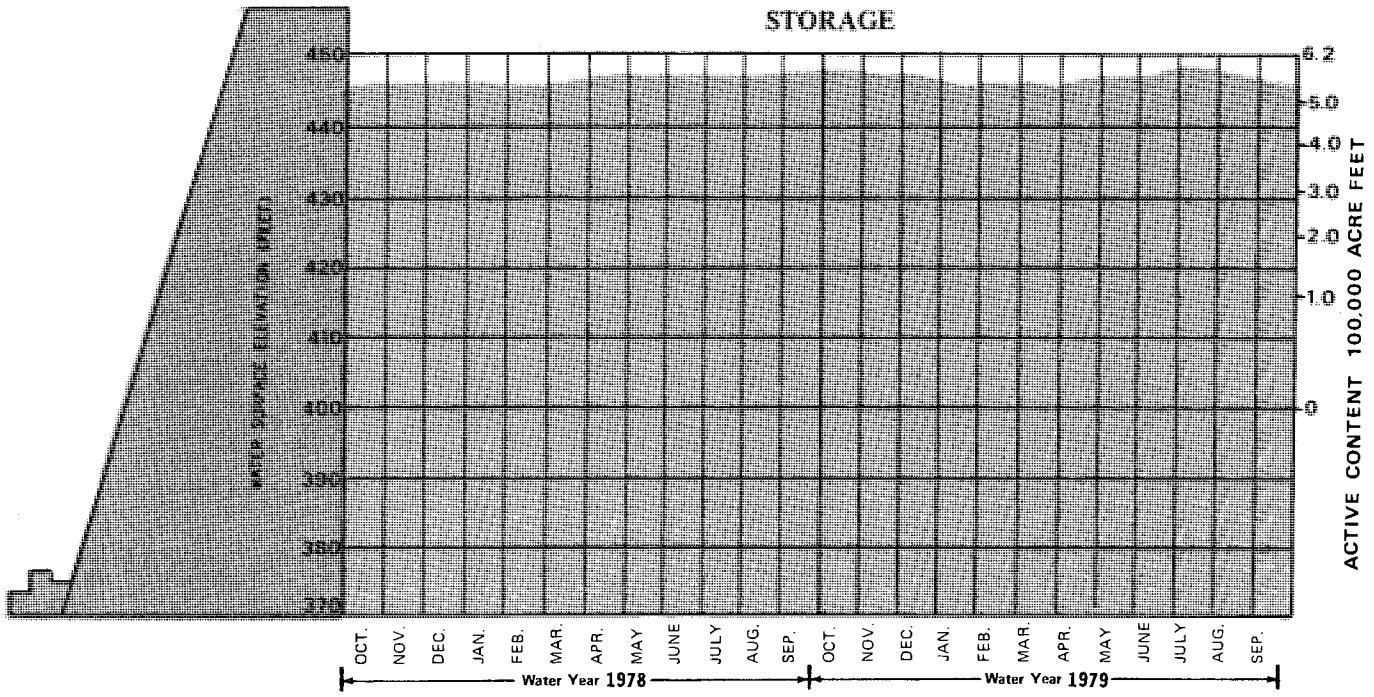
During the water year, 6,718,000 acre-feet were released at Parker Dam, all of which passed through the turbines for power production.

Joint-use space in the top 10 feet of Lake Havasu (about 180,000 acre-feet) is reserved by the United States for control of floods and other uses, including river regulation. Normally, only about the top 4 feet, or 77,000 acre-feet of space, have been used for this purpose since Alamo Reservoir on the Bill Williams River has been in operation.





**Parker Dam, Parker-Davis Project, Arizona-California.**



# River Regulation

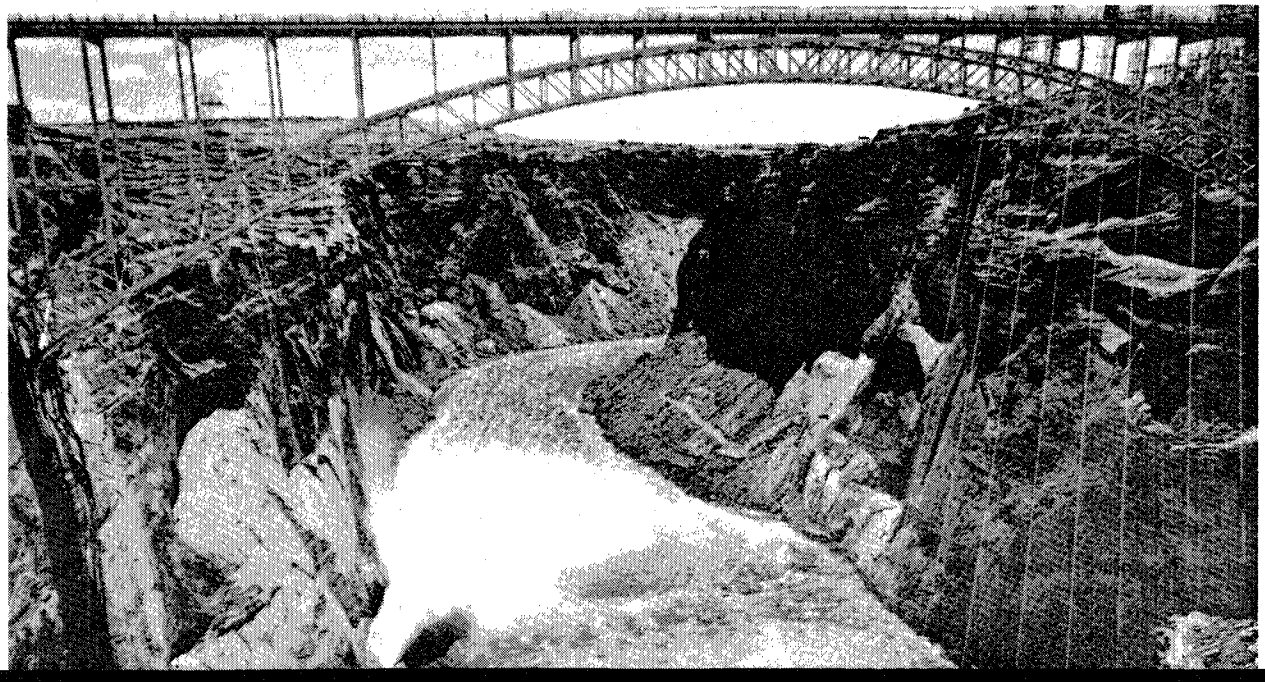
During water year 1978, 8,214,000 acre-feet were released from Glen Canyon Dam based on measurements at the gaging station at Lees Ferry, Arizona. For the 1-year and 10-year periods ending September 30, 1978, 8,229,000 acre-feet and 88,122,000 acre-feet, respectively, passed the compact point at Lee Ferry, Arizona. The expected release of 8,230,000 acre-feet from Lake Powell scheduled for the year ending September 30, 1979, is based on the most probable runoff. When added to the flow of the Paria River this will result in an Upper Basin delivery of about 87.5 million acre-feet for the 10-year period ending September 30, 1979, and Lake Mead water storage will be more than storage in Lake Powell.

Water releases scheduled for the Colorado River Storage Project and participating projects reservoirs were planned to accommodate all of the multiple purposes for which the project was designed, in addition to the many day-to-day demands which developed throughout the year.

Normally, daily releases are made from the storage reservoirs in the Lower Basin to meet the incoming orders of the water user agencies. All water passes through the powerplant units. The daily releases are regulated on an hourly basis to meet, as nearly as possible, the power loads of the electric power customers. Minimum daily flows are provided in the river to maintain fishery habitat. Adjustments to the normal releases are made when conditions permit to provide more satisfactory condition for water-oriented recreation activities, to provide transport for riverborne sediment to desilting facilities, and to provide a degree of control of water quality. Minimum releases from Lake Powell were 1,000 cubic feet per second ($ft^3/s$) during the winter months and were increased to 3,000 $ft^3/s$ during the summer months with an average daily flow of 8,000 $ft^3/s$. These flows in the Grand Canyon are typical of a normal water year situation. They are similar to flows in past years and have proven satisfactory to recreational users in the Grand Canyon.

River regulation below Hoover Dam was accomplished in a manner which resulted in delivery to Mexico of 231,524 acre-feet in excess of minimum treaty requirements during water year 1978. Of that quantity, 194,247 acre-feet were delivered for salinity control pursuant to provisions of Minute No. 242 of the Mexican Treaty.

**Colorado River below Glen Canyon Dam, Arizona-Utah.**



# Beneficial Consumptive Uses

## Upper Basin Uses

The three largest categories of depletion in the Upper Basin are agricultural use within the drainage basin, diversion for all purposes to adjacent drainage basins, and evaporation losses from all reservoirs.

During water year 1978, agricultural and M&I depletions in the Upper Basin were estimated at 2,420,000 acre-feet. Approximately 630,000 acre-feet of water were diverted to adjacent drainage basins and approximately 550,000 acre-feet evaporated from mainstream reservoirs in the Upper Basin. It is estimated that an additional 150,000 acre-feet evaporated from other reservoirs and stockponds in the Upper Colorado Basin for total depletion of 3,750,000 acre-feet.

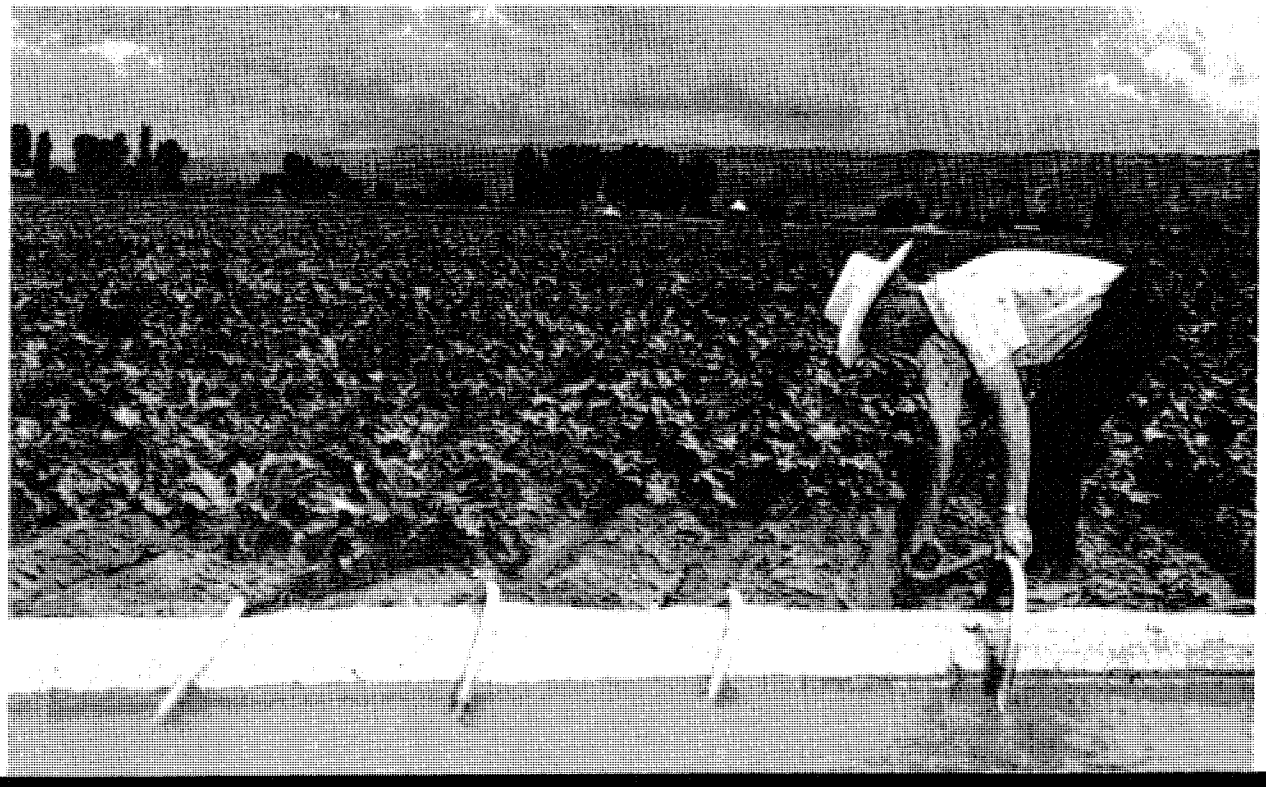
This compares to the following consumptive uses and losses in the Upper Basin as published in the "Colorado River System Consumptive Uses and Losses Report" for the 5-year period ending in 1975.

**Upper Basin Uses and Losses**

| | *1,000 acre-feet* |
|---|---|
| 1971 | 3,413 |
| 1972 | 3,500 |
| 1973 | 3,403 |
| 1974 | 3,819 |
| 1975 | 3,606 |

Water is being stored in the Upper Basin reservoirs and will be released to the Lower Basin as specified by the Colorado River Basin Project Act and the laws, compacts, and treaties upon which the operating criteria promulgated pursuant to Section 602(a) of the act are based.

**Sugar beet irrigation, Grand Valley Project, Colorado.**



## Lower Basin Uses and Losses

During water year 1978, releases of 6,718,000 acre-feet of water from Lake Havasu were made to meet the requirements for water deliveries at Imperial Dam, as well as those of the Colorado River Indian Reservation near Parker, Arizona, the Palo Verde Irrigation District near Blythe, California, other miscellaneous users along the river, and transit losses between Parker Dam and Imperial Dam. Deliveries to Mexico consisted of river water delivered to Imperial Dam and waste and drainage return flows from water users below Imperial Dam. Beneficial use of the small amount of regulatory storage space in Imperial, Laguna, and Senator Wash Reservoirs resulted in limiting the regulatory waste to 37,349 acre-feet.

The major water diversion above Parker Dam was by Metropolitan Water District (MWD) of southern California. MWD pumped 896,700 acre-feet from Lake Havasu during water year 1978, which included 7,674 acre-feet for delivery to the city of Tijuana, pursuant to a contract for temporary emergency delivery of a portion of Mexico's treaty entitlement. During water year 1978, releases of 7,997,200 acre-feet were made from Lake Mohave to provide for releases at Parker Dam; to supply diversion requirements of the MWD, miscellaneous contractors, and other users; to offset evaporation and other transit losses between Davis and Parker Dams; and to maintain the scheduled levels of Lake Havasu.

During water year 1978, releases of 7,685,000 acre-feet were made from Lake Mead at Hoover Dam to regulate the levels of Lake Mohave and to provide for the small uses and the losses from this reservoir. In addition, 94,320 acre-feet were diverted from Lake Mead for use by Lake Mead National Recreation Area, Boulder City, Basis Management, Inc., and contractors of the Division of Colorado River Resources, State of Nevada. During the water year 1978, the total releases and diversions from Lake Mead were 7,779,300 acre-feet.

Lower Basin consumptive uses and losses for the 5-year period ending in 1975, as published in the "Colordo River System Consumptive Uses and Losses Report" were as follows:

| Year | Mainstream [1] | Tributaries [2] | Lower Basin total | Water passing to Mexico |
|---|---|---|---|---|
| | | *(1,000 acre-feet)* | | |
| 1971 | 7,795 | 3,759 | 11,554 | 1,561 |
| 1972 | 7,959 | 4,096 | 12,055 | 1,600 |
| 1973 | 7,766 | 4,267 | 12,033 | 1,594 |
| 1974 | 8,315 | 4,470 | 12,785 | 1,721 |
| 1975 | 7,693 | 4,482 | 12,175 | 1,656 |

[1] Includes reservoir and channel losses.
[2] Includes uses supplied from ground water overdraft.

# Water Quality Control

## Water Quality Operations During Water Year 1978

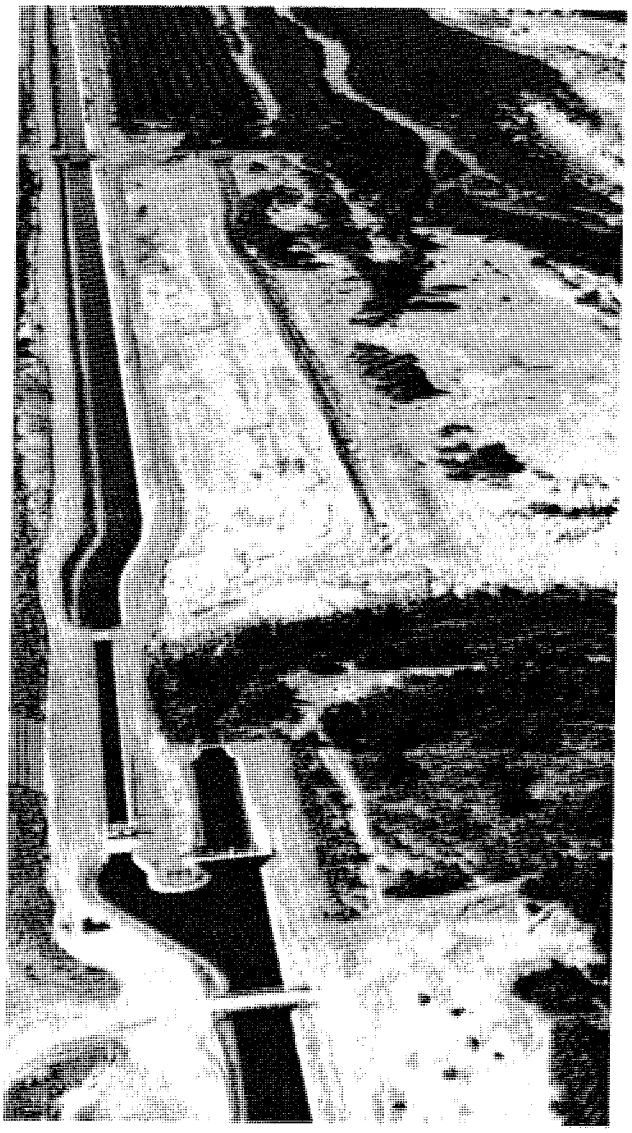
Since water quality aspects of Colorado River operations are extensively described in the biennial series of reports entitled "Quality of Water, Colorado River Basin," only minimal discussion of this aspect of operation is presented in this report. Report No. 9 of the biennial series will be issued in January 1979.

The Bypass Drain, a feature of the Colorado River Basin Salinity Control Act, was constructed and became operational in June 1977. Subsequently, Wellton-Mohawk drainage waters have not been discharged back to the Colorado River below Morelos Dam but have been conveyed via the Bypass Drain to the Santa Clara Slough in Mexico. This action prevents the poor quality waters from seeping into the ground water which then migrates toward the Mexican irrigation wells in the Mexicali Valley. During the water year 1978, the United States bypassed 192,490 acre-feet to the Colorado River below Morelos Dam and 1,757 acre-feet through the Bypass Drain for a total of 194,247 acre-feet which was replaced with a like amount of other water, pursuant to Minute No. 242 of the Treaty of Mexico.

Quality of water has been enhanced within the Basin by reservoir storage, as demonstrated during the 1977 drought year when the salinity of waters released from Lake Powell was approximately 225 mg/L lower than the salinity that would have occurred under natural low-flow conditions without the reservoir.

In recognizing the need to manage water quality of the Colorado River, it has been recommended that salinity increases in the river be controlled through a water quality improvement program generally described in the Bureau of Reclamation's report, "Colorado River Water Quality Improvement Program," dated February 1972, and a status report of the same title dated January 1974.

The program calls for a basinwide approach to salinity control while the Upper Basin continues to develop its compact-apportioned waters. The initial step towards improvement of the quality of the river's water was authorization by the Congress (Public Law 93-320) of the Colorado River Basin Salinity Control Project, June 24, 1974.



Yuma Project Bypass Drain, Arizona-California.

Blue Heron nesting at Topock Marsh on the Colorado River near Needles, California.

# Enhancement of Fish and Wildlife

## Upper Basin

For the benefit of fish habitat, the interim operating rules for Fontenelle Reservoir provide a continuous flow of at least 300 $ft^3/s$ in the channel immediately below Fontenelle Dam. During water year 1978 releases for power production and other purposes provided flows of at least 500 $ft^3/s$.

Fishing below Flaming Gorge Dam has been enhanced by maintaining a minimum 800 $ft^3/s$ release to the river.

A release at least 76 $ft^3/s$ throughout the winter of 1976-77 assured good fish habitat in the river below Taylor Park and Blue Mesa Reservoirs. Coordinated operation between Taylor Park and Blue Mesa Reservoirs in delivering irrigation water to the Uncompahgre Project provided additional fishery and recreation opportunities between the two reservoirs. The interim operating rules specify a minimum of 200 $ft^3/s$ to maintain fish habitat below Crystal Dam and below the Gunnison Tunnel.

A continuous flow of at least 530 $ft^3/s$ was maintained throughout the year immediately below Navajo Dam for fish propagation.

Clear water and a minimum release of 1,000 $ft^3/s$ provided good habitat for introduced species of fish in the river below Glen Canyon Dam.

## Lower Basin

During the 1978 bass spawning season (March-June), the Lake Mead water level declined only 2.9 feet. This small water level fluctuation combined with other favorable environmental factors resulted in a good bass spawn.

To provide satisfactory fish habitat along the lower river and in Lake Havasu, releases from Lakes Mohave and Havasu were regulated so that minimum flows were 2,000 $ft^3/s$ except during a storm period in mid-January and the level of Lake Havasu remained stable during the spring spawning season.

# Preservation of Environment

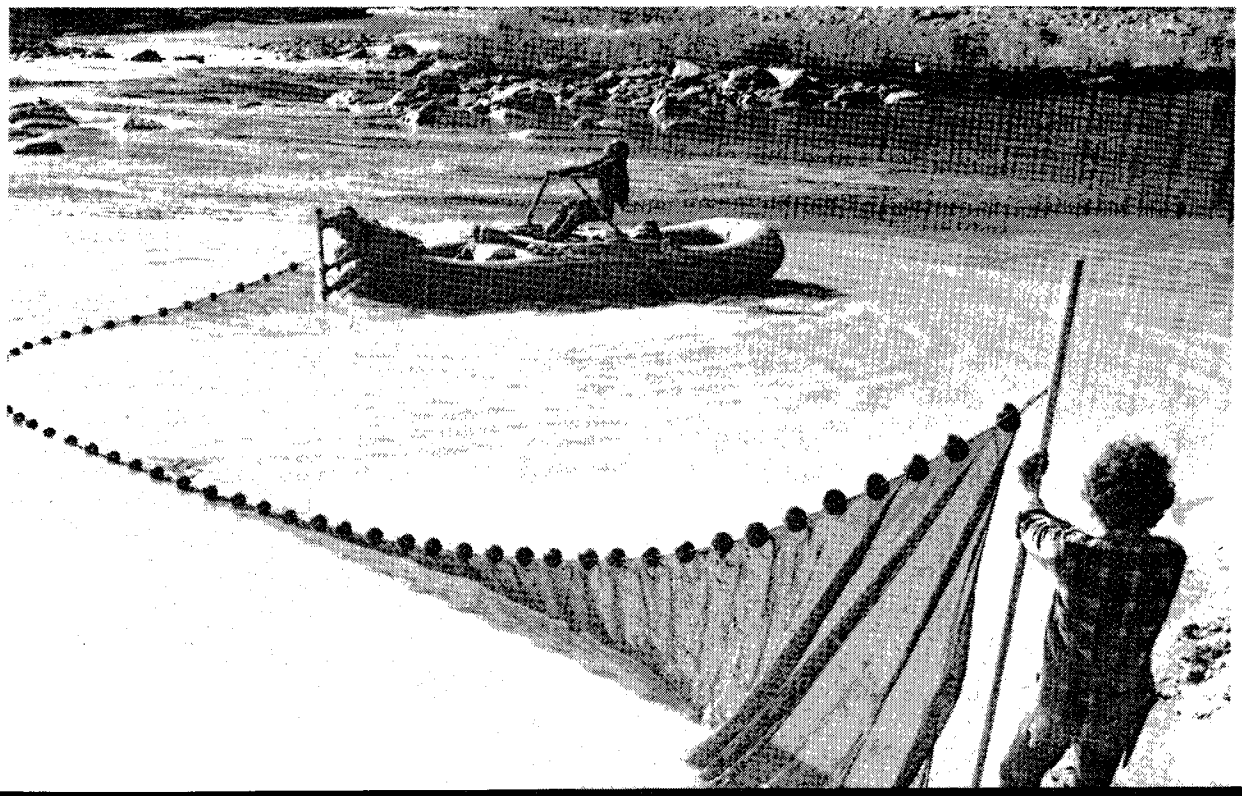
Preservation or enhancement of environment is a matter of the highest importance in the planning, construction, and operation of all Colorado River storage features. Contracts for water services, grants of rights-of-way and indentures of leases for use of Federal land, supply contracts, and participating ageements approved by the Secretary of the Interior include language to control water and air pollution, to require restoration and reseeding of lands scarred by construction and operation activities, and to encourage conservation of the aesthetic beauty of nature.

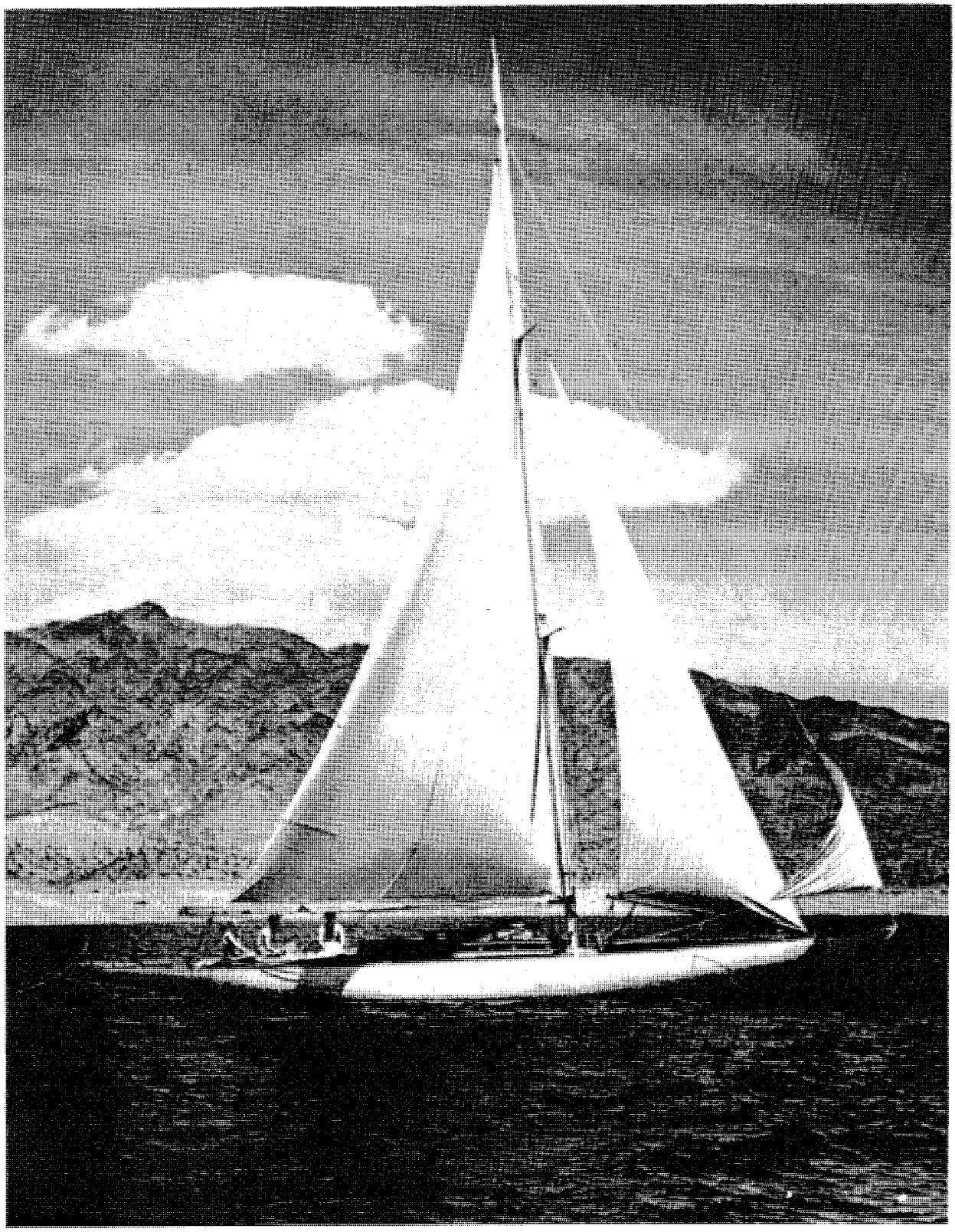
In operating the reservoirs of the Colorado River system, releases from Fontenelle Reservoir are scheduled so the flow pattern will not adversely affect the downstream goose-nesting areas. Minimum flows are maintained below all dams to provide a desirable habitat for fish, animal, and plant life. Flood control operations at Navajo Reservoir and Lake Mead protect the downstream channels and flood plains from erosion and scouring during periods of high flow. Recent proposals for several large thermal-electric generating plants cooled with water and for coal gasification plants utilizing water from Reclamation facilities in the Colorado River system have required special consideration to protect the environment of the area. The Secretary of the Interior's responsibility for water pollution control has been delegated to the Commissioner of Reclamation and redelegated to the Regional Director of the Upper Colorado Region. The Regional Director of the Lower Colorado Region has been delegated responsibility for water pollution control at the Mohave Powerplant.

Reclamation is presently involved in a Federal-State study to evaluate, among other things, the effects of reservoir operation on the Lake Mead bass fishery. The study is scheduled for completion in 1982 and should provide valuable information pertaining to the future management of the Lake Mead bass fishery.

Periodic dredging in Topock Marsh, part of Havasu National Wildlife Refuge, provides improved habitat for waterfowl and for endangered species such as the Yuma clapper rail and bald eagle. Topock Marsh is one of many created along the river by Reclamation projects.

**Seining for aquatic-life specimens for Colorado River studies.**





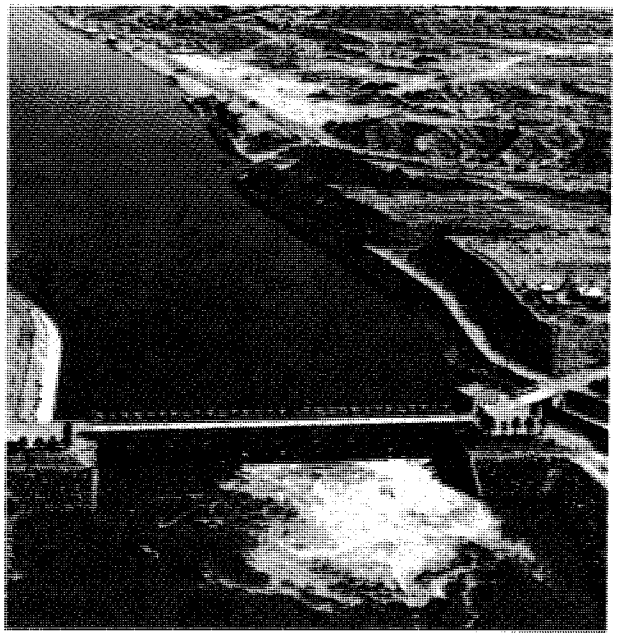
**Sailboating on Lake Mead, Boulder Canyon Project, Arizona-Nevada.**

# Projected Plan of Operation under Criteria for Current Year

## Determination of "602(a) Storage"

Section 602(a)(3) of the Colorado River Basin Project Act of September 30, 1968, (Public Law 90-537), provides for the storage of Colorado River water not required to be released under article III(c) and III(d) of the Colorado River Compact in Upper Basin reservoirs to the extent the Secretary finds it to be reasonably necessary to assure Compact deliveries without impairment of annual consumptive uses in the Upper Basin. Article II of the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs," pursuant to the act, provides that the annual plan of operation shall include a determination by the Secretary of the quantity of water considered necessary as of September 30 of the current year to be in storage as required by section 602(a) of Public Law 90-537 after consideration of all applicable laws and relevant factors including, but not limited to: (a) historic streamflows; (b) the most critical period of record; (c) probabilities of water supply; (d) estimated future depletions in the Upper Basin, including the effects of recurrence of critical periods of water supply; (e) the "Report of the Committee on Probabilities and Test studies to the Task Force on Operating Criteria for the Colorado River," dated October 30, 1969, and such additional studies as the Secretary deems necessary; (f) the necessity to assure that Upper Basin consumptive uses are not impaired because of failure to store sufficient water to assure deliveries under section 602(a)(1) and (2) of Public Law 90-537.

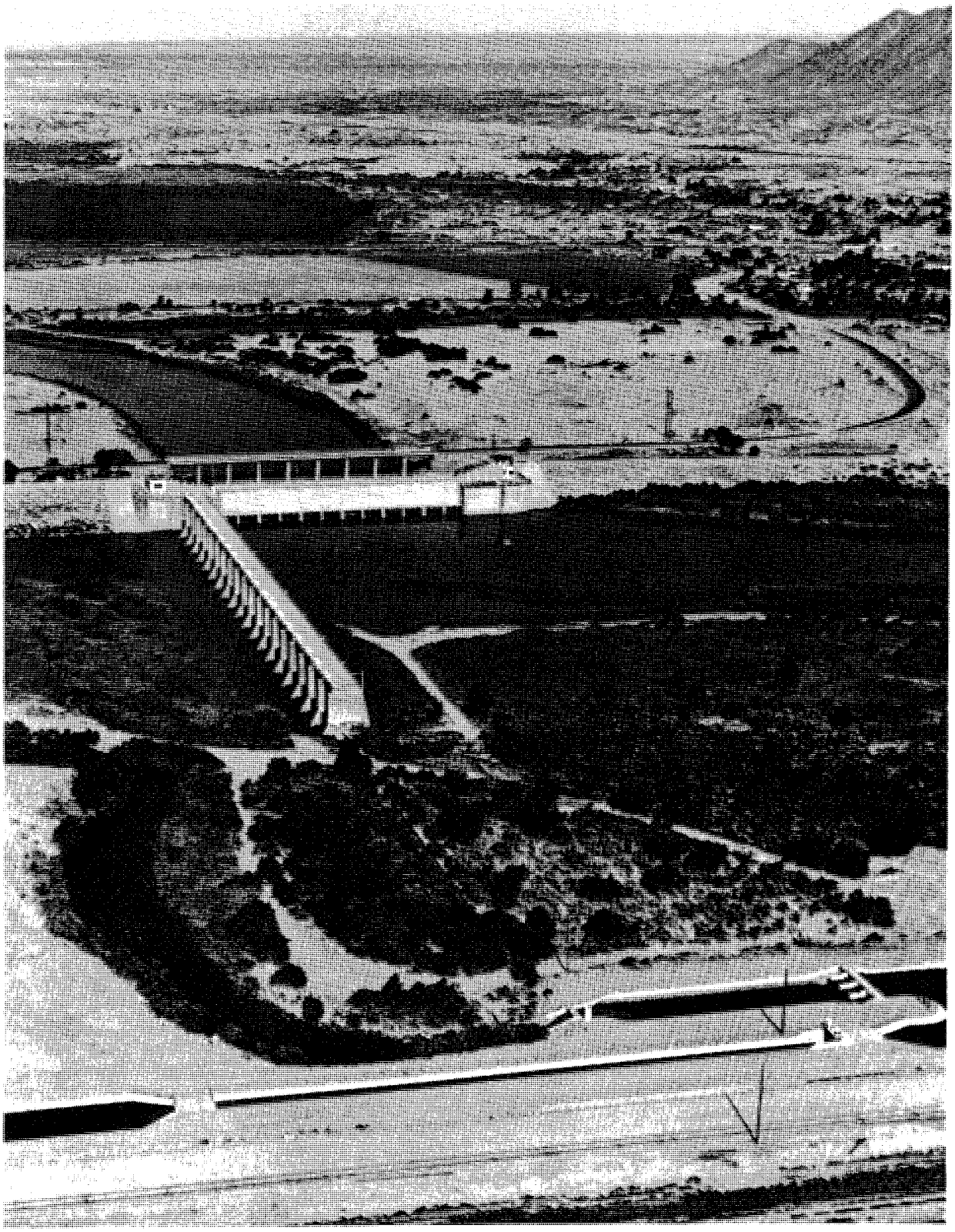
Taking into consideration these and other relevant factors, the Secretary has determined that the active storage in Upper Basin reservoirs forecast for September 30, 1979, exceeds the "602(a) Storage" requirement under any reasonable range of assumptions which might be realistically applied to those items which he is directed to consider in establishing this storage requirement. Therefore, the accumulation of "602(a) Storage" is not the criterion governing the release of water during the current year.



**Headgate Rock Dam, Arizona-California.**

Storage in Lake Powell on September 30, 1978, was 4.3 million acre-feet less than the storage in Lake Mead on that date. Even with a minimal scheduled release from Lake Powell of 8.23 million acre-feet and assuming average runoff for water year 1979, the Lake Powell active storage forecast for September 30, 1979, is about 2.9 million acre-feet less than the Lake Mead active storage forecast for that date.

Therefore, the plan of operation during the current year is based on a minimal release of 8,230,000 acre-feet of water from Lake Powell, in accordance with section 602(a)(3) of Public Law 90-537.



**Delivery of water to Mexico.**

# Lower Basin Requirements

## Mexican Treaty Obligations

Annual calendar year schedules of monthly deliveries of water in the limitrophe section of the Colorado River, allotted in accordance with the Mexican Water Treaty signed in 1944, are formulated by the Mexican Section and presented to the United States Section, International Boundary and Water Commission, before the beginning of each calendar year.

Upon 30 days' advance notice to the United States Section, Mexico has the right to modify, within the total schedule, any monthly quantity prescribed by the schedule by not more than 20 percent of the monthly quantity. In addition to the 1.5 million acre-feet of scheduled Treaty deliveries, approximately 20,000 acre-feet are projected for regulatory wastes and approximately 185,000 acre-feet of Wellton-Mohawk drainage water will be bypassed around Morelos Dam, Mexico's diversion structure, pursuant to Minute No. 242.

## Consumptive Uses and Losses—1979

For water year 1979, a release of 6,972,000 acre-feet from Lake Havasu has been projected, including consumptive use requirements in the United States below Parker Dam, transit losses in the river between Parker Dam and the Mexican Border, and Treaty deliveries to Mexico.

During water year 1979, the Metropolitan Water District of Southern California is expected to divert 852,000 acre-feet by pumping from Lake Havasu, including a small contract delivery to the City of Tijuana as a part of Mexico's Treaty delivery.

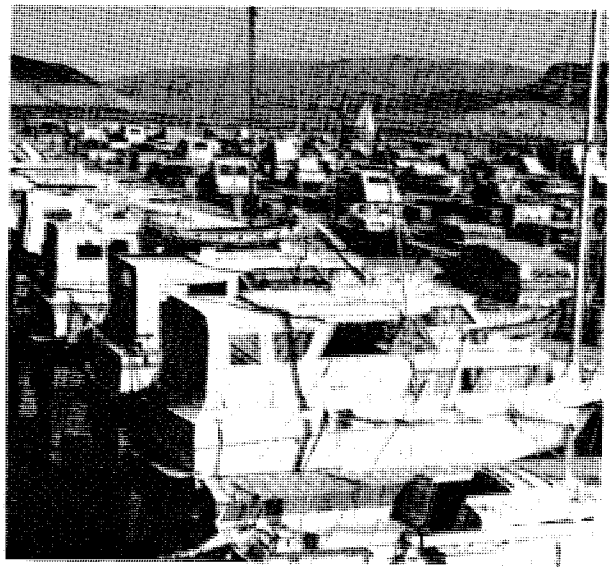
Consumptive uses by small users, river losses or gains, and reservoir losses between Davis Dam and Parker Dam are projected to be 233,000 acre-feet.

There are no major users between Hoover Dam and Davis Dam. During water year 1979, consumptive uses by small users, river losses or gains, and reservoir losses between Hoover Dam and Davis Dam are projected to be a net loss of 2,000 acre-feet. The net diversions from Lake Mead are projected at 103,000 acre-feet. Evaporation from Lake Mead is expected to be about 881,000 acre-feet, and net gain between Glen Canyon Dam and Lake Mead is expected to be about 873,000 acre-feet.

## Regulatory Wastes

A regulatory waste of 20,000 acre-feet has been projected as being lost from the Lower Colorado River for water year 1979, as indicated in this section under Mexican Treaty obligations.

The guides set forth in the "Report on Reservoir Regulations for Flood Control Storage at Hoover Dam and Lake Mead" were in effect, but no flood control releases were necessary during water year 1978.



**Lake Mead Marina, Boulder Canyon Project, Nevada.**

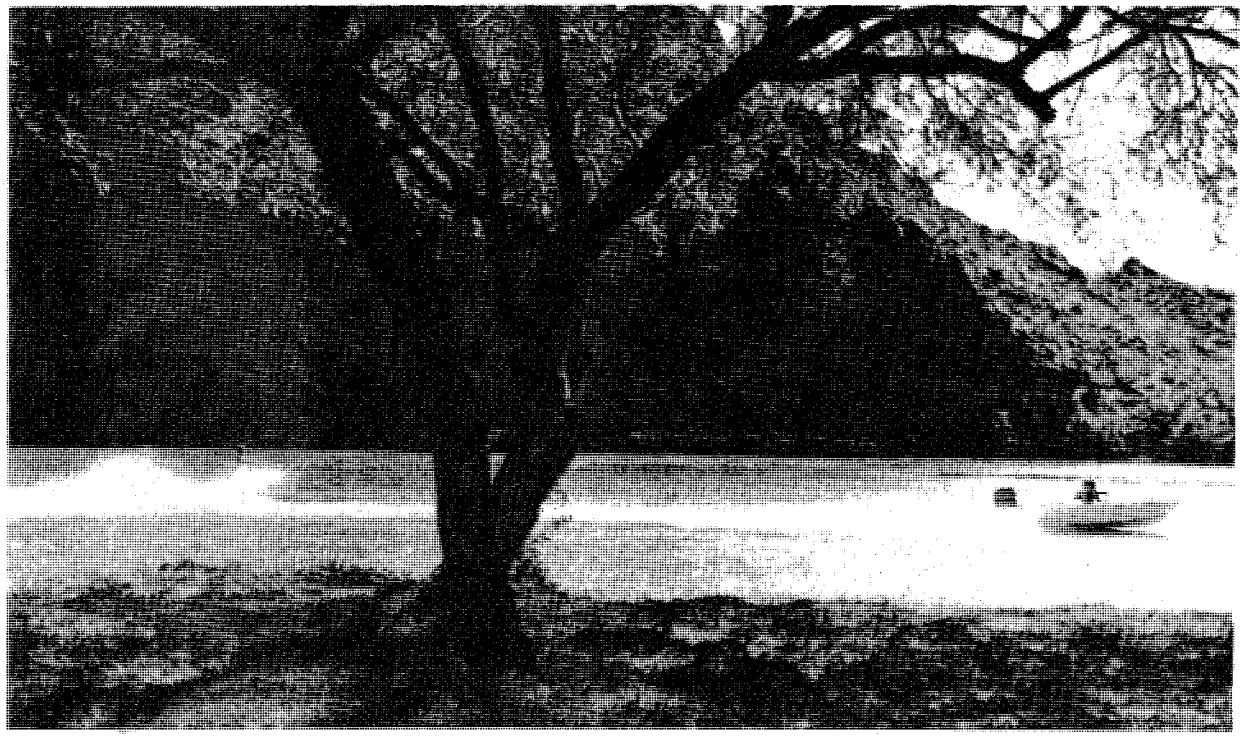
# Plan of Operation—Water Year 1979

For average runoff conditions during water year 1979, the projected operation of each of the reservoirs in the Colorado River Basin is described in the following paragraphs. Charts 1 through 10 show hydrographs of the projected monthly outflow from the reservoirs and the projected end-of-month elevation and active storage in the reservoirs for average and three other assumptions of 1979 modified runoff from the Basin. The four assumptions are: (1) AVERAGE based on the 1906-68 record of runoff; (2) UPPER QUARTILE based on the level of annual streamflow which has been exceeded 25 percent of the time during 1906-68; (3) LOWER QUARTILE based on flows exceeded 75 percent of the time during 1906-68; and (4) MOST ADVERSE based on the lowest year of record, which occurred in 1977.

The projected operations of Lake Mead, Lake Mohave, and Lake Havasu are the same under all four of the runoff assumptions.

## ALTERNATIVE PLAN OF OPERATION

A review is currently being made of the terms and conditions of the merits of alternative plans of operation associated with the release of water from Lake Mead in excess of downstream requirements for beneficial consumptive use. Also included is the joint study by the Bureau of Reclamation and the Corps of Engineers to determine the best flood control operation for Lake Mead and Hoover Dam. Because of the extreme drought conditions during 1976 and 1977, no releases in excess of downstream requirements are anticipated during water year 1979. However, such additional releases are recognized as a possibility before 1985, when the Central Arizona Project is scheduled to begin diversions.



**Water skiing at Colorado River State Park, Parker-Davis Project, Arizona-California.**

# Upper Basin Reservoirs

## Fontenelle

To conserve water and to meet municipal and industrial contractual obligations, provide for tailwater fishery and wildlife requirements, and for electic power generations, releases will be maintained at 800 $ft^3/s$ until forecasts based on accumulated precipitation and snowpack provide reasonable assurance of normal or above normal runoff for water year 1979. The Reservoir water level will be lowered until a water surface level of about 6,485 feet is reached prior to the spring runoff. With average runoff, during the spring months, Fontenelle Reservoir will fill during the month of June. After the spring runoff the Reservoir water level will be controlled by adjusting the releases through the powerplant to slowly reduce the elevation to 6504 feet by the end of the summer of 1979. (Chart 1.)

## Flaming Gorge

At the beginning of water year 1979 the active storage at Flaming Gorge was 2,829,000 acre-feet with the water surface elevation at 6016 feet. The Reservoir level will stay about level until the spring of 1979 and should remain high enough so boats can be launched from the nine boat ramps. Average inflow would cause the Reservoir to reach elevation 6024 feet with an active storage of 3,120,000 acre-feet during July. Summertime flow in the river below the dam should not exceed 4,500 $ft^3/s$ and would not be less than 800 $ft^3/s$. Releases should average about 108,000 acre-feet per month through September 1979 for a water year total of about 1,300,000 acre-feet. (Chart 2.)

## Curecanti Unit

During the current year, water level in Blue Mesa Reservoir should reach a low in April 1979 at elevation 7453 feet and the active storage would be 330,000 acre-feet. With average inflow during the spring of 1979 the Reservoir should reach elevation 7511 feet with an active storage of 755,000 acre-feet. At that elevation the Reservoir has a surface area of 8,730 acres and a Reservoir length of 23 miles. (Chart 3.)

Morrow Point Reservoir will be operated during the current year at or near its total storage capacity. Crystal Reservoir will be operated nearly full except for daily fluctuations as required to regulaté the releases from Morrow Point to meet diversion requirements of the Gunnison Tunnel as well as requirements downstream from the Gunnison Tunnel. (Charts 4 and 5.)

## Navajo Reservoir

On September 30, 1978, Navajo Reservoir had an active storage of 1,375,000 acre-feet with water surface elevation at 6051. During October through February releases will be maintained at 530 $ft^3/s$ to conserve storage in the Reservoir. The elevation of the Reservoir is expected to drop to 6047 feet prior to the Spring runoff. At elevation 6047 feet, Navajo Reservoir will have about 1,191,000 acre-feet of active storage, enough to assure the full water supply to the Navajo Indian Irrigation Project.

Average inflow would cause the reservoir to reach elevation 6072 feet with an active storage of 1,504,000 acre-feet by July 1979. The Reservoir will be maintained at or near that level throughout the remainder of the summer to enhance recreation use. (Chart 6.)

## Glen Canyon—Lake Powell

For the current year, the level of Lake Powell should drop about 8 feet during the fall and winter months to elevation 3632 feet. The active storage would be 15.6 million acre-feet in February 1979. Assuming an average April-July 1979 runoff, the resulting inflow of about 8.0 million acre-feet would cause the lake to reach 3660 feet elevation during July with an active storage of 19.1 million acre-feet, or approximately 76 percent of the active capacity of the Reservoir. The lake would have the length

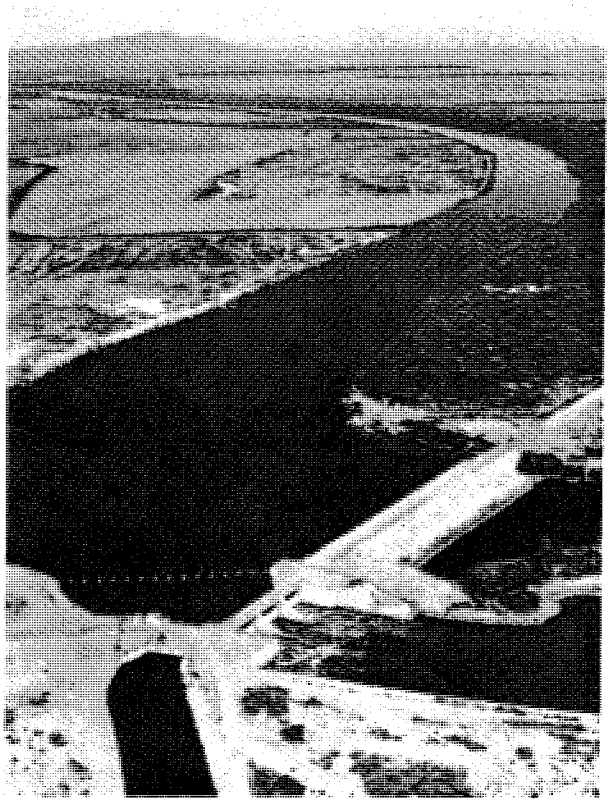
### Glen Canyon—Lake Powell

of 183 miles and a water surface area of 134,280 acres. Assuming average conditions during water year 1979 a total release of 8.23 million acre-feet is scheduled from Lake Powell to satisfy storage requirements for Lake Mead and Lake Powell in compliance with Section 602 of Public Law 90-537. The scheduled release will pass through the turbines to generate power for customers in the Colorado River Basin States. (Chart 7.)

## Lower Basin Reservoirs

### Lake Mead

During the 1979 water year, the Lake Mead water level is scheduled to rise to elevation 1190 feet at the end of January 1979, then be drawn down to a low elevation of 1182 feet at the end of May 1979. At that level, the lake will have an average active storage of about 20.9 million acre-feet. During water year 1979, a total of 7.9 million acre-feet is scheduled to be released from Lake Mead to meet all downstream requirements. All releases are scheduled to pass through the turbines for electric power production. (Chart 8.)



Palo Verde Diversion Dam, Arizona-California.

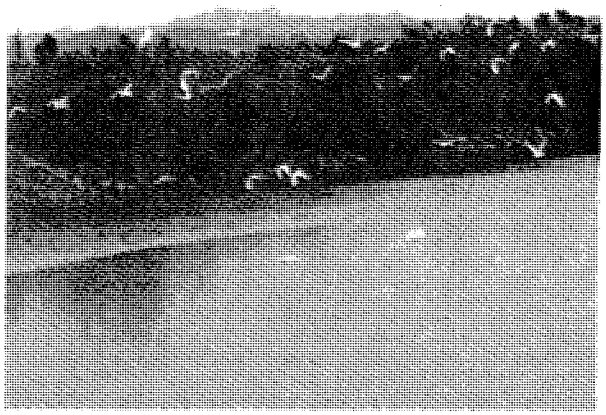
### Lake Mohave

The water level of Lake Mohave is scheduled to rise through the fall and winter months and reach elevation 643 feet by the end of January 1979. It should remain near that yearly high elevation through May 1979. Because of the heavy irrigation use during the summer months, the water level in Lake Mohave is expected to be drawn down to elevation 631 feet by the end of water year 1979. During that time a total of 7.9 million acre-feet is scheduled to be released from Lake Mohave to meet all downstream requirements. All releases are scheduled to pass through the turbines for electric power production. (Chart 9.)

### Lake Havasu

Lake Havasu is scheduled at the highest levels consistent with the requirements for maintaining flood control space. The yearly low elevation of 446 feet is scheduled for the December through February high flood-hazard period. The yearly high of 449 feet is scheduled for the low flood-hazard months of May and June. During water year 1979, a total of 7.0 million acre-feet is scheduled to be released from Lake Havasu to meet all downstream requirements. All releases are scheduled to pass through the turbines for electric power production. (Chart 10.)

**Trout fisherman and catch.**



**Birds in flight over the Colorado River.**

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.

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**Back cover: Hoover Dam has attracted countless visitors and sightseers over the years.**