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ANNUAL OPERATING PLAN

# Kansas River Projects

## 1961 Operations

## 1962 Outlook

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 7
DENVER, COLORADO

February 1962

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BUREAU OF RECLAMATION
Floyd E. Dominy, Commissioner

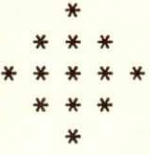
Region 7 - Denver, Colorado
John N. Spencer, Regional Director

# ANNUAL OPERATING PLAN

# KANSAS RIVER PROJECTS

# 1961 OPERATIONS

# 1962 OUTLOOK



February 1962

# SYNOPSIS

## Annual Operating Plan-Kansas River Projects
## Missouri River Basin
## 1961 Operations
## 1962 Outlook

This is the ninth Annual Operating Plan for irrigation units in the Kansas River Projects area. The potential development is shown by the frontispiece while the total systems in operation or under construction are featured on exhibit 38. The prime purpose of this report is to describe the irrigation operations and define the responsibilities of the Bureau of Reclamation in relation to the Federally constructed and rehabilitated irrigation facilities in the Republican, Solomon, and Smoky Hill River drainage areas. Harlan County Reservoir on the Republican River is operated by the Corps of Engineers. Bonny, Enders and Lovewell Reservoirs, Swanson, Hugh Butler and Harry Strunk Lakes in the Republican River Basin; Webster and Kirwin Reservoirs in the Solomon River Basin; and Cedar Bluff Reservoir in the Smoky Hill River Basin are operated by the Bureau of Reclamation. As there are no irrigation facilities completed below the Corps of Engineer's reservoirs , Kanopolis on the Smoky Hill River and Tuttle Creek on the Blue River, they are not considered in this report.

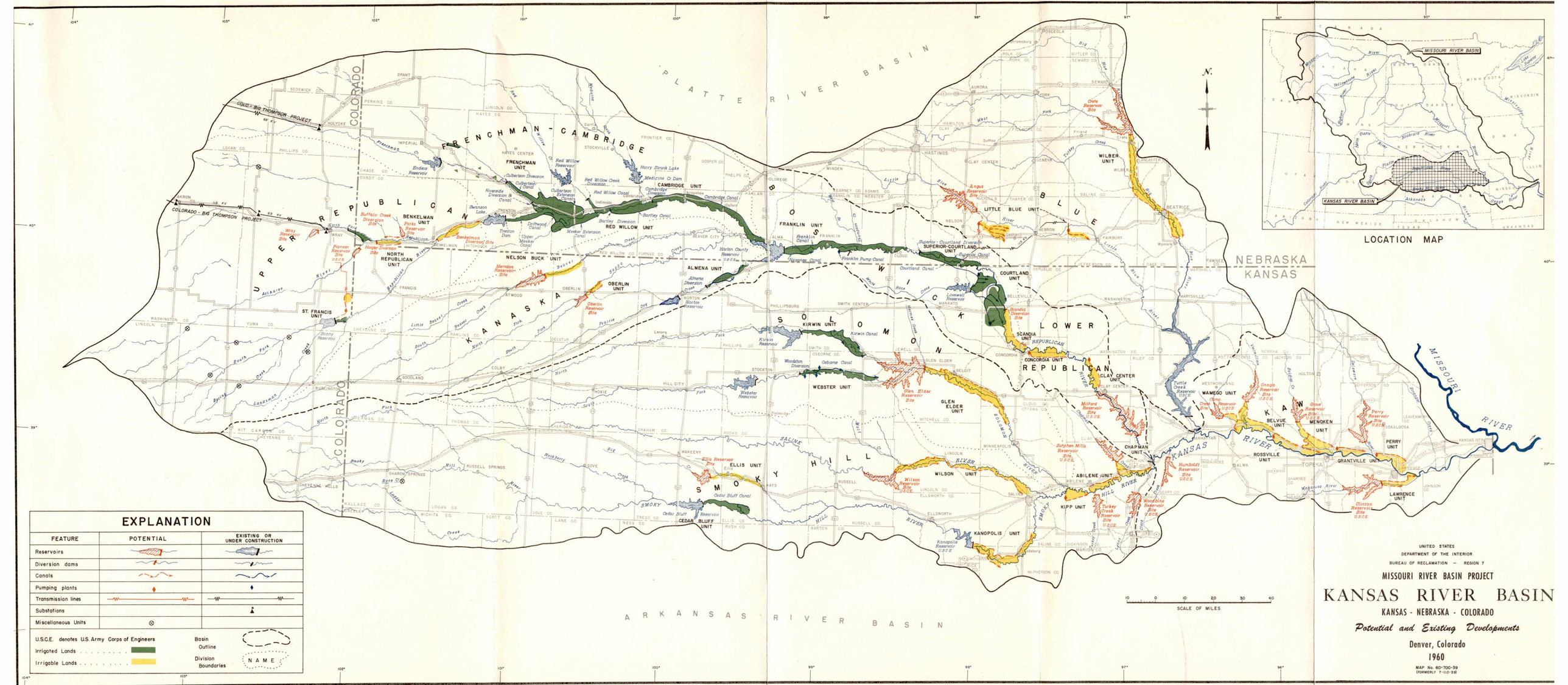
Chapter I, the introduction of the report, gives a brief description of the irrigation units in the Kansas River Projects area. Chapter II summarizes the 1961 operations, and the plan of operation for 1962 is presented in Chapter III.

## 1961 OPERATIONS

The water supply was more than adequate to meet the 1961 irrigation requirements of 94,002 acres under Kansas River Projects. The diversion for all the Kansas River Projects averaged 2.53 acre-feet per acre. The inflows to Bonny, Enders and Harlan County Reservoirs, Swanson, and Harry Strunk Lakes were below normal but the inflows to Lovewell, Kirwin, Webster and Cedar Bluff Reservoirs were well above normal. The precipitation at the reservoirs in Kansas River Basin varied from 90% to 141% of normal. All of the completed reservoirs spilled in the spring of 1961. Storage was commenced in Hugh Butler Lake (formed by Red Willow Dam) on September 5, 1961.

## 1962 OUTLOOK

Facilities are completed to serve 143,469 acres; however, only 118,500 acres are expected to be irrigated in 1962. The carryover storage and dry year inflows will be more than adequate to meet the demands of these acres. All of the reservoirs except Kirwin, Webster and Hugh Butler Lake are expected to spill even under dry year inflow conditions prior to the start of the 1962 irrigation season.




## EXPLANATION

| FEATURE | POTENTIAL | EXISTING OR UNDER CONSTRUCTION |
|---|---|---|
| Reservoirs | | |
| Diversion dams | | |
| Canals | | |
| Pumping plants | | |
| Transmission lines | | |
| Substations | | |
| Miscellaneous Units | ⊗ | |

U.S.C.E. denotes U.S. Army Corps of Engineers

Irrigated Lands

Irrigable Lands

Basin Outline

Division Boundaries

NAME

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION — REGION 7

MISSOURI RIVER BASIN PROJECT

# KANSAS RIVER BASIN

KANSAS - NEBRASKA - COLORADO

*Potential and Existing Developments*

Denver, Colorado

1960

MAP No. 60-700-39
(FORMERLY 7-110-318)

KANSAS RIVER PROJECTS
1961 OPERATIONS
1962 OUTLOOK

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ANNUAL OPERATING PLAN - KANSAS RIVER PROJECTS

1961 OPERATIONS - 1962 OUTLOOK

# CHAPTER 1 - INTRODUCTION

## PURPOSE OF THE REPORT

The purpose of this ninth Annual Operating Plan is to advise water users, cooperating agencies, and other interested groups or persons of the irrigation operations during 1961 and of the plan of operations for 1962 in the Kansas River Projects area. Flood control operations are the responsibility of the Corps of Engineers and are not included in this report.

## LOCATION AND MAJOR FEATURES

The Kansas River Projects consist of the irrigation units of the Kansas River Basin, which are a part of the Missouri River Basin Project. This includes multi-purpose reservoirs which provide storage for irrigation, flood control, municipal water supply, recreational purposes, stream pollution abatement, and other uses. These dams and reservoirs, constructed and operated by the Bureau of Reclamation or Corps of Engineers, serve the irrigation systems for these units. The canals and diversion dams have been constructed or rehabilitated by the Bureau of Reclamation and, for the most part, are operated by Irrigation Districts.

Twelve reservoirs, fourteen canal systems, and five diversion dams are in operation. Cedar Bluff Canal, Red Willow Canal, and Red Willow Diversion Dam are under construction. The railroad relocation in the Norton Reservoir area is presently under construction. Construction will be started on Norton Dam on the Prairie Dog Creek this year. Milford Dam on the Republican River and Wilson Dam on the Saline River are presently under construction by the Corps of Engineers. As Tuttle Creek and Kanopolis Reservoirs, operated by the Corps of Engineers, do not serve irrigation systems at the present time, they are not considered. Storage allocations for the ten reservoirs presently serving irrigated areas are shown in Table 1. The reservoirs and main irrigation canals are schematically shown in Exhibit 38.

## IRRIGATION DISTRICTS

Nine Irrigation Districts in the Kansas River Projects have contracted with the Bureau of Reclamation for construction of irrigation facilities. Table No. 2 shows the status of the repayment and water service contracts with the development periods, where appropriate. Table 8 shows the planned ultimate acreage, the acres irrigated in 1961 and the anticipated acreage for 1962 for each irrigation district.

## Frenchman Valley Irrigation District and H & RW Irrigation District

Culbertson Diversion Dam and Canal were reconstructed and Culbertson Extension Canal constructed to serve 9,600 acres in the Frenchman Valley Irrigation District and 11,490 acres in the H & RW Irrigation District. The lands in the Frenchman Valley Irrigation District have been irrigated since the 1890's. Water was first delivered to these lands under repayment contract in 1958. Service is available in 1962 for the first time to the full 11,490 acres in the H & RW Irrigation District. The lands in these districts lie to the north of the Frenchman Creek and Republican River from Palisade to approximately three miles east of McCook, Nebraska. Enders Reservoir provides storage water for both districts.

## Frenchman-Cambridge Irrigation District

43,190 acres of land in this irrigation district will ultimately be irrigated. Swanson and Harry Strunk Lakes now provide storage for 38,640 acres of land with service available under the Meeker-Driftwood, Bartley and Cambridge Canals. These lands are in the Republican River Valley from Trenton to Alma, Nebraska. Red Willow Dam is now complete and initial storage has started in Hugh Butler Lake. Construction will be initiated on Red Willow Diversion Dam and Red Willow Canal in 1962.

## Bostwick Irrigation District in Nebraska

Storage for the ultimate planned 24,240 acres in this irrigation district is provided by Harlan County Reservoir. The Franklin, Naponee, Franklin Pump, Superior and Courtland (Nebraska) Canals have been constructed with service available to 22,787 acres in Nebraska. These lands are in the Republican River Valley from Republican City to Hardy, Nebraska. Courtland Canal was also constructed to serve lands in the Kansas-Bostwick Irrigation District described in the following paragraph.

## Kansas-Bostwick Irrigation District No. 2

This district was originally planned for 49,000 acres. All of the major construction work to serve district lands has been completed. Storage water for the 40,952 acres with service available will be provided by Harlan County and Lovewell Reservoirs. Lovewell Reservoir serves as a regulating and storage reservoir. The Courtland Canal system was constructed to serve 11,378 acres of land above Lovewell Reservoir as well as to transport Republican River flows and Harlan County storage releases as required to Lovewell Reservoir. The Courtland Canal system below Lovewell reservoir serves an additional 29,574 acres of land below Lovewell Reservoir. The Kansas-Bostwick Irrigation lands are in the Republican River and White Rock Creek Basins from Superior, Nebraska, to Kackley, Kansas.

## Kirwin Irrigation District No. 1

Kirwin Reservoir provides storage for 11,500 acres of land served by the Kirwin Main, North and South Canals. These lands are in the North Fork of the Solomon River Valley between Kirwin and Portis, Kansas.

Webster Irrigation District No. 4

Webster Reservoir provides storage for the 8,500 acres served by the Osborne Canal. These lands are on the North side of the South Fork of the Solomon River Valley from Woodston to approximately five miles east of Osborne, Kansas.

Almena Irrigation District No. 5

Norton Reservoir will provide storage for the irrigation of 5,350 acres of land in the Almena Irrigation District. The initial construction will be started on Norton Dam this year. Construction of the Almena Diversion Dam and irrigation facilities is scheduled to begin late in 1963.

Cedar Bluff Irrigation District No. 6

Cedar Bluff Reservoir will provide storage water for 6,500 acres in the Smoky Hill Basin served by the Cedar Bluff Canal. This Canal is under construction and will be completed early in 1963.

## IRRIGATION SEASON

The Normal irrigation season for Frenchman Valley, H & RW, and Frenchman-Cambridge Irrigation Districts is from May 1 to October 15, for all other districts, the irrigation season is May 1 to September 30.

## MUNICIPAL WATER

City of Norton, Kansas

Norton Reservoir will provide storage for the municipal water supply of Norton, Kansas. A long term contract has been negotiated with the City.

City of Beloit, Kansas

A municipal water supply contract is under negotiation between the City of Beloit and the Bureau of Reclamation. Storage water as required will be furnished from Webster Reservoir until Glen Elder Dam is constructed.

City of Russell, Kansas

The Bureau of Reclamation and the City of Russell are negotiating a long term contract for municipal water supply from Cedar Bluff Reservoir.

## FISH HATCHERY

A warm-water fish hatchery is in operation below Cedar Bluff Reservoir. A maximum of 4,000 acre-feet of reservoir storage per year is allocated for hatchery use.

## CHAPTER II - SUMMARY OF 1961 OPERATIONS

### PRECIPITATION

The annual precipitation was below normal at Hugh Butler and Swanson Lakes and Enders Reservoir, normal at Harry Strunk Lake, and above normal at Bonny, Harlan County, Lovewell, Kirwin, Webster and Cedar Bluff Reservoirs.

### RESERVOIR INFLOW

All of the reservoirs spilled in the spring of 1961. Inflows into Bonny, and Harlan County Reservoirs, Swanson and Harry Strunk Lakes were below normal. Enders inflow was about normal, while Lovewell, Kirwin, Webster and Cedar Bluff inflows were well above normal. Table 4 shows the 1961 inflows compared to historical averages and forecasts for 1962. Exhibits 28 through 37 graphically present the 1961 inflows as compared to historical inflows for the period to record.

### RESERVOIR OPERATIONS

All of the operations during 1961 in Kansas River Projects were well within the plan of operation and there were no shortages for the 94,002 acres irrigated. All of the irrigation pools were full at the start of the 1961 irrigation season. Initial storage was started in Hugh Butler Lake in September, 1961. Table 5, Pages 1, 2 & 3 show the 1961 reservoir operations by months. The 1961 inflows, outflows, reservoir contents, and the 1962 estimates are plotted on exhibits 1 through 19.

Ample flood protection was provided at all times. Controlled spills were made under the direction of the Corps of Engineers.

The details of operations for each reservoir are described in the following paragraphs:

#### Bonny Reservoir

As planned, no releases were made during the winter of 1960-1961. Controlled spills were made from March to mid-June.

The reservoir water surface was at the desired spring operating level of about two feet below the top of the irrigation pool from March until the middle of June. Natural flow bypasses as required for irrigation were made to Hale Ditch from June to mid-November. Only 22 acre-feet of storage water was delivered under Warren Act Contracts as a supplemental water supply for 590 acres served by Hale Ditch. The releases of natural flow and supplemental storage water to Hale Ditch lowered the reservoir level to about 4 feet below the top of the irigation pool.

Swanson Lake

The reservoir level reached a depth of about one foot in the flood control pool during the spring of 1961. Controlled spills were made from mid-May to the end of June, when the reservoir level was lowered to the top of the irrigation pool.

18,546 acres under the Bartley and Meeker-Driftwood Canals were provided a full water supply. Additional releases amounting to 88 acre-feet were delivered under Warren Act Contracts to serve 249 acres. This resulted in a drawdown of about 9 feet in the irrigation pool by the end of the season.

Enders Reservoir

Controlled spills were made from March to late June. The storage was more than adequate to meet the irrigation demand of 8,109 acres in the Frenchman Valley Irrigation District, 4,744 acres in H & RW Irrigation District and to furnish 727 acre-feet of water to 2,111 acres of Warren Act Contractors. Enders Reservoir was drawn down about 17½ feet during 1961. Special releases were made during July and August to facilitate a special sedimentation study at the Culbertson Diversion Dam.

Hugh Butler Lake

Red Willow Dam was under construction during 1961. The reservoir created by storage of water behind Red Willow Dam has been designated Hugh Butler Lake by the Congress. Initial storage was started on September 5, 1961. The storage level was regulated by construction forces to facilitate clearing of trees from the lake area. On December 31,the pool level was at Elevation 2543.87 (2,459 acre-feet) or 8.13 feet below the top of the dead storage pool.

Harry Strunk Lake

Releases made for diversion to the Cambridge Canal resulted in a drawdown of 10½ feet below the top of the irrigation pool. 117 acre-feet of water was provided for 806 acres under Warren Act Contract. The maximum water surface elevation during 1961 was about two feet above the top of the irrigation pool. Controlled spills occurred from May to early July.

Harlan County Reservoir

The reservoir pool level was lowered only 4.20 feet in the irrigation pool during the irrigation season. Releases were made during July, August and September to meet the demands of Nebraska and Kansas Bostwick Irrigation District. Releases were made throughout the year to maintain the desired minimum sanitation flows as stated in the Harlan County Reservoir Statement of Operational Objectives. The maximum reservoir level during 1961 was 5.39 feet above the top of the irrigation pool. Controlled spills were made from May to early July. Part of these spills were used to facilitate a channel flow study to determine a roughness coefficient at several points on the Republican River.

Lovewell Reservoir

The inflows from White Rock Creek raised the pool level to an elevation of 1588.92 on June 9, 1961, which was the highest level since initial storage in the spring of 1957. This was 6.32 feet in the flood control pool. Controlled spills were made during June, October, November and December. The reservoir was regulated to meet the demand of Courtland Canal. Above normal precipitation during August and September caused the reservoir to spill at the end of the irrigation season. The inflow to Lovewell Reservoir from the Republican River flows and Harlan County Reservoir releases transported through the Courtland Canal amounted to 27,861 acre-feet.

The spillway radial gates hoisting equipment was modified to permit manual override of the automatic float controlled system.

Kirwin Reservoir

The maximum reservoir level in 1961 was 3.77 feet in the flood control pool. This was the highest reservoir level since initial storage in March of 1955. The flood storage was released during June. A full water supply was furnished to 7,551 acres, with a drawdown of 2.39 feet below the top of the irrigation pool.

Webster Reservoir

Controlled spills were made during April and May. Releases were made during July and August to meet the demands of 2,912 acres under the Osborne Canal. Releases were also made to lower the pool level to 1884.5 by the end of August to facilitate the installation of new seals and cables in the spillway radial gates. The hoisting equipment for the spillway gates was modified to permit manual override of the automatic float controlled system.

During the fall months, operations were regulated to control flows for the base flow study of the South Fork of the Solomon River by the Geological Survey, the Kansas State Board of Water Resources, and the Corps of Engineers.

Cedar Bluff Reservoir

Controlled spills occurred at Cedar Bluff Reservoir during the entire year. There was no demand for storage water by the City of Russell, Kansas, in 1961.

The fish hatchery operated by the Bureau of Sport Fisheries and Wildlife diverted 4,013 acre-feet with 2,875 acre-feet passing back to the river below Cedar Bluff Dam.

## CANAL OPERATIONS

A total of 237,415 acre-feet of water was diverted into fourteen canal systems that irrigated 94,002 acres of land in the Kansas River Projects. This is 75 percent of the area that had service available for 1961 and 63 % of the ultimate area. The following table presents the irrigable acreage and diversion and farm delivery data for each of the irrigation districts.

| Irrigation District | Acres Irrigated | Acre-feet Diverted | Diversion Rate Acre-foot/acre | Farm Delivery Acre-foot/acre |
|---|---|---|---|---|
| Frenchman Valley | 8,109 | 26,844 | 3.31 | (no records) |
| H&RW | 4,744 | 12,769 | 2.69 | 1.37 |
| Frenchman-Cambridge | 31,818 | 69,579 | 2.19 | 1.48 |
| Bostwick in Nebraska | 16,906 | 49,963 | 2.95 | 1.19 |
| Kansas-Bostwick | 21,962 | 49,086 | 2.24 | 1.23 |
| Kirwin | 7,551 | 18,904 | 2.64 | 1.38 |
| Webster | 2,912 | 9,270 | 3.18 | 1.30 |
| TOTAL Kansas River Projects | 94,002 | 237,415 | 2.53 | 1.33 for 85,893 Acres |

932 acre-feet of storage water was released to Warren Act Contractors as supplemental water supply for 3,756 acres of non-project land in the Frenchman-Cambridge Division in Nebraska. 2,495 acre-feet of water was diverted to Hale Ditch, of which 22 acre-feet was delivered under Warren Act Contract.

Table 6 presents the monthly diversions and acres irrigated for each canal system. Table 7 tabulates the irrigation development by canal systems and the estimates for 1961. The acres irrigated in 1961 and estimated for 1962 are compared to the planned acreage on table 8. A graphic representation of development by irrigation districts is presented in Exhibits 20 through 27.

## RECREATION

During the 1961 recreation season all reservoirs showed a decrease in visitors from those recorded in 1960. However, these impoundments drew 1,283,600 visitors in 1961 to enjoy boating, water skiing, swimming, camping and hunting, and the ever-popular and predominant sport, fishing. Table 9 shows the major recreation uses and the number of visitors participating in each use for each of the reservoirs.

## CHAPTER III - ANNUAL OPERATING PLAN FOR 1962

### WATER SUPPLY

The water supply outlook for 1962 is excellent at all reservoirs. Even under extremely dry conditions, no shortages are expected in meeting the demands of 118,500 acres of Kansas River Project lands which are expected to be irrigated, and any demands for municipal water of Beloit, Kansas and Russell, Kansas.

The total available water supply of each reservoir is equal to the carryover storage from the previous year plus the inflow of the current year. While the carryover storage is readily known, it is difficult to forecast reservoir inflows for an area where the major source of water is flood run-off. For forecasting purposes, values of annual inflows that will be statistically equaled or exceeded 10, 50 and 90 percent of the time were selected from the probability curve to be "reasonable maximum," "most probable," and "reasonable minimum" inflow conditions. The estimates for 1962 are shown in Table 4 and are graphically compared with the historical inflow records on Exhibits 28 through 37.

### RESERVOIR OPERATIONS

The normal storage limitiations at each of the reservoirs for irrigation and municipal purposes will be at the top of the irrigation storage pool as shown in Table 1. Administration of the use of water in accordance with state laws will affect the amount and time of storing streamflows.

Each fall after the demand period, the storage in each reservoir is evaluated and when it is apparent that a reservoir will spill under all inflow conditions before the start of next irrigation season, controlled releases will be made to store only that portion of the inflow required to fill the irrigation pool by the first of April. This plan is not used for Bonny Reservoir, as winter releases are undesirable.

Exhibits 1, 3, 5, 7, 8, 10, 12, 14, 16 and 18 show the probable effects on each reservoir for 1962 under "most probable," "reasonable minimum," and "reasonable maximum" inflow conditions.

#### Bonny Reservoir

The only expected demand on Bonny Reservoir is for supplemental water to irrigate 590 acres of non-project land served by Hale Ditch. Continuous winter releases are undesirable because of the exposed Hale Ditch outlet pipe. Releases in extremely cold weather are not necessary if the pool level is at least three feet below the top of the irrigation pool in the fall. To reduce the chances of a large fall drawdown, the reservoir pool is lowered two feet by early April and maintained there throughout the spring and summer months. During dry years, the supplemental water demand and normal reservoir losses will lower the pool another two to three feet by September. During other years, it will be necessary to make special releases during September to draw the pool level down another foot.

Swanson Lake

Irrigation demands will be made by irrigators under the Meeker-Driftwood and Bartley Canal systems for 18,700 acres. The carryover storage and available inflow will be more than adequate to meet this demand. The maximum expected drawdown even under dry year conditions will be about 13 feet below the top of the irrigation pool. The reservoir is expected to spill prior to the start of the 1962 irrigation season.

Enders Reservoir

Enders Reservoir will be spilling by early spring. The storage and available inflow will be more than adequate to meet the irrigation demands of 8,200 acres in the Frenchman Valley Irrigation District and 7,500 acres in the H & RW Irrigation District. The pool level will be lowered to elevation 3097.0 by September 1 to facilitate repair and repainting of the spillway gates. This elevation will be maintained until approximately November 1, 1962.

Hugh Butler Lake

The only demands expected on Hugh Butler Lake are small releases to meet the requirements of senior appropriations on Red Willow Creek. The lake is not expected to spill in 1962.

Harry Strunk Lake

The irrigation pool is expected to be filled by the start of the 1961 irrigation season. The storage and available inflow will more than meet the irrigation demands of 13,300 acres served by Cambridge Canal. The maximum expected drawdown under reasonable minimum inflow conditions will be about 15 feet below the top of the irrigation pool. A re-survey of the sedimentation conditions in the reservoir will be made in the spring of 1962.

Harlan County Reservoir

The irrigation pool will be filled by spring. Therefore, an ample water supply is available to irrigate 19,950 acres in the Bostwick Irrigation District in Nebraska, and 35,950 acres in Kansas-Bostwick Irrigation District. Of the 35,950 acres in Kansas, 24,550 acres are served by Courtland Canal system below Lovewell Reservoir.

Under dry and normal year inflow conditions, a transfer of storage from Harlan County Reservoir to Lovewell Reservoir is required to meet the irrigation demands of the Courtland system below Lovewell Reservoir. If conditions permit, the transfers of storage from Harlan County Reservoir to Lovewell Reservoir will be made during the irrigation season, but unusual conditions may occasionally require transfer operations during the non-irrigation season. The transfer of storage during the winter months will be held to a minimum as the maintenance costs are higher and the irrigation districts are normally preparing their canals for the next year's operation.

## Lovewell Reservoir

Lovewell Reservoir was planned for regulation of Courtland Canal as well as the storage of natural flows of White Rock Creek. The demands of 24,550 acres under the Courtland Canal below Lovewell Reservoir will be met with water stored from White Rock Creek flows and transfers of Republican River flows and storage releases, if required, from Harlan County Reservoir through the upper Courtland Canal. During periods of low water supply in Harlan County and Lovewell Reservoirs, all Republican River flows not required by Superior and Courtland Canals, and downstream water rights will be diverted into Lovewell Reservoir. Under prolonged drouth conditions, these diversions could continue through all of the non-irrigation season except January and February.

During the winter months, it is desirable that the pool level in Lovewell Reservoir be at elevation 1,577 or above to reduce the possibilities of erosion to the upstream face of the dam. Under dry year conditions, it is planned to operate the entire season at about this pool level. If Republican River flows or surplus storage are available in Harlan County Reservoir, the irrigation pool will be filled during May and June.

## Kirwin Reservoir

The project area of 11,500 acres is 1,500 acres larger than the area planned for irrigation with the available water supply, and successful operation will at times be dependent upon several years of carry-over reservoir storage. An extensive canal lining program is planned to minimize the seepage losses in the canal system. The carryover storage and available inflow are more than adequate to meet the irrigation demand of 9,500 acres in 1962.

## Webster Reservoir

The irrigation pool will be filled by the start of the 1962 Irrigation Season with normal or better inflows. The storage and available inflow will be more than adequate to meet the irrigation demand of 5,000 acres to be served by the Osborne Canal and the municipal demand by Beloit, Kansas.

## Cedar Bluff Reservoir

Cedar Bluff Reservoir was spilling at the end of 1961. The only 1962 demands on this reservoir are to supply the Fish Cultural Station requirements, supplement the municipal water supply of the City of Russell, Kansas, and to irrigate 400 acres under Cedar Bluff Canal. The Cedar Bluff Canal is under construction and will be completed by the end of the 1963 fiscal year.

## CANAL OPERATIONS

It is estimated that 118,500 acres under Kansas River Projects will be irrigated in 1962. Of this, 67,650 acres are in Nebraska and 50,850 acres in Kansas. The acres expected to be irrigated in 1962 are shown by canals in Table 7. The irrigable acres and probable canal diversions for 1962 under the "most probable," "reasonable driest year," and "reasonable wettest year" are shown graphically on exhibits 20 through 27.

The expected canal operations for 1962 are discussed in the following paragraphs for each irrigation district.

### Frenchman Valley Irrigation District

The district will operate and maintain the Culbertson Diversion Dam and Culbertson Canal to irrigate 8,200 acres. The seepage losses on the Culbertson Canal will be shared with the H & RW Irrigation District.

### H & RW Irrigation District

This will be the first year of operation for the entire Culbertson Extension System and 7,500 acres are expected to be irrigated. The operation and maintenance work will be performed by the Bureau of Reclamation.

### Frenchman-Cambridge Irrigation District

The irrigation district will operate and maintain the Bartley, Cambridge and Meeker-Driftwood Canal systems. We estimate 32,000 acres will be irrigated by these three systems in 1962.

### Bostwick Irrigation District in Nebraska

Franklin, Naponee, Franklin Pump and Superior Canals will be operated and maintained by the irrigation district. It is estimated that 19,950 acres will be irrigated in 1962. The Kansas-Bostwick Irrigation District will operate and maintain the Superior-Courtland Diversion Dam and Courtland Canal in Nebraska and the Bostwick Irrigation District in Nebraska will operate and maintain the Courtland Lateral System in Nebraska.

### Kansas-Bostwick Irrigation District No. 2

35,950 acres are expected to be irrigated in 1962, of which 11,400 acres are above Lovewell Reservoir and 24,550 acres below. This is the first year that the district will operate and maintain the entire system.

Kirwin Irrigation District No. 1

The district will operate and maintain the Kirwin Canal system. We estimate that 9,500 acres will be irrigated during the 1962 irrigation season.

Webster Irrigation District No. 4

Of the 8,500 acres available for service in the Osborne Canal System, 5,000 acres are expected to be irrigated this year. The operation and maintenance was transferred to the district on January 1, 1962.

Cedar Bluff Irrigation District No. 6

This will be the first year of operation for the first section of the Cedar Bluff Canal and only 400 acres are expected to be irrigated. The initial operation and maintenance will be performed by the Bureau of Reclamation.

TABLE 1
RESERVOIR DATA - KANSAS RIVER PROJECTS

| RESERVOIR | STORAGE ALLOCATIONS | | | CONDITIONS EXPECTED BY MAY 1, 1961 |
|---|---|---|---|---|
| | DEAD 1/ | IRRIGATION 1/ | FLOOD CONTROL | |
| Bonny | | | | |
| Elevation (Ft.) | 3635.5 | 3672.0 | 3710.0 | 3670.0 |
| Total Acre Feet | 1,420 | 41,340 | 170,160 | 37,390 |
| Net Acre Feet | 1,420 | 39,920 | 128,820 | 35,970 |
| Swanson Lake | | | | |
| Elevation (Ft.) | 2710.0 | 2752.0 | 2773.0 | 2752.0 |
| Total Acre Feet | 4,100 | 120,160 | 253,950 | 120,160 |
| Net Acre Feet | 4,100 | 116,060 | 133,790 | 116,060 |
| Enders | | | | |
| Elevation (Ft.) | 3080.0 | 3112.3 | 3127.0 | 3112.3 |
| Total Acre Feet | 8,470 | 44,480 | 74,520 | 44,480 |
| Net Acre Feet | 8,470 | 36,010 | 30,040 | 36,010 |
| Hugh Butler | | | | |
| Elevation (Ft.) | 2552.0 | 2581.8 | 2604.9 | 2554.1 |
| Total Acre Feet | 6,310 | 37,780 | 86,630 | 7,700 |
| Net Acre Feet | 6,310 | 30,144 | 48,851 | 1,390 |
| Harry Strunk | | | | |
| Elevation (Ft.) | 2335.0 | 2366.1 | 2386.2 | 2366.1 |
| Total Acre Feet | 5,370 | 39,230 | 90,920 | 39,230 |
| Net Acre Feet | 5,370 | 33,860 | 51,690 | 33,860 |
| Harlan County | | | | |
| Elevation (Ft.) | 1920.0 2/ | 1946.0 | 1973.5 | 1946.0 |
| Total Acre Feet | 97,200 3/ | 350,120 | 850,000 | 350,120 |
| Net Acre Feet | 97,200 3/ | 252,920 | 499,880 | 252,920 |
| Lovewell | | | | |
| Elevation (Ft.) | 1562.07 4/ | 1582.6 | 1595.3 | 1582.6 |
| Total Acre Feet | 5,050 5/ | 41,690 | 92,150 | 41,690 |
| Net Acre Feet | 5,050 5/ | 36,640 | 50,460 | 37,330 |
| Kirwin | | | | |
| Elevation (Ft.) | 1693.0 | 1728.4 | 1757.3 | 1727.6 |
| Total Acre Feet | 6,380 | 95,180 | 314,550 | 91,280 |
| Net Acre Feet | 6,380 | 88,800 | 219,370 | 84,895 |
| Webster | | | | |
| Elevation (Ft.) | 1855.5 | 1889.6 | 1923.7 | 1888.5 |
| Total Acre Feet | 2,180 | 67,100 | 260,740 | 63,370 |
| Net Acre Feet | 2,180 | 64,920 | 193,640 | 61,190 |
| Cedar Bluff | | | | |
| Elevation (Ft.) | 2100.4 4/ | 2144.0 | 2166.0 | 2143.9 |
| Total Acre Feet | 21,580 6/ | 185,090 | 376,950 | 184,410 |
| Net Acre Feet | 21,580 6/ | 163,510 | 191,860 | 162,830 |
| Total Storage (A.F.) | 158,060 | 1,022,170 | 2,570,570 | 979,830 |
| Total Net Acre Feet | 158,060 | 862,784 | 1,548,401 | 822,455 |

1/ Includes space for sediment storage.
2/ Controlling elevation to Franklin Canal.
3/ Could release 95,900 A.F. to river.
4/ Controlling elevation to canal.
5/ Could release 690 A.F. to river.
6/ Could release 13,320 A.F. to river and fish hatchery.

Note: Reservoir storage data based on latest reservoir surveys.

TABLE 2

STATUS OF REPAYMENT--WATER SERVICE CONTRACTS
KANSAS RIVER PROJECTS

| Contracting Organization | Contract Number | Date of Contract | Date Contract Approved by Court | Development Period Start | Development Period End |
|---|---|---|---|---|---|
| Frenchman-Cambridge Irrigation District | I 1r-1500 | May 29,1947 | July 19,1950 (Rej.) | Jan.1,1957(Blk.1) | Dec.31,1961 (Blk.1) |
| | Amendatory No.1 | July 19,1951 | Feb.11,1956 (Appr.) | Jan.1,1960(Blk.II) | Dec.31,1964 (Blk.II) |
| | Amendatory No.2 | Jan.4,1956 | | | |
| | Amendatory No.3 | Nov.1,1957 | | | |
| Frenchman Valley Irrigation District | 14-06-700-1241 | Nov.7,1956 | Oct.20,1958 | No development period Pay only water service charges | |
| H&RW Irrigation District | 14-06-700-1242 | Nov.7,1956 | July 19,1957 | | |
| | Amendment No.1 | Aug.12,1958 | | | |
| Bostwick Irrigation District in Nebr. | I 1r-1079 | Feb.21,1949 | | Jan.1,1957 | Dec.31,1961 |
| | Amended | Nov.10,1954 | Feb.28,1955 | | |
| Kansas-Bostwick Irrig.Dist.No. 2 | I 1r-1584 | Apr.20,1951 | Mar.9,1953 | Jan.1,1957(Blk.I) | Dec.31,1961 (Blk I) |
| | Amendment No.2 | Apr.24,1957 | Dec.20,1957 | Jan.1,1960(Blk.II) | Dec.31,1964 (Blk II) |
| | | | | Jan.1,1961(Blk.III) | Dec.31,1965(Blk.III) |
| | | | | Jan.1,1962(Blk.IV) | Dec.31,1966(Blk.IV) |
| Almena Irrigation District No. 5 | 14-06-700-1579 | Mar.7,1958 | Nov.20,1958 | | |
| Kirwin Irrigation District No. 1 | 14-06-W55 | June 9,1953 | May 26,1954 | Jan.1,1960 | Dec.31,1964 |
| | Amendatory | Oct.18,1955 | | | |
| | Amendatory No.2 | Feb.12,1959 | | | |
| Webster Irrigation District No. 4 | 14-06-700-1375 | Apr.24,1957 | Oct.22,1957 | Jan.1,1962 | Dec.31,1966 |
| Cedar Bluff Irrigation District No.6 | 14-06-700-2118 | Sept.3,1959 | March 17,1960 | | |
| City of Norton, Kansas | 14-06-700-1573 | Mar.7,1958 | | | |

Table 3

PRECIPITATION DATA

| Month | BONNY DAM | | | | TRENTON DAM | | | | ENDERS DAM | | | | MEDICINE CREEK DAM | | | | HARLAN CO. DAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 |
| Jan. | 0.35 | 0.49 | 0.94 | T | 0.44 | 0.61 | 0.61 | 0 | 0.42 | 0.69 | 1.70 | 0 | 0.40 | 0.51 | 1.38 | T | 0.41 | 0.48 | 0.95 | 0.03 |
| Feb. | 0.41 | 0.22 | 2.94 | T | 0.52 | 0.14 | 2.19 | 0.11 | 0.46 | 0.54 | 2.09 | 0.03 | 0.64 | 0.26 | 1.39 | 0.05 | 0.58 | 0.29 | 0.80 | 0.40 |
| Mar. | 0.91 | 0.87 | 0.48 | 1.16 | 1.21 | 1.14 | 0.72 | 1.41 | 1.06 | 1.34 | 0.67 | 2.23 | 0.99 | 1.70 | 0.63 | 1.20 | 0.95 | 1.67 | 0.72 | 1.42 |
| Apr. | 1.59 | 0.76 | 1.08 | 1.11 | 1.94 | 0.85 | 1.07 | 0.95 | 1.94 | 0.50 | 1.37 | 1.52 | 2.31 | 1.61 | 1.69 | 2.44 | 2.27 | 2.49 | 2.23 | 1.29 |
| May | 2.40 | 2.61 | 2.66 | 4.04 | 3.20 | 2.31 | 3.12 | 4.55 | 3.38 | 3.62 | 4.74 | 3.12 | 3.22 | 2.79 | 3.08 | 9.47 | 3.21 | 3.76 | 4.48 | 6.20 |
| June | 2.57 | 0.82 | 2.51 | 1.36 | 3.19 | 2.38 | 3.20 | 2.10 | 3.36 | 1.73 | 2.55 | 3.06 | 3.52 | 2.12 | 6.86 | 1.54 | 3.66 | 3.29 | 5.64 | 5.31 |
| July | 2.32 | 2.61 | 3.90 | 4.22 | 2.61 | 2.45 | 2.64 | 2.18 | 2.19 | 0.88 | 1.88 | 2.03 | 2.79 | 1.34 | 1.04 | 0.93 | 2.86 | 1.10 | 1.47 | 1.28 |
| Aug. | 2.27 | 1.56 | 0.03 | 1.47 | 2.50 | 2.23 | 0.49 | 1.78 | 2.23 | 0.76 | 1.16 | 1.46 | 2.61 | 2.94 | 1.11 | 1.71 | 2.48 | 1.83 | 2.58 | 2.30 |
| Sept. | 1.28 | 1.30 | 0.93 | 2.20 | 1.68 | 1.64 | 1.04 | 2.30 | 1.79 | 1.68 | 0.65 | 2.48 | 2.02 | 1.76 | 0.88 | 1.84 | 2.19 | 2.46 | 1.03 | 2.94 |
| Oct. | 0.74 | 1.75 | 2.09 | 0.42 | 0.87 | 2.67 | 1.71 | 0.24 | 0.80 | 2.78 | 1.66 | 0.40 | 1.12 | 2.87 | 1.46 | 0.61 | 1.03 | 2.15 | 1.17 | 0.35 |
| Nov. | 0.41 | 0.01 | 0.15 | 0.78 | 0.68 | 0.08 | 0.06 | 1.04 | 0.54 | 0.21 | 0.07 | 0.66 | 0.84 | T | 0.23 | 0.68 | 0.77 | T | 0.36 | 1.19 |
| Dec. | 0.39 | 0.36 | 1.07 | 0.43 | 0.45 | 0.93 | 0.71 | 0.62 | 0.45 | 0.10 | 0.77 | 0.35 | 0.57 | 0.00 | 0.43 | 0.66 | 0.49 | 0.03 | 0.34 | 0.64 |
| Total | 15.64 | 13.36 | 18.78 | 17.19 | 19.29 | 17.43 | 17.56 | 17.28 | 18.62 | 14.83 | 19,31 | 17,34 | 21.03 | 17.90 | 20.18 | 21.13 | 20.90 | 19.55 | 21.77 | 23.35 |

| Month | LOVEWELL DAM | | | | KIRWIN DAM | | | | WEBSTER DAM | | | | CEDAR BLUFF DAM | | | | KANOPOLIS DAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 | Norm. | 1959 | 1960 | 1961 |
| Jan. | 0.60 | 0.48 | 1.42 | 0.06 | 0.47 | 0.36 | 1.19 | 0.04 | 0.40 | 0.51 | 1.37 | 0.05 | 0.48 | 0.19 | 0.59 | T | 0.77 | 0.21 | 0.91 | 0.04 |
| Feby. | 0.85 | 0.38 | 1.80 | 0.56 | 0.70 | 0.19 | 1.01 | 0.25 | 0.78 | 0.38 | 2.29 | 0.37 | 0.62 | 0.05 | 1.35 | 0.25 | 1.08 | 0.39 | 1.88 | 0.53 |
| Mar. | 1.26 | 2.27 | 2.02 | 2.60 | 1.18 | 1.41 | 0.84 | 2.16 | 1.00 | 1.62 | 1.01 | 2.29 | 1.26 | 0.86 | 0.47 | 1.39 | 1.71 | 2.21 | 1.47 | 1.71 |
| Apr. | 2.21 | 1.56 | 2.70 | 1.99 | 2.40 | 1.15 | 2.13 | 1.50 | 2.20 | 1.67 | 2.45 | 1.74 | 2.11 | 0.52 | 3.55 | 1.01 | 2.65 | 1.29 | 1.52 | 3.66 |
| May | 3.60 | 8.11 | 3.13 | 8.38 | 2.90 | 5.25 | 6.18 | 8.96 | 2.90 | 4.23 | 4.18 | 8.77 | 3.62 | 4.43 | 1.08 | 3.72 | 4.02 | 6.45 | 1.85 | 4.85 |
| June | 4.82 | 2.59 | 6.50 | 3.70 | 3.75 | 2.48 | 4.23 | 5.33 | 3.70 | 2.75 | 4.55 | 5.09 | 3.92 | 3.07 | 2.66 | 4.28 | 4.01 | 3.55 | 4.57 | 5.08 |
| July | 2.81 | 1.15 | 1.34 | 2.63 | 2.87 | 3.45 | 1.77 | 1.98 | 2.70 | 4.16 | 0.14 | 1.96 | 2.33 | 2.97 | 0.14 | 3.29 | 3.31 | 4.39 | 1.79 | 4.48 |
| Aug. | 2.68 | 1.07 | 3.62 | 3.97 | 2.85 | 1.04 | 3.32 | 4.30 | 2.75 | 1.88 | 4.94 | 3.65 | 2.43 | 1.39 | 2.89 | 4.66 | 3.45 | 3.14 | 6.55 | 1.18 |
| Sept. | 2.69 | 3.10 | 2.53 | 6.24 | 2.27 | 4.48 | 3.26 | 2.59 | 2.50 | 3.24 | 1.83 | 3.94 | 2.06 | 4.38 | 2.40 | 3.44 | 3.02 | 4.55 | 3.81 | 3.74 |
| Oct. | 1.45 | 5.64 | 2.05 | 1.01 | 1.26 | 4.53 | 1.81 | 0.65 | 1.40 | 4.25 | 1.78 | 1.30 | 1.16 | 3.17 | 1.95 | 1.26 | 2.29 | 4.19 | 3.32 | 2.00 |
| Nov. | 1.03 | 0.03 | 0.32 | 1.90 | 0.84 | T | 0.19 | 1.00 | 0.99 | T | T | 1.22 | 0.86 | T | 0.31 | 1.53 | 1.30 | 0.01 | 0.28 | 1.64 |
| Dec. | 0.77 | 0.18 | 0.29 | 1.04 | 0.57 | T | 0.41 | 0.69 | 0.70 | 0.06 | 0.49 | 0.77 | 0.55 | 0.10 | 0.32 | 0.31 | 0.90 | 0.37 | 1.76 | 0.46 |
| Total | 24.77 | 26.56 | 27.72 | 34.08 | 22.06 | 24.34 | 26.34 | 29.45 | 22.02 | 24.75 | 25.03 | 31.15 | 21.40 | 21.13 | 17.71 | 25,14 | 28.51 | 30.75 | 29.71 | 29.37 |

The records on this table were taken from U. S. Weather Bureau Records.

TABLE 4
INFLOW INTO RESERVOIRS - 1961 RECORDS, 1962 ESTIMATES

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| | 1,000 Acre-Feet | | | | | |
| | 1961 Records | | 1962 Estimates 1/ | | | Average |
| Reservoir | Actual | Adjusted | Reasonable Minimum | Most Probable | Reasonable Maximum | for period of Record |
| Bonny | 19.3 | | 17.9 | 26.2 | 40.4 | 32.3 |
| Swanson Lake | 86.8 | 88.8 3/ | 64.8 | 114.9 | 199.2 | 136.5 3/ |
| Enders | 49.7 | | 41.1 | 50.4 | 55.3 | 50.2 |
| Hugh Butler Lake | ---- | | 13.4 | 20.6 | 27.2 | 21.1 |
| Harry Strunk Lake | 39.3 | | 37.9 | 45.9 | 79.2 | 55.0 |
| Harlan County | 234.1 | 322.7 3/ | 223.9 | 434.7 | 728.7 | 484.3 3/ |
| Lovewell | 63.9 4/ | 36.2 5/ | 2.5 | 17.9 | 54.7 | 27.4 5/ |
| Kirwin | 46.4 | | 14.4 | 34.7 | 100.0 | 54.4 |
| Webster | 68.3 | | 10.0 | 33.6 | 90.4 | 52.1 |
| Cedar Bluff | 64.4 | | 12.5 | 36.7 | 112.9 | 65.0 |

1/ Values determined from inflow frequency curves. A value of 90% on curve = reasonable minimum conditions, 50% = most probable conditions, and 10% = reasonable maximum conditions.
2/ Average computed for period of record up to and including 1960.
3/ Actual records plus upstream depletions caused by reservoirs and canals in Missouri Basin Projects.
4/ Includes total of White Rock Creek and inflow from Courtland Canal.
5/ Natural inflow from White Rock Creek.

Note: Closure was made on Hugh Butler Lake in September, 1961

# RESERVOIR OPERATIONS
## BONNY, SWANSON & ENDERS RESERVOIR
(Units in 1,000 Acre-Feet)

| Month | TOTAL STORAGE END OF MONTH 1960 | TOTAL STORAGE END OF MONTH 1961 | TOTAL 1961 OUTFLOW | INFLOW 1961 ACTUAL | INFLOW MOST PROBABLE |
|---|---|---|---|---|---|
| Jan. | 38.8 | 38.2 | 0.4 | 1.7 | 2.3 |
| Feb. | 41.3 | 39.7 | 0.3 | 1.7 | 2.3 |
| Mar. | 46.4 | 37.4 | 4.4 | 2.1 | 3.0 |
| Apr. | 45.1 | 37.4 | 2.2 | 2.0 | 2.7 |
| May | 42.2 | 37.7 | 4.1 | 2.3 | 3.1 |
| June | 37.3 | 36.9 | 1.5 | 1.2 | 3.0 |
| July | 36.4 | 35.9 | 1.0 | 0.4 | 1.2 |
| Aug. | 34.5 | 34.6 | 1.0 | 0.7 | 1.3 |
| Sept. | 33.2 | 33.8 | 1.1 | 1.0 | 1.5 |
| Oct. | 34.2 | 34.2 | 0.8 * | 1.8 * | 1.7 |
| Nov. | 35.9 | 35.9 | 0.4 * | 2.4 * | 1.9 |
| Dec. | 37.5 | 37.5 | 0.4 * | 2.0 * | 2.2 |
| Total | | | 17.6 | 19.3 | 26.2 |

| DAM AND RESERVOIR INFORMATION | |
|---|---|
| DAM: BONNY | |
| RESERVOIR: BONNY | |
| | STORAGE CAPACITY |
| DEAD | 1.4 |
| IRRIGATION | 39.9 |
| SUB-TOTAL | 41.3 |
| FLOOD | 128.8 |
| TOTAL | 170.1 |

| Month | TOTAL STORAGE END OF MONTH 1960 | TOTAL STORAGE END OF MONTH 1961 | TOTAL 1961 OUTFLOW | INFLOW 1961 ACTUAL | INFLOW MOST PROBABLE |
|---|---|---|---|---|---|
| Jan. | 82.8 | 86.5 | 0.1 | 6.7 | 8.2 |
| Feb. | 94.7 | 94.0 | 0.1 | 7.8 | 11.3 |
| Mar. | 140.9 | 105.7 | 0.1 | 14.0 | 16.0 |
| Apr. | 146.0 | 115.7 | 0.1 | 11.3 | 11.9 |
| May | 123.0 | 125.6 | 0.4 | 14.2 | 14.3 |
| June | 122.8 | 120.8 | 0.8 | 5.9 | 15.1 |
| July | 107.4 | 104.1 | 19.3 | 5.4 | 5.4 |
| Aug. | 83.6 | 86.7 | 18.2 | 4.2 | 9.1 |
| Sept. | 75.4 | 79.8 | 6.3 | 1.6 | 4.7 |
| Oct. | 74.1 | 81.5 | 0.5 * | 3.5 * | 4.7 |
| Nov. | 76.6 | 87.5 | 0.1 * | 6.7 * | 7.2 |
| Dec. | 81.4 | 92.8 | 0.1 * | 5.5 * | 7.0 |
| Total | | | 46.1 | 86.8 a/ | 114.9 |

| DAM AND RESERVOIR INFORMATION | |
|---|---|
| DAM: TRENTON | |
| RESERVOIR: SWANSON LAKE | |
| | STORAGE CAPACITY |
| DEAD | 4.1 |
| IRRIGATION | 116.1 |
| SUB-TOTAL | 120.2 |
| FLOOD | 133.8 |
| TOTAL | 254.0 |

a/ Recorded inflow

| Month | TOTAL STORAGE END OF MONTH 1960 | TOTAL STORAGE END OF MONTH 1961 | TOTAL 1961 OUTFLOW | INFLOW 1961 ACTUAL | INFLOW MOST PROBABLE |
|---|---|---|---|---|---|
| Jan. | 42.6 | 42.0 | 2.2 | 4.9 | 4.6 |
| Feb. | 45.7 | 43.6 | 2.0 | 4.2 | 4.4 |
| Mar. | 52.0 | 45.0 | 2.4 | 4.0 | 4.4 |
| Apr. | 48.0 | 45.3 | 4.1 | 4.4 | 4.0 |
| May | 45.4 | 44.9 | 5.2 | 4.5 | 4.3 |
| June | 45.2 | 44.0 | 4.4 | 3.6 | 4.6 |
| July | 41.2 | 33.7 | 14.5 | 3.7 | 4.0 |
| Aug. | 36.3 | 24.0 | 14.2 | 3.6 | 3.6 |
| Sept. | 34.6 | 21.3 | 7.5 | 3.6 | 3.8 |
| Oct. | 34.7 | 25.9 | 0.2 * | 3.9 * | 4.0 |
| Nov. | 36.6 | 28.9 | 0.4 * | 4.6 * | 4.2 |
| Dec. | 39.4 | 33.2 | 0.4 * | 4.7 * | 4.5 |
| Total | | | 57.5 | 49.7 | 50.4 |

| DAM AND RESERVOIR INFORMATION | |
|---|---|
| DAM: ENDERS | |
| RESERVOIR: ENDERS | |
| | STORAGE CAPACITY |
| DEAD | 8.5 |
| IRRIGATION | 36.0 |
| SUB-TOTAL | 44.5 |
| FLOOD | 30.0 |
| TOTAL | 74.5 |

* Computed from Reservoir Operation Data

RESERVOIR OPERATIONS
MEDICINE CREEK, HARLAN COUNTY and LOVEWELL RESERVOIRS
(Units 1,000 A.F.)

| Month | TOTAL STORAGE END OF MONTH 1960 | 1961 | TOTAL 1961 OUTFLOW | INFLOW 1961 ACTUAL | MOST PROBABLE | DAM AND RESERVOIR INFORMATION |
|---|---|---|---|---|---|---|
| Jan. | 34.0 | 32.0 | 0.2 | 3.0 | 3.6 | DAM: MEDICINE CREEK |
| Feb. | 41.2 | 34.7 | 0.2 | 3.6 | 3.8 | RESERVOIR: |
| Mar. | 48.4 | 37.2 | 1.5 | 4.3 | 4.5 | HARRY STRUNK LAKE |
| Apr. | 41.9 | 38.5 | 1.9 | 4.0 | 5.5 | STORAGE CAPACITY |
| May | 40.1 | 41.8 | 4.1 | 5.5 | 4.0 | |
| June | 39.7 | 39.9 | 4.5 | 3.4 | 5.9 | |
| July | 32.6 | 30.8 | 10.6 | 2.3 | 3.8 | DEAD 5.4 |
| Aug. | 22.9 | 24.9 | 7.3 | 1.7 | 3.6 | IRRIGATION 33.8 |
| Sept. | 21.4 | 24.7 | 1.8 | 2.1 | 2.6 | SUB-TOTAL 39.2 |
| Oct. | 23.6 | 27.1 | 0.3* | 3.1* | 2.5 | FLOOD 51.7 |
| Nov. | 26.3 | 29.8 | 0.3* | 3.1* | 2.9 | TOTAL 90.9 |
| Dec. | 29.2 | 32.6 | 0.3* | 3.2* | 3.2 | |
| Total | | | 33.0 | 39.3 | 45.9 | |
| Jan. | 289.3 | 326.9 | 0.6 | 9.8 | 23.9 | DAM: HARLAN COUNTY |
| Feb. | 318.4 | 340.1 | 0.6 | 13.4 | 31.0 | RESERVOIR: |
| Mar. | 477.5 | 357.0 | 0.7 | 17.2 | 39.2 | HARLAN COUNTY |
| Apr. | 404.0 | 370.6 | 0.7 | 16.7 | 41.3 | STORAGE CAPACITY |
| May | 356.2 | 399.4 | 42.1 | 64.5 | 52.9 | |
| June | 384.8 | 376.1 | 100.1 | 61.3 | 76.7 | |
| July | 340.5 | 325.7 | 59.0 | 10.7 | 49.5 | DEAD 1.3 |
| Aug. | 312.3 | 305.5 | 29.5 | 12.4 | 31.5 | INACTIVE 95.9 |
| Sept. | 302.9 | 297.6 | 8.6 | 4.2 | 32.6 | IRRIGATION 252.9 |
| Oct. | 305.2 | 299.6 | 0.6* | 6.5* | 14.9 | SUB-TOTAL 350.1 |
| Nov. | 310.3 | 307.4 | 0.6* | 10.3* | 18.8 | FLOOD 499.9 |
| Dec. | 318.3 | 313.4 | 0.6* | 7.1* | 22.4 | TOTAL 850.0 |
| Total | | | 243.7 | 234.1 a/ | 434.7 | |
| Jan. | 28.1 | 28.3 | 0 | 0.2 | 0.3 | DAM: LOVEWELL |
| Feb. | 27.5 | 28.7 | 0 | 0.2 | 1.0 | RESERVOIR: |
| Mar. | 40.4 | 29.5 | 0 | 0.2 | 1.2 | LOVEWELL |
| Apr. | 41.4 | 29.7 | 0 | 0.6 | 1.0 | STORAGE CAPACITY |
| May | 43.2 | 46.6 | 0 | 11.7 | 1.8 | |
| June | 50.8 | 43.1 | 23.0 | 15.9 | 5.0 | DEAD 4.4 |
| July | 33.7 | 39.8 | 11.5 | 9.9 | 14.4 | INACTIVE 0.7 |
| Aug. | 30.5 | 39.6 | 12.7 | 12.9 | 14.3 | IRRIGATION 36.6 |
| Sept. | 28.2 | 43.6 | 3.7 | 6.3 | 5.4 | SUB-TOTAL 41.7 |
| Oct. | 28.3 | 42.0 | 3.6* | 2.8* | 0.6 | FLOOD 50.5 |
| Nov. | 28.1 | 42.4 | 1.0* | 1.8* | 0.6 | TOTAL 92.2 |
| Dec. | 28.2 | 42.6 | 1.1* | 1.4* | 0.5 | |
| Total | | | 56.6 | 63.9 a/ | 46.1 a/ | |

a/ Recorded inflow

a/ Total inflow from White Rock Creek and deliveries from Upper Courtland Canal

* Computed from reservoir operation data.

RESERVOIR OPERATIONS
KIRWIN, WEBSTER & CEDAR BLUFF RESERVOIRS
(Units in 1,000 Acre-Feet)

| Month | TOTAL STORAGE END OF MONTH 1960 | 1961 | TOTAL 1961 OUTFLOW | INFLOW 1961 ACTUAL | MOST PROBABLE | DAM AND RESERVOIR INFORMATION |
|---|---|---|---|---|---|---|
| Jan. | 80.4 | 81.3 | 0 | 0.7 | 0.8 | DAM: KIRWIN |
| Feb. | 83.1 | 82.4 | 0 | 0.9 | 1.8 | |
| Mar. | 101.7 | 84.3 | 0 | 1.2 | 1.9 | RESERVOIR: KIRWIN |
| Apr. | 97.2 | 85.2 | 0 | 1.2 | 2.6 | |
| May | 106.2 | 99.1 | 0.9 | 11.2 | 4.1 | STORAGE CAPACITY |
| June | 100.7 | 90.3 | 21.4 | 21.0 | 9.3 | |
| July | 92.0 | 90.5 | 9.5 | 2.6 | 5.6 | |
| Aug. | 85.5 | 86.7 | 7.1 | 3.7 | 3.6 | DEAD 6.4 |
| Sept. | 82.9 | 84.5 | 1.6 | 0.5 | 2.3 | IRRIGATION 88.8 |
| Oct. | 81.6 | 83.9 | 0 * | 0.9* | 1.0 | SUB-TOTAL 95.2 |
| Nov. | 80.5 | 84.9 | 0 * | 1.5* | 0.9 | FLOOD 219.4 |
| Dec. | 80.8 | 85.8 | 0 * | 1.0* | 0.8 | TOTAL 314.6 |
| Total | | | 40.5 | 46.4 | 34.7 | |
| Jan. | 65.8 | 65.7 | 0 Engr. | 1.5 | 0.7 | DAM: WEBSTER |
| Feb. | 69.6 | 67.6 | 0 | 2.0 | 1.6 | |
| Mar. | 89.4 | 70.1 | 0.3 | 2.3 | 2.0 | RESERVOIR: WEBSTER |
| Apr. | 72.7 | 67.1 | 5.7 | 2.7 | 2.8 | |
| May | 74.3 | 79.8 | 3.0 | 11.8 | 4.4 | STORAGE CAPACITY |
| June | 70.0 | 90.8 | 20.9 21.9 | 23.0 | 9.7 | |
| July | 63.2 | 67.4 | 20.0 24.5 | 4.2 | 4.4 | |
| Aug. | 64.7 | 51.1 | 26.5 26.6 | 10.2 | 3.3 | DEAD 2.2 |
| Sept. | 63.0 | 50.0 | 2.9 3.0 | 1.7 | 2.2 | IRRIGATION 64.9 |
| Oct. | 62.8 | 51.2 | 0 * | 2.2 * | 0.8 | SUB-TOTAL 67.1 |
| Nov. | 63.0 | 54.8 | 0 * | 3.8 * | 1.0 | FLOOD 193.6 |
| Dec. | 64.4 | 57.6 | 0 * | 2.9 * | 0.7 | TOTAL 260.7 |
| Total | | | 79.3 | 68.3 | 33.6 | |
| Jan. | 182.7 | 185.1 | 0.5 | 0.5 | 0.8 | DAM: CEDAR BLUFF |
| Feb. | 184.1 | 185.1 | 0.5 | 0.5 | 1.2 | |
| Mar. | 214.9 | 185.1 | 0.6 | 0.4 | 1.3 | RESERVOIR: CEDAR BLUFF |
| Apr. | 187.2 | 185.1 | 0.5 | 0.4 | 2.1 | |
| May | 189.2 | 187.2 | 0.7 | 1.9 | 5.0 | STORAGE CAPACITY |
| June | 186.1 | 205.9 | 15.4 | 30.4 | 8.0 | |
| July | 183.4 | 190.4 | 23.5 | 8.3 | 6.7 | DEAD 8.3 |
| Aug. | 203.1 | 192.2 | 23.1 | 11.4 | 4.6 | INACTIVE 13.3 |
| Sept. | 193.4 | 193.1 | 7.9 | 2.8 | 3.7 | IRRIGATION 163.5 |
| Oct. | 188.5 | 189.9 | 3.0 * | 2.5 * | 1.5 | SUB-TOTAL 185.1 |
| Nov. | 186.3 | 190.3 | 1.9 * | 3.1 * | 1.0 | FLOOD 191.9 |
| Dec. | 185.1 | 189.7 | 2.4 * | 2.2 * | 0.8 | TOTAL 377.0 |
| Total | | | 80.0 a/ | 64.4 | 36.7 | |

a/ Cedar Bluff outflow includes releases to Fish Hatchery

* Computed from reservoir operation data.

TABLE 6
ACRES IRRIGATED AND CANAL DIVERSIONS - 1961
KANSAS RIVER PROJECTS

| State and Canal System | Acres Irrigated | Acre-Feet Diverted Apr. | May | June | July | Aug. | Sept. | Oct. | Total |
|---|---|---|---|---|---|---|---|---|---|
| COLORADO | | | | | | | | | |
| Hale Ditch (Non-Project) 1/ | 590 | 0 | 0 | 95 | 602 | 551 | 718 | 437 | 2,403 |
| NEBRASKA | | | | | | | | | |
| Warren Act (Non-Project) 2/ | 3,166 | 0 | 0 | 0 | 420 | 480 | 32 | 0 | 932 |
| Culbertson (Frenchman Valley I.D.) | 8,109 | 3,641 | 611 | 792 | 8,081 | 7,775 | 5,944 | 0 | 26,844 |
| Culbertson Extension Canal (H&RW) | 4,744 | 48 | 305 | 218 | 4,829 | 5,332 | 2,037 | 0 | 12,769 |
| Meeker-Driftwood | 13,192 | 0 | 1,442 | 1,315 | 12,750 | 11,276 | 4,292 | 460 | 31,535 |
| Bartley | 5,354 | 0 | 486 | 369 | 4,780 | 3,782 | 1,291 | 149 | 10,857 |
| Cambridge | 13,272 | 0 | 1,438 | 1,261 | 12,591 | 9,124 | 2,089 | 684 | 27,187 |
| Total (Frenchman-Cambridge I.D.) | 31,818 | 0 | 3,366 | 2,945 | 30,121 | 24,182 | 7,672 | 1,293 | 69,579 |
| Franklin | 7,794 | 0 | 510 | 2,999 | 8,775 | 9,306 | 3,215 | 0 | 24,805 |
| Naponee | 1,297 | 0 | 0 | 26 | 1,432 | 1,466 | 315 | 0 | 3,239 |
| Franklin Pump | 1,739 | 0 | 0 | 0 | 1,174 | 950 | 198 | 0 | 2,322 |
| Superior | 4,837 | 0 | 974 | 403 | 6,184 | 4,681 | 1,194 | 0 | 13,436 |
| Courtland (Nebraska) 3/ | 1,239 | 113 | 583 | 455 | 3,041 | 1,576 | 393 | 0 | 6,161 |
| Total (Nebraska-Bostwick I.D.) | 16,906 | 113 | 2,067 | 3,883 | 20,606 | 17,979 | 5,315 | 0 | 49,963 |
| KANSAS | | | | | | | | | |
| Courtland (Above Lovewell Res.) 4/ | 7,910 | 156 | 1,204 | 1,025 | 10,393 | 5,697 | 2,647 | 139 | ~~20,983~~ 21,261 |
| Courtland (Below Lovewell Res.) | 14,052 | 0 | 0 | 938 | 11,169 | 12,454 | 3,542 | 0 | 28,103 |
| Total (Kansas-Bostwick I.D.) | 21,962 | 156 | 1,204 | 1,963 | 21,562 | 18,151 | 6,189 | 139 | 49,086 |
| Kirwin (Kirwin I.D.) | 7,551 | 0 | 829 | 1,164 | 9,249 | 7,047 | 1,164 | 0 | 19,904 |
| Osborne (Webster I.D.) | 2,912 | 0 | 575 | 1,313 | 3,185 | 3,350 | 847 | 0 | 9,270 |
| TOTAL OF PROJECTS (Does not include non-project lands) | 94,002 | 3,958 | 8,957 | 12,278 | 97,633 | 83,816 | 29,619 | 1,154 | 237,415 |

1/ Includes 22 acre-feet of surplus storage water supplied under Warren Act Contracts on 140 acres.
2/ Storage water supplied to non-project lands. No record of natural flow use.
3/ Headgate records less state line records.
4/ State line records less records at deliveries to Lovewell Reservoir.

TABLE 7
IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

| Irrig.Dist. / Canal | COLORADO (Non-Proj) Hale Ditch 1/ | NEBRASKA (Non-Proj) Warren Act 2/ | Fr. Valley Culbertson | H & RW Extension | Frenchman-Cambridge Meeker-Driftwood | Meeker | Bartley | Cambridge | Total | Nebr.-Bostwick Franklin | Naponee |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1962 Estimates | | | | | | | | | | | |
| Acres | 590 | 5,000 | 8,200 | 7,500 | 13,200 | 3/ | 5,500 | 13,300 | 32,000 | 9,500 | 1,470 |
| AF-Dry Yr. | 5,200 | 1,400 | 27,100 | 21,600 | 38,800 | | 15,600 | 39,300 | 93,700 | 31,900 | 4,900 |
| AF-Med Yr. | 3,800 | 600 | 18,800 | 15,000 | 27,400 | | 10,800 | 26,500 | 64,700 | 21,200 | 3,300 |
| AF-Wet Yr. | 2,600 | 100 | 11,800 | 9,400 | 16,100 | | 6,300 | 15,600 | 38,000 | 10,700 | 1,700 |
| 1961 | | | | | | | | | | | |
| Acres | 590 | 3,166 | 8,109 | 4,744 | 13,192 | | 5,354 | 13,272 | 31,818 | 7,794 | 1,297 |
| AF Div. | 2,495 | 932 | 26,844 | 12,769 | 31,535 | | 10,857 | 27,187 | 69,579 | 24,805 | 3,239 |
| AF/Ac | 4.23 | 0.29 | 3.31 | 2.69 | 2.39 | | 2.03 | 2.05 | 2.19 | 3.18 | 2.50 |
| 1960 | | | | | | | | | | | |
| Acres | 590 | 4,355 | 9,400 | | 13,538 | | 4,911 | 14,249 | 32,698 | 8,424 | 1,411 |
| AF Div. | 2,855 | 1,095 | 22,094 | | 33,960 | | 11,760 | 27,170 | 72,890 | 22,596 | 2,293 |
| AF/Ac. | 4.83 | 0.25 | 2.40 | | 2.51 | | 2.39 | 1.90 | 2.23 | 2.68 | 1.62 |
| 1959 | | | | | | | | | | | |
| Acres | 590 | 4,499 | 9,400 | | 9,670 | | 4,815 | 13,485 | 27,970 | 9,687 | 1,474 |
| AF Div. | 2,571 | 1,039 | 22,076 | | 30,141 | | 10,457 | 30,807 | 71,405 | 25,847 | 3,223 |
| AF/Ac. | 4.36 | 0.23 | 2.35 | | 3.12 | | 2.17 | 2.29 | 2.55 | 2.67 | 2.19 |
| 1958 | | | | | | | | | | | |
| Acres | 575 | 3,350 | 9,400 | | 1,895 | 2,855 | 5,300 | 12,800 | 22,850 | 8,359 | 930 |
| AF Div. | 2,066 | 226 | 26,330 | | 8,710 | 9,558 | 8,550 | 20,380 | 47,198 | 13,810 | 407 |
| AF/Ac. | 3.59 | 0.07 | 2.80 | | 4.60 | 3.35 | 1.61 | 1.59 | 2.07 | 1.65 | 0.44 |
| 1957 | | | | | | | | | | | |
| Acres | 880 | 4,187 | 4/ | | 739 | 2,908 | 5,050 | 11,855 | 20,552 | 6,887 | 1,220 |
| AF Div. | 2,677 | 388 | | | 3,480 | 8,906 | 8,560 | 21,430 | 42,376 | 13,150 | 1,940 |
| AF/Ac. | 3.04 | 0.09 | | | 4.71 | 3.06 | 1.70 | 1.81 | 2.06 | 1.91 | 1.59 |
| 1956 | | | | | | | | | | | |
| Acres | 1,643 | 6,310 | | | | 2,975 | 4,430 | 9,860 | 17,265 | 5,834 | 1,057 |
| AF Div. | 4,729 | 1,040 | | | | 13,830 | 9,490 | 33,890 | 57,210 | 21,250 | 2,040 |
| AF/Ac. | 2.88 | 0.16 | | | | 4.65 | 2.14 | 3.44 | 3.31 | 3.64 | 1.93 |
| 1955 | | | | | | | | | | | |
| Acres | 982 | 14,214 5/ | | | | 3,048 | 3,502 | 9,104 | 15,654 | 2,743 | 548 |
| AF Div. | 5,267 | 2,574 | | | | 11,626 | 11,430 | 32,540 | 55,596 | 11,490 | 1,700 |
| AF/Ac. | 5.36 | 0.18 | | | | 3.81 | 3.26 | 3.57 | 3.55 | 4.19 | 3.10 |
| 1954 | | | | | | | | | | | |
| Acres | 1,541 | 14,573 5/ | | | | 2,950 | 450 | 5,938 | 9,338 | 1,165 | |
| AF Div. | 5,493 | 2,572 | | | | 11,330 | 1,520 | 22,860 | 35,710 | 7,930 | |
| AF/Ac. | 3.56 | 0.18 | | | | 3.84 | 3.38 | 3.85 | 3.82 | 6.81 | |
| 1953 | | | | | | | | | | | |
| Acres | 700 | 730 | | | | 2,800 | | 4,390 | 7,190 | | |
| AF Div. | 3,870 | 469 | | | | 9,980 | | 16,340 | 16,970 | | |
| AF/Ac. | 5.53 | 0.64 | | | | 3.56 | | 3.72 | 3.66 | | |
| 1952 | | | | | | | | | | | |
| Acres | 700 | 330 | | | | 2,887 | | 1,419 | 4,306 | | |
| AF Div. | 3,463 | 84 | | | | 10,460 | | 6,510 | 16,970 | | |
| AF/Ac. | 4.95 | 0.25 | | | | 3.62 | | 4.59 | 3.94 | | |
| 1951 | | | | | | | | | | | |
| Acres | 700 | | | | | 2,816 | | 1,450 | 4,266 | | |
| AF Div. | 2,821 | | | | | 7,390 | | 8,900 | 16,290 | | |
| AF/Ac. | 4.03 | | | | | 2.62 | | 6.14 | 3.82 | | |
| 1950 | | | | | | | | | | | |
| Acres | | | | | | 2,791 | | | 2,791 | | |
| AF Div. | | | | | | 7,660 | | | 7,660 | | |
| AF/Ac. | | | | | | 2.74 | | | 2.74 | | |
| 1949 | | | | | | | | | | | |
| Acres | | | | | | 2,906 | | | 2,906 | | |
| AF Div. | | | | | | 5,290 | | | 5,290 | | |
| AF/Ac. | | | | | | 1.82 | | | 1.82 | | |
| 1948 | | | | | | | | | | | |
| Acres | | | | | | 2,675 | | | 2,675 | | |
| AF Div. | | | | | | 5,180 | | | 5,180 | | |
| AF/Ac. | | | | | | 1.94 | | | 1.94 | | |

1/ Hale Ditch is not a Government Project. Acre feet diverted includes both natural flow and supplemental water delivered under Warren Act Contracts.
2/ Supplemental storage delivered under Warren Act Contracts to private pumps and irrigation systems.
3/ Lands under Meeker Canal served to Meeker-Driftwood Canal after 1958.
4/ Operated from 1890's to 1957 as non-project lands. First year delivery under repayment contract was in 1958.
5/ Includes Culbertson Canal before it became a part of Kansas River Projects.

TABLE 7 (cont'd) 

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

| rrig.Dist. | NEBRASKA (cont'd) | | | | KANSAS | | | | | | TOTAL FOR PROJECT SYSTEMS 1/ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nebraska-Bostwick | | | | Kansas-Bostwick | | | Kirwin | Webster | Cedar Bl. | |
| anal | Franklin Pump | Superior | Courtland | Total | Courtland Canal Upper | Lower | Total | Kirwin | Osborne | Cedar Bl. | |
| | | | | | 1962 Estimates | | | | | | |
| cres | 1,900 | 5,240 | 1,840 | 19,950 | 11,400 | 24,550 | 35,950 | 9,500 | 5,000 | 400 | 118,500 |
| F-Dry Yr. | 6,400 | 15,600 | 4,700 | 63,500 | 29,400 | 63,400 | 92,800 | 25,400 | 15,500 | 1,200 | 340,800 |
| F-Med Yr. | 4,200 | 11,200 | 3,400 | 43,300 | 21,200 | 45,700 | 66,900 | 17,100 | 10,600 | 900 | 237,300 |
| F-Wet Yr. | 2,100 | 5,500 | 1,700 | 21,700 | 10,300 | 22,100 | 32,400 | 10,600 | 6,400 | 600 | 130,900 |
| | | | | | 1961 | | | | | | |
| cres | 1,739 | 4,837 | 1,239 | 16,906 | 7,910 | 14,052 | 21,962 | 7,551 | 2,912 | | 94,002 |
| F Div. | 2,322 | 13,436 | 6,161 | 49,963 | 20,983 | 28,103 | 49,086 | 19,904 | 9,270 | | 237,415 |
| F/Ac. | 1.34 | 2.78 | 4.97 | 2.95 | 2.65 | 2.00 | 2.24 | 2.64 | 3.18 | | 2.53 |
| | | | | | 1960 | | | | | | |
| cres | 1,903 | 5,029 | 1,427 | 18,194 | 7,020 | 12,935 | 19,955 | 8,216 | 1,159 | | 89,622 |
| F Div. | 2,676 | 13,124 | 5,230 | 45,919 | 18,592 | 26,529 | 45,121 | 16,834 | 4,185 | | 207,043 |
| F/Ac. | 1.41 | 2.61 | 3.66 | 2.52 | 2.65 | 2.05 | 2.26 | 2.04 | 3.61 | | 2.31 |
| | | | | | 1959 | | | | | | |
| cres | 1,930 | 5,080 | 1,664 | 19,835 | 7,159 | 9,081 | 16,240 | 6,470 | | | 79,915 |
| F Div. | 3,110 | 17,449 | 5,133 | 54,762 | 23,343 | 26,388 | 49,731 | 21,005 | | | 218,979 |
| F/Ac. | 1.61 | 3.43 | 3.08 | 2.76 | 3.26 | 2.91 | 3.06 | 3.25 | | | 2.74 |
| | | | | | 1958 | | | | | | |
| cres | 1,391 | 3,978 | 489 | 15,147 | 5,829 | 2,878 | 8,707 | 4,127 | | | 60,230 |
| F Div. | 858 | 8,420 | 1,620 | 25,115 | 13,727 | 5,690 | 19,417 | 15,150 | | | 133,210 |
| F/Ac. | 0.62 | 2.12 | 3.31 | 1.66 | 2.35 | 1.98 | 2.23 | 3.67 | | | 2.21 |
| | | | | | 1957 | | | | | | |
| cres | 1,628 | 4,685 | 1,396 | 15,816 | 7,272 | | 7,272 | 1,336 | | | 44,976 |
| F Div. | 1,800 | 10,490 | 2,180 | 29,560 | 18,240 | | 18,250 | 5,530 | | | 95,706 |
| F/Ac. | 1.11 | 2.24 | 1.56 | 1.87 | 2.51 | | 2.51 | 4.14 | | | 2.13 |
| | | | | | 1956 | | | | | | |
| cres | 1,596 | 4,681 | 1,399 | 14,567 | 5,347 | | 5,347 | | | | 37,179 |
| F Div. | 3,710 | 13,190 | 6,140 | 25,080 | 20,860 | | 20,860 | | | | 103,150 |
| F/Ac. | 2.32 | 2.82 | 4.39 | 1.72 | 3.90 | | 3.90 | | | | 2.77 |
| | | | | | 1955 | | | | | | |
| cres | 1,516 | 4,316 | 1,383 | 10,506 | 2,385 | | 2,385 | | | | 28,545 |
| F Div. | 3,830 | 15,100 | 6,600 | 38,720 | 14,370 | | 14,370 | | | | 108,686 |
| F/Ac. | 2.53 | 3.50 | 4.77 | 3.69 | 6.03 | | 5.07 | | | | 3.81 |
| | | | | | 1954 | | | | | | |
| cres | 1,460 | 3,812 | 1,079 | 7,516 | 30 | | 30 | | | | 16,854 |
| F Div. | 2,540 | 9,610 | 9,690 | 29,770 | 3,910 | | 3,910 | | | | 69,390 |
| F/Ac. | 1.74 | 2.52 | 8.98 | 3.96 | 13.03 | | 13.03 | | | | 4.12 |
| | | | | | 1953 | | | | | | |
| cres | 994 | 3,093 | 282 | 4,376 | | | | | | | 11,566 |
| F Div. | 2,290 | 10,170 | 1,470 | 13,930 | | | | | | | 40,250 |
| F/Ac. | 2.30 | 3.29 | 5.21 | 3.18 | | | | | | | 3.48 |
| | | | | | 1952 | | | | | | |
| cres | | 1,900 | 338 | 2,238 | | | | | | | 6,544 |
| F Div. | | 6,280 | 7,340 | 13,620 | | | | | | | 30,590 |
| F/Ac. | | 3.31 | 21.72 | 6.09 | | | | | | | 4.67 |
| | | | | | 1951 | | | | | | |
| cres | | 193 | | 193 | | | | | | | 4,459 |
| F Div. | | 1,940 | | 1,940 | | | | | | | 18,230 |
| F/Ac. | | 10.05 | | 10.05 | | | | | | | 4.09 |
| | | | | | 1950 | | | | | | |
| cres | | | | | | | | | | | 2,791 |
| F Div. | | | | | | | | | | | 7,660 |
| F/Ac. | | | | | | | | | | | 2.74 |
| | | | | | 1949 | | | | | | |
| cres | | | | | | | | | | | 2,906 |
| F Div. | | | | | | | | | | | 5,290 |
| f/Ac. | | | | | | | | | | | 1.82 |
| | | | | | 1948 | | | | | | |
| cres | | | | | | | | | | | 2,675 |
| F Div. | | | | | | | | | | | 5,180 |
| F/Ac. | | | | | | | | | | | 1.94 |

1/ Totals for project systems only. Excludes Hale Ditch and deliveries under Warren Act Contracts.

TABLE 8

IRRIGATION DEVELOPMENT AND OPERATION OF PROJECT CANAL SYSTEMS

| State and Canal System | Acres Planned in Definite Plan Reports | Acres 1961 Irrigation Season Service Available 1/ | Acres 1961 Irrigation Season Actually Irrigated 2/ | Acres 1962 Estimates Service Available 3/ | Acres 1962 Estimates Expected To Be Irrigated | Years (Inclusive) Canal was Operated By Bureau of Reclamation | Years (Inclusive) Canal was Operated By Irrigation District |
|---|---|---|---|---|---|---|---|
| NEBRASKA | | | | | | | |
| Culbertson (Fr.-Val. I.D.) | 9,600 | 9,600 4/ | 8,109 | 9,600 | 8,200 | None | 1958-Present 5/ |
| Culbertson Ext. (H & RW) | 11,490 | 7,007 | 4,744 | 11,490 | 7,500 | 1961 | |
| Red Willow 6/ | 4,150 | --- | --- | 0 | | | |
| Meeker-Driftwood | 16,440 | 16,440 | 13,192 | 16,440 | 13,200 | 1957-59 7/ | 1960-Present |
| Bartley | 7,000 | 6,592 | 5,354 | 6,600 | 5,500 | 1954-56 | 1957-Present |
| Cambridge | 15,600 | 15,600 | 13,272 | 15,600 | 13,300 | 1951-56 | 1957-Present |
| Total (Fr.-Cam.I.D.) | 43,190 | 38,632 | 31,818 | 38,640 | 32,000 | | |
| Franklin | 11,510 | 11,267 | 7,794 | 11,267 | 9,500 | 1954-56 | 1957-Present |
| Naponee | 1,640 | 1,533 | 1,297 | 1,533 | 1,470 | 1955-56 | 1957-Present |
| Franklin Pump | 2,120 | 2,125 | 1,739 | 2,125 | 1,900 | 1953-56 | 1957-Present |
| Superior | 6,320 | 5,892 | 4,837 | 6,021 | 5,240 | 1951-56 | 1957-Present |
| Courtland (Nebraska) | 2,650 | 2,018 | 1,239 | 1,841 | 1,840 | 1952-58 8/ | 1959-Present |
| Total (Nebr.-Bost. I.D.) | 24,240 | 22,835 | 16,906 | 22,787 | 19,950 | | |
| KANSAS | | | | | | | |
| Courtland (Above Lov.Res.) | 15,270 | 11,476 | 7,910 | 11,378 | 11,400 | 1954-58 9/ | 1959-Present |
| Courtland (Below Lov.Res.) | 33,730 | 25,052 | 14,052 | 29,574 | 24,550 | 1958 | 1959-Present |
| Total (Kans.-Bost.I.D.) | 49,000 | 36,528 | 21,962 | 40,952 | 35,950 | | |
| Kirwin (Kirwin I.D.) | 10,000 10/ | 11,500 | 7,551 | 11,500 | 9,500 | 1957-59 | 1960-Present |
| Webster (Webster I.D.) | 8,500 | 0 | 2,912 | 8,500 | 5,000 | 1960-61 | 1962 |
| TOTAL OF PROJECTS | 149,170 | 126,102 | 94,002 | 143,469 | 118,500 | | |

(See attached sheet for footnotes.)

Footnotes for Table 8

1/ Acres used in crop census reports and official program documents.

2/ Determined by crop census.

3/ Based upon land classification reports.

4/ Acres paying water charges.

5/ District operated since 1890, but 1958 was first year operated as part of Kansas River Projects.

6/ Construction will be initiated in 1962.

7/ In 1948 Bureau took over operation of 2,912 acres of old Meeker Canal now included in Meeker-Driftwood system.

8/ Nebraska-Bostwick District took over lateral operation in 1957. Kansas-Bostwick District took over main canal operation in 1959, and operation of the Superior-Courtland Diversion Dam in 1960.

9/ Kansas-Bostwick District operated lateral systems in 1957.

10/ The repayment contract states 11,500 acres.

Table 9

## RECREATION USES OF BUREAU OF RECLAMATION RESERVOIRS IN KANSAS RIVER PROJECTS DURING 1961

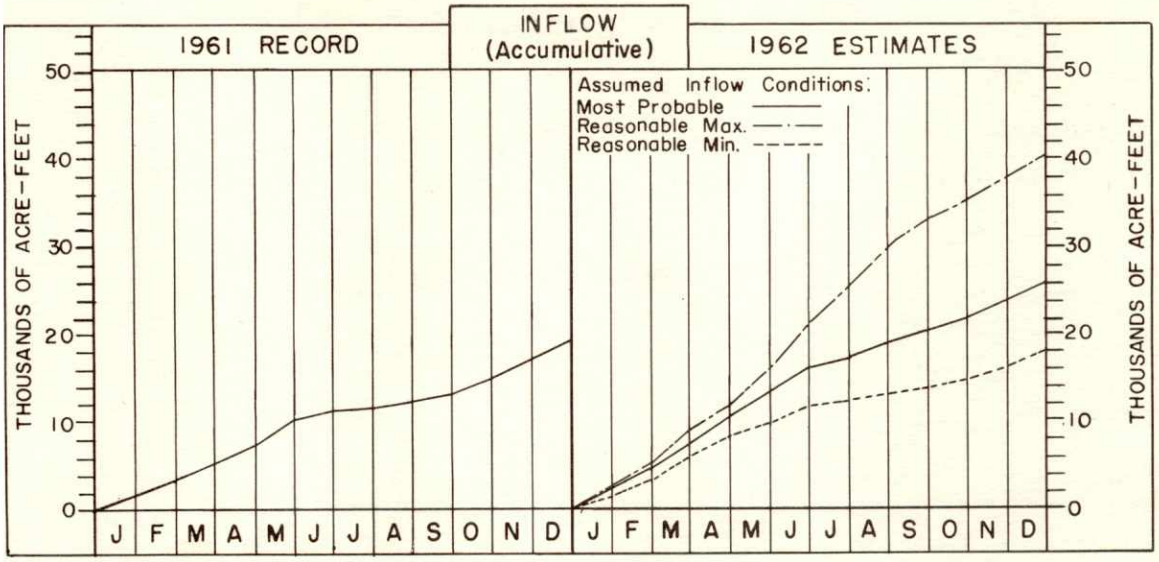
### Annual Totals

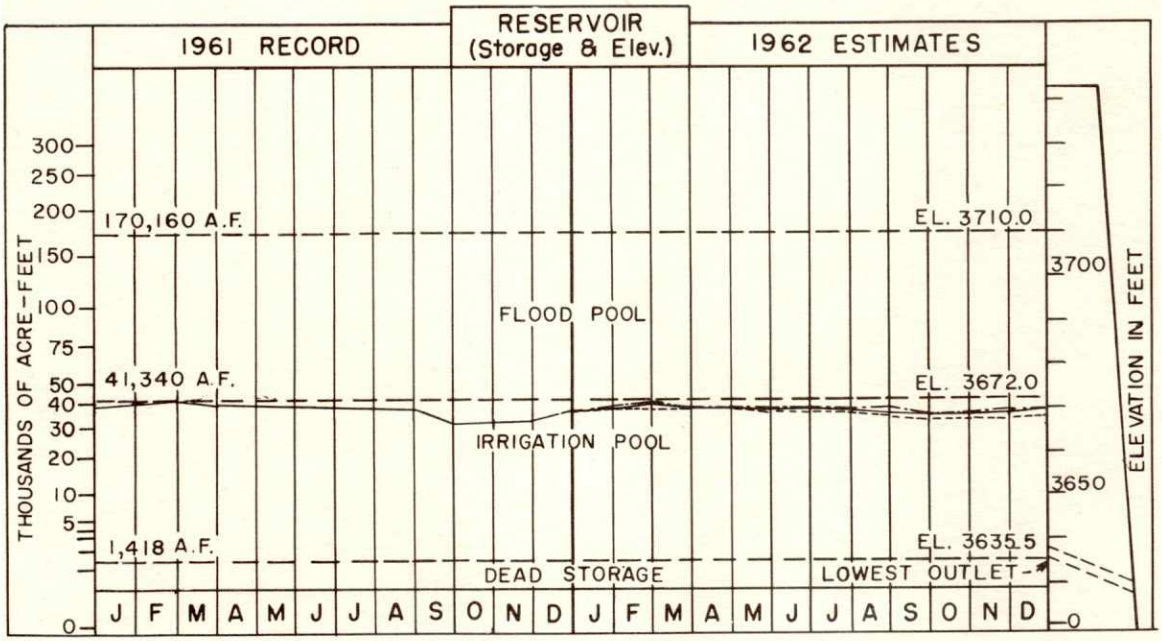
| Reservoirs | Visitors | Cars in area | Water Craft | Sport Fish Caught | Season Take Ducks | Season Take Geese |
|---|---|---|---|---|---|---|
| COLORADO | | | | | | |
| BONNY | 35,600 | 8,900 | 1,800 | 18,000 | 1,000 | 75 |
| KANSAS | | | | | | |
| CEDAR BLUFF | 300,881 | 75,220 | 9,759 | 44,649 | 2,100 | 52 |
| WEBSTER | 227,046 | 56,761 | 4,813 | 62,250 | 200 | 132 |
| KIRWIN | 150,849 | 52,018 | 400 | 260,000 | 217 | 77 |
| LOVEWELL | 215,722 | 53,930 | 4,894 | 114,768 | 1,000 | 75 |
| NEBRASKA | | | | | | |
| ENDERS | 77,512 | 19,378 | 1,509 | 31,392 | 450 | 50 |
| SWANSON | 192,500 | 48,125 | 2,685 | 80,212 | 1,300 | 15 |
| HARRY STRUNK | 70,716 | 17,679 | 2,266 | 70,179 | 512 | 18 |
| TOTAL | 1,283,608 | 335,206 | 28,126 | 688,191 | 6,779 | 494 |

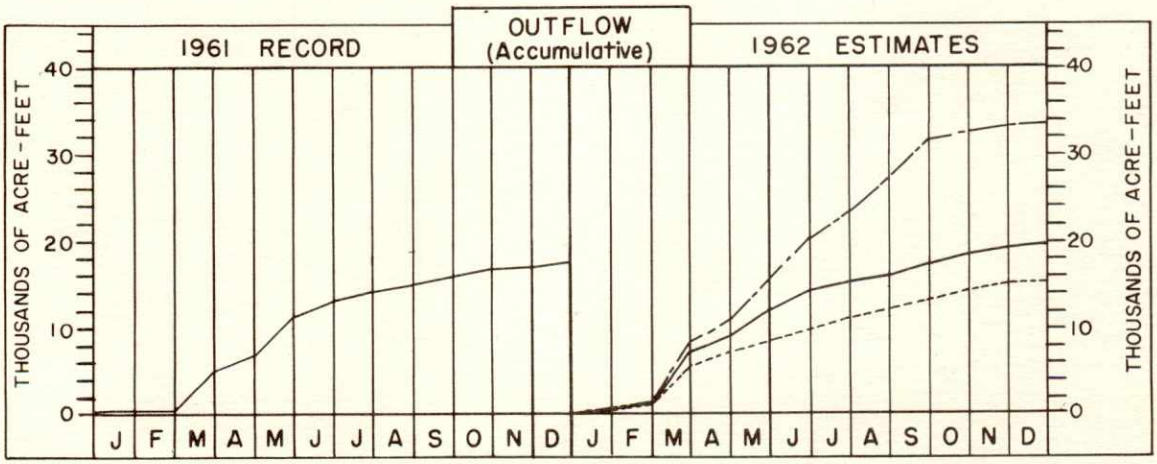
Visitors = Total visitor days which includes fishing, hunting, boating, skiing, camping, picnicking & sightseeing.

Water Craft = Boating days which includes rentals, inboards, outboards, rowboats & sailboats.

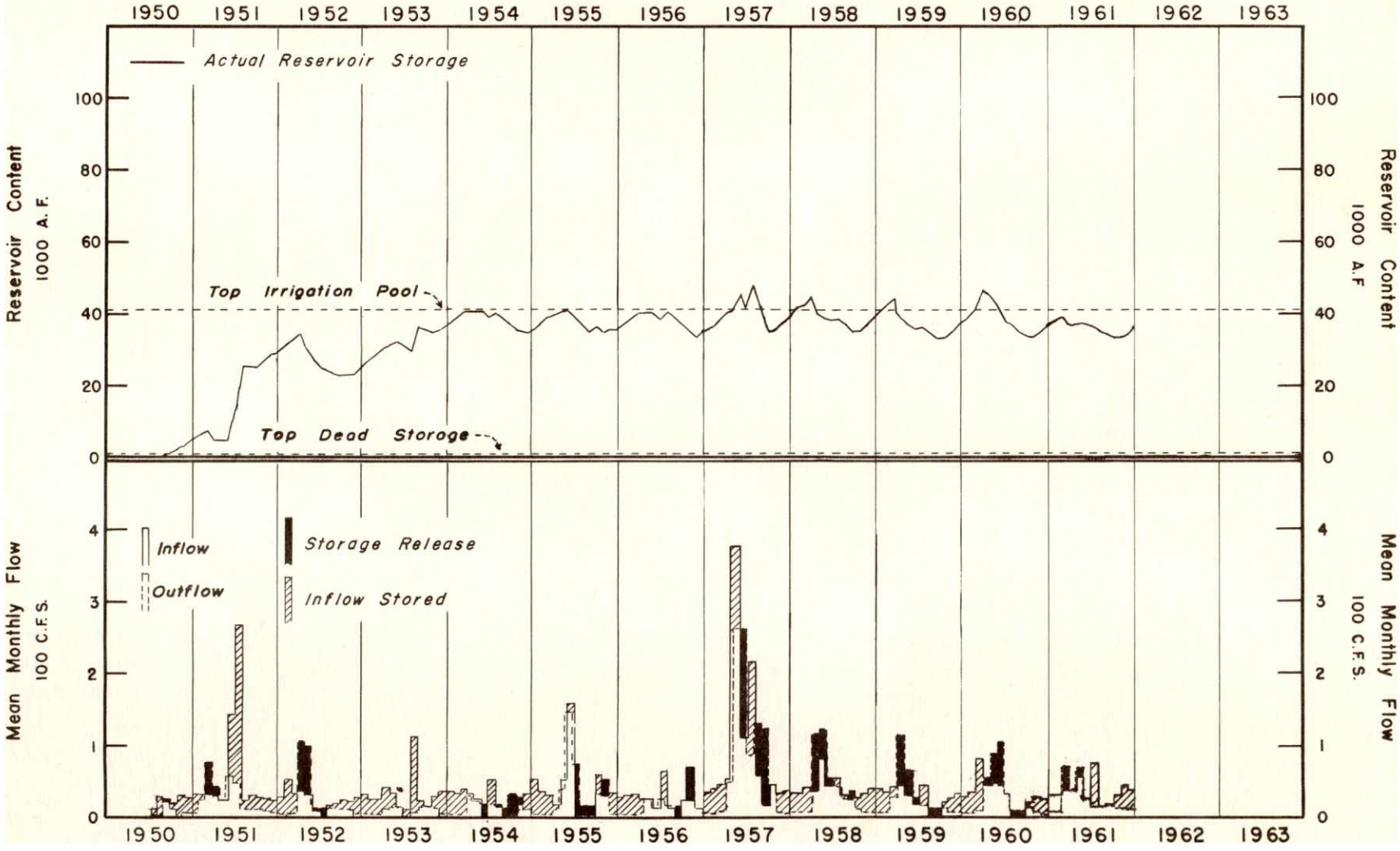
# BONNY RESERVOIR OPERATION



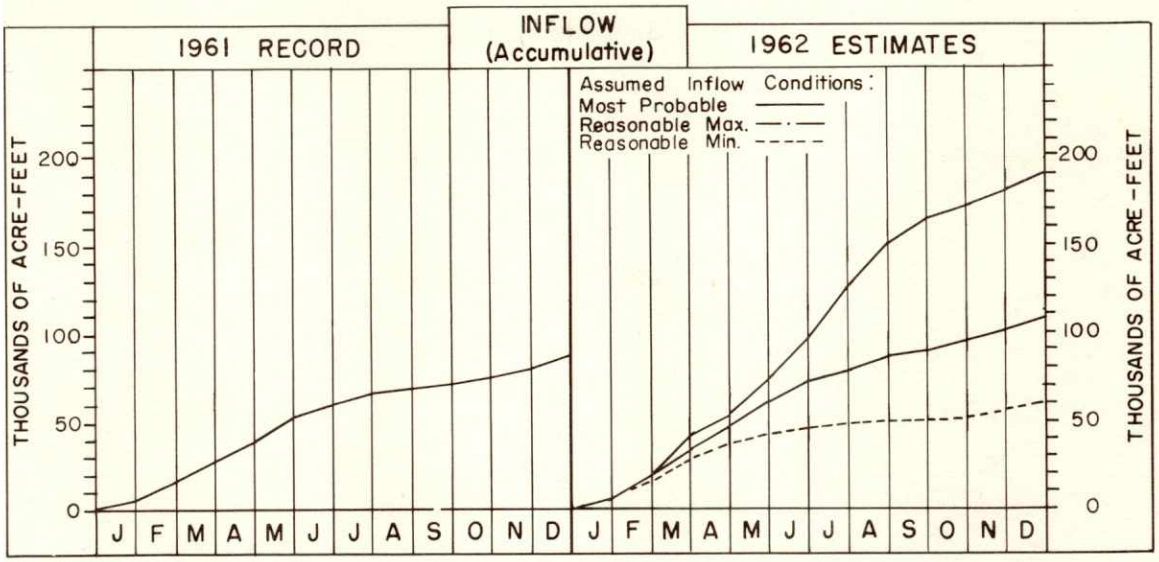



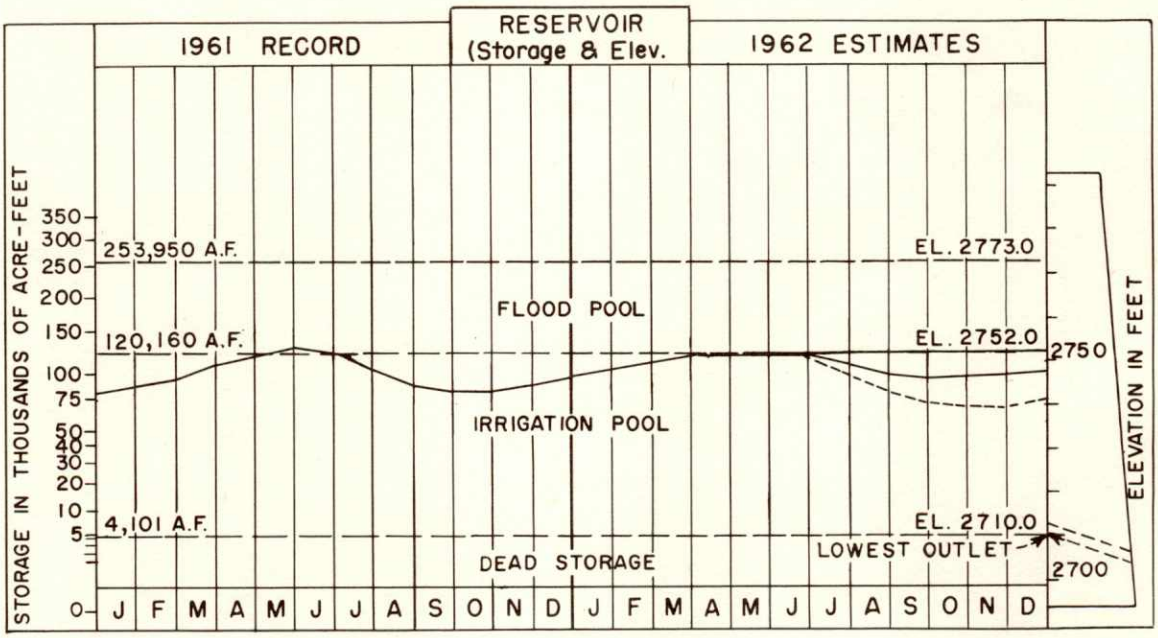



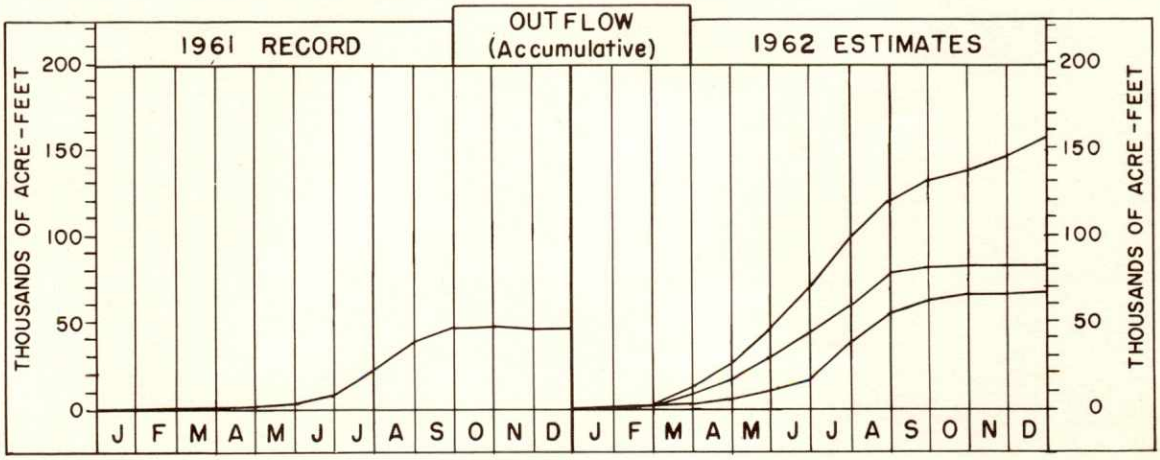
# BONNY RESERVOIR
# OPERATION HYDROGRAPHS



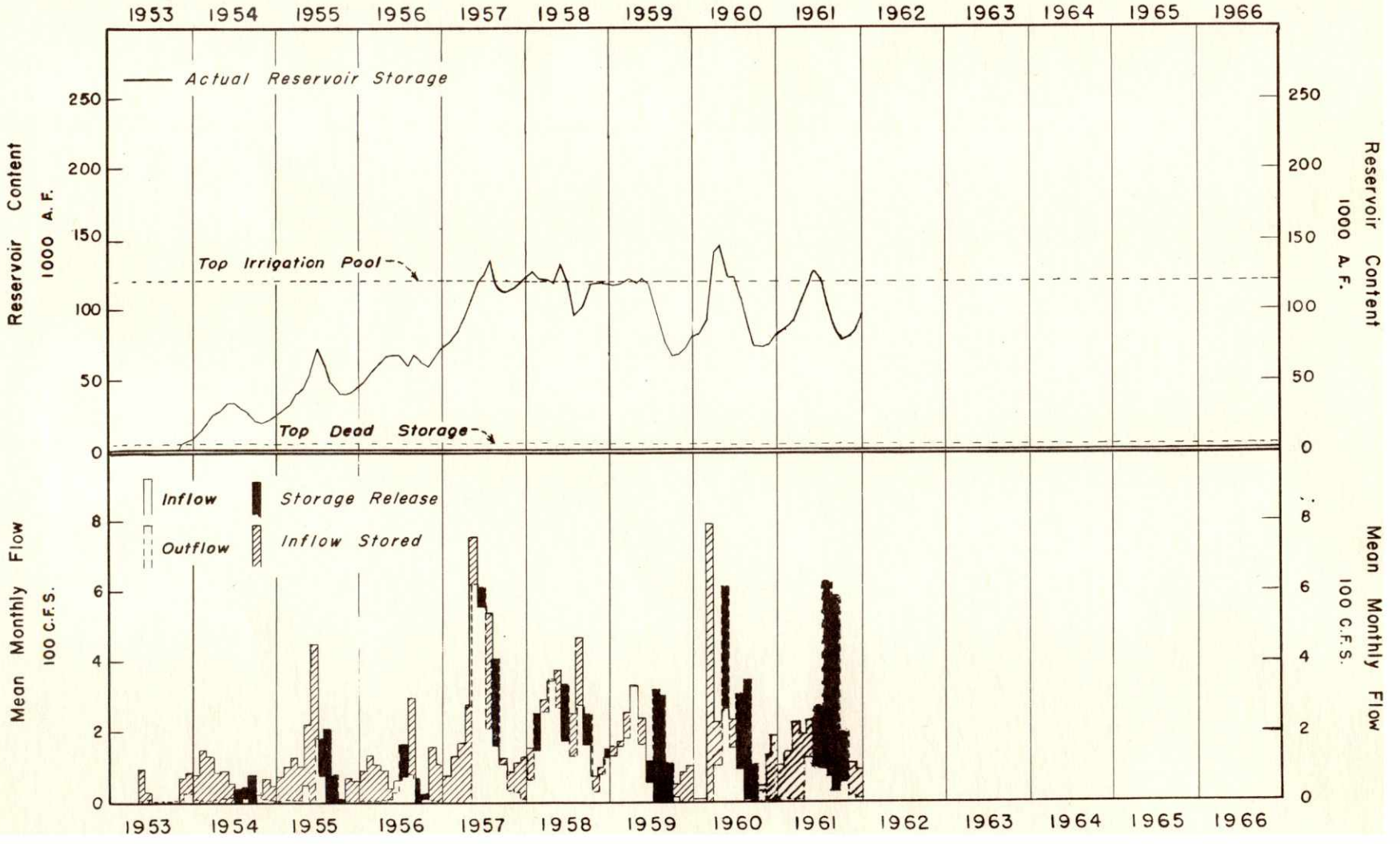
# SWANSON LAKE OPERATION



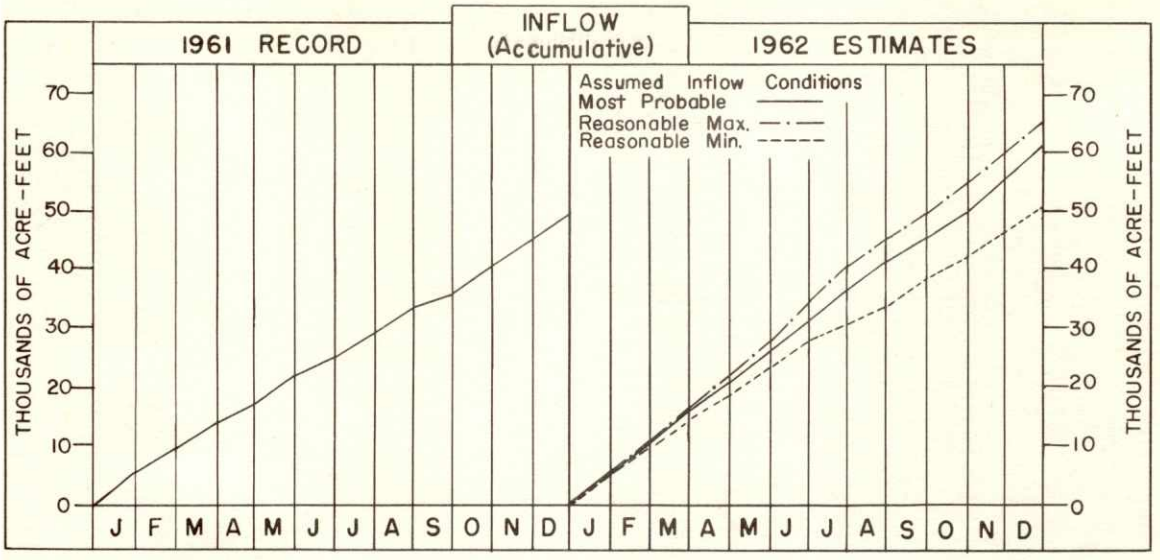



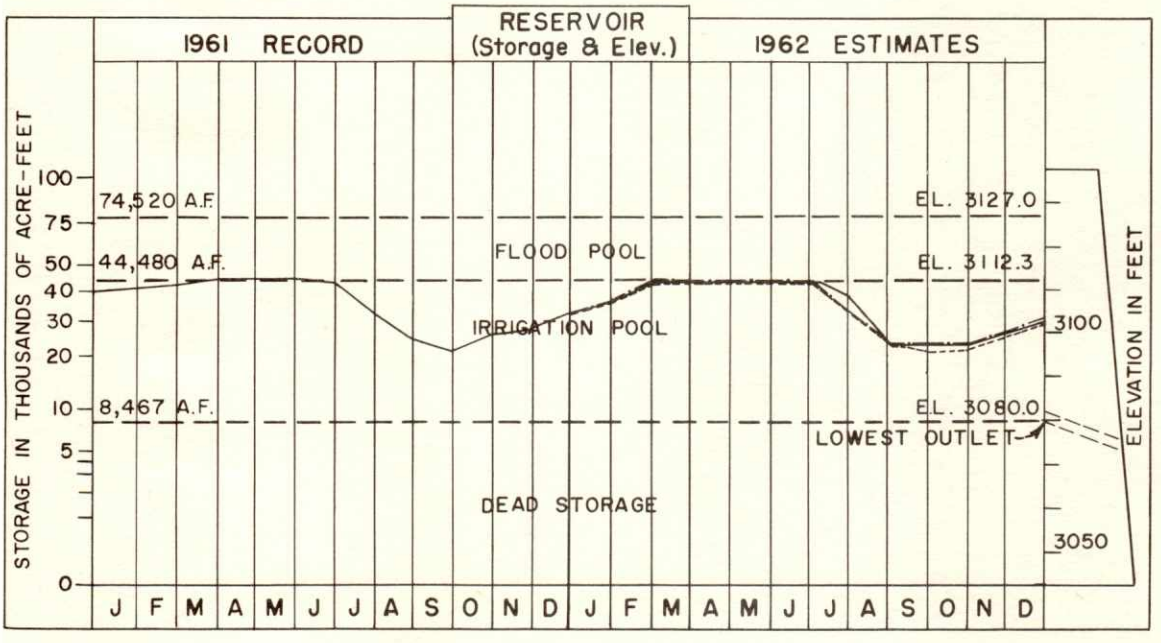



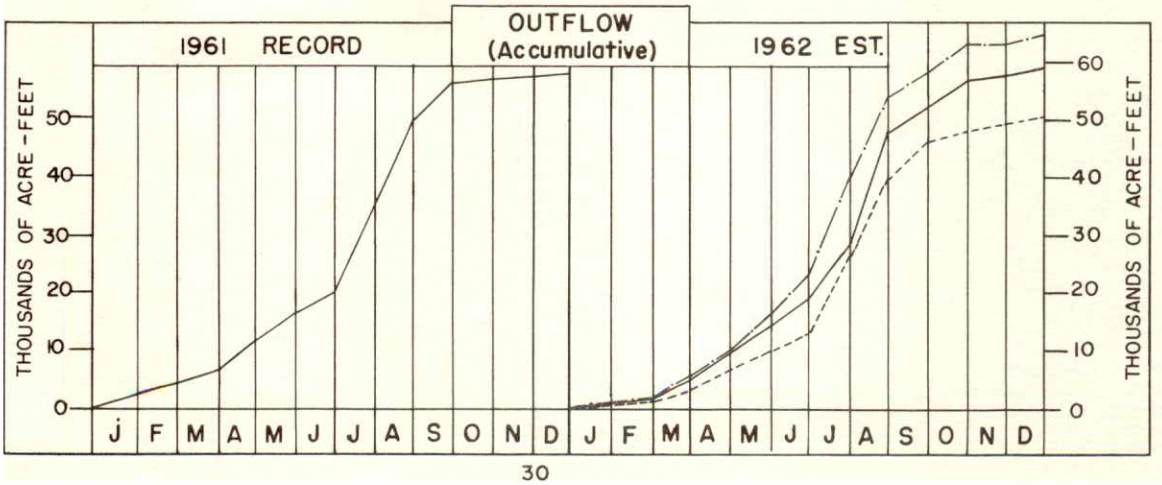
# SWANSON LAKE
## OPERATION HYDROGRAPHS



# ENDERS RESERVOIR OPERATION



# ENDERS RESERVOIR
# OPERATION HYDROGRAPHS

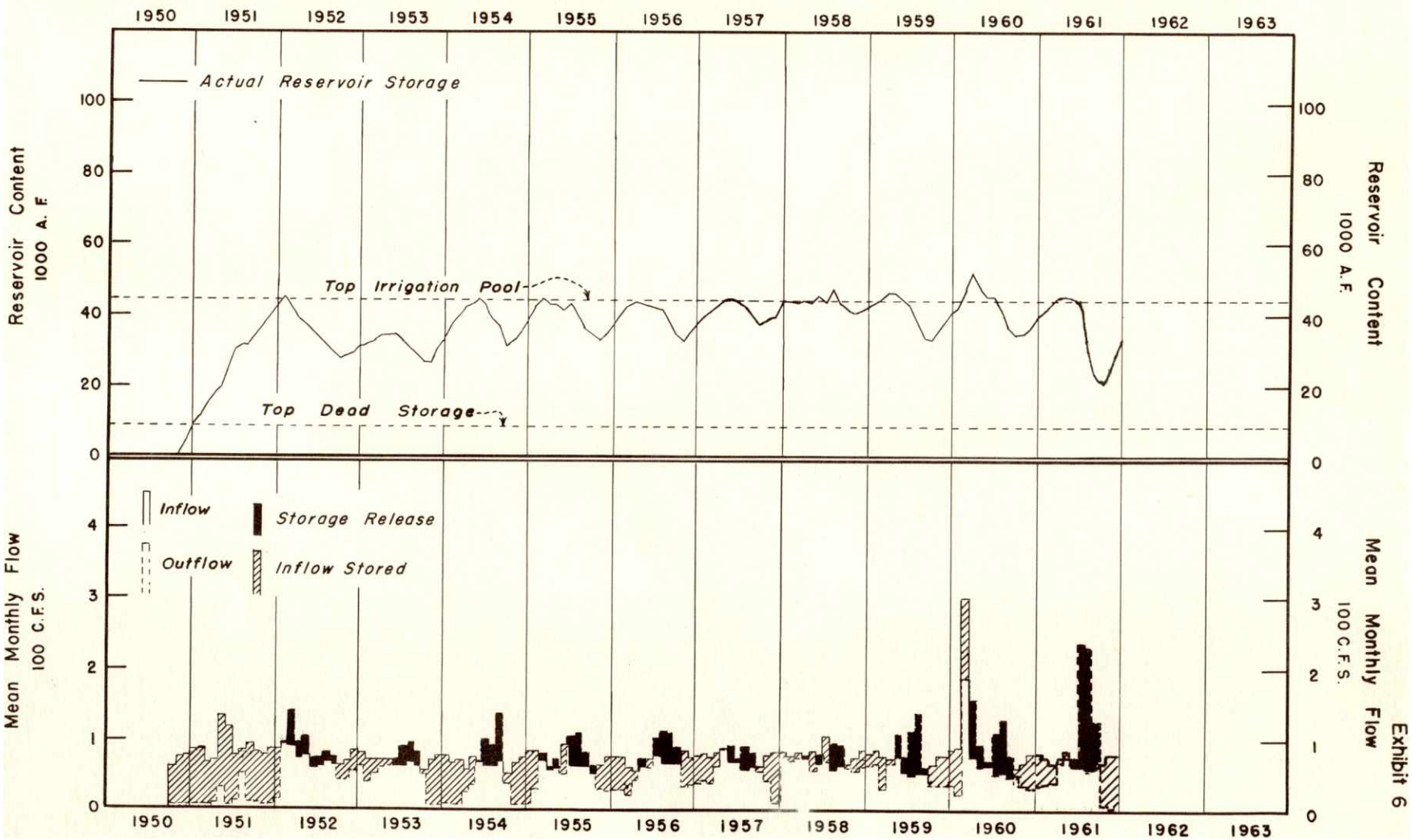
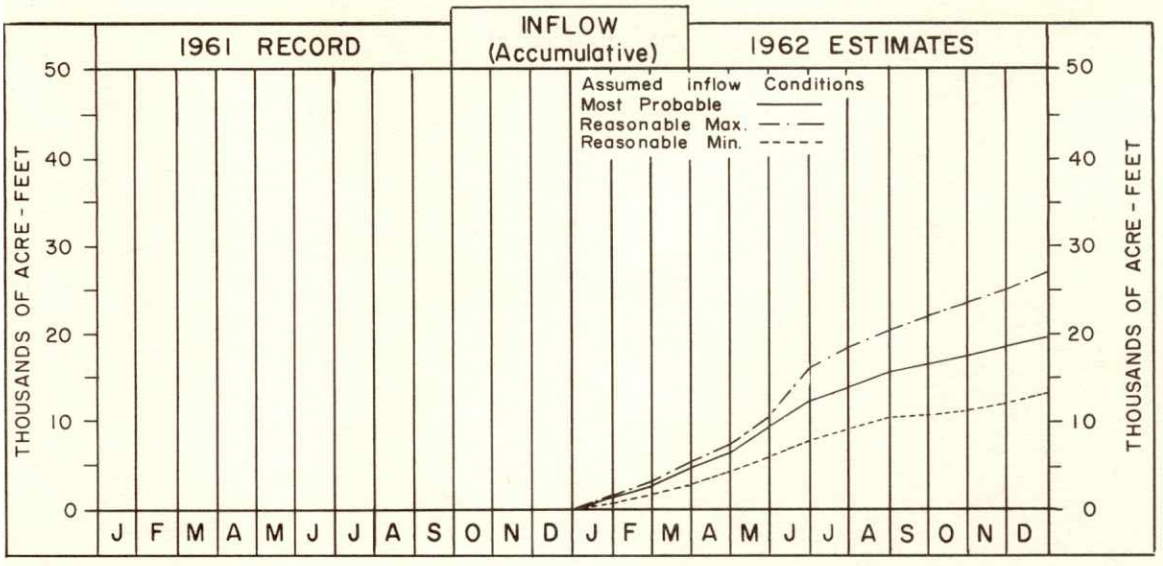
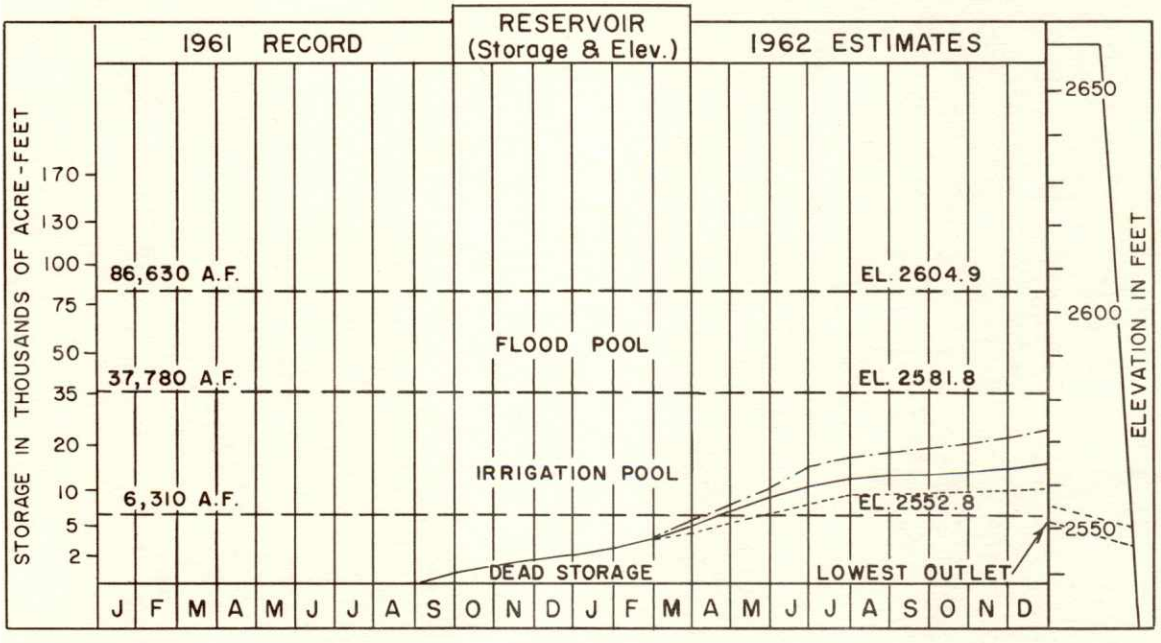
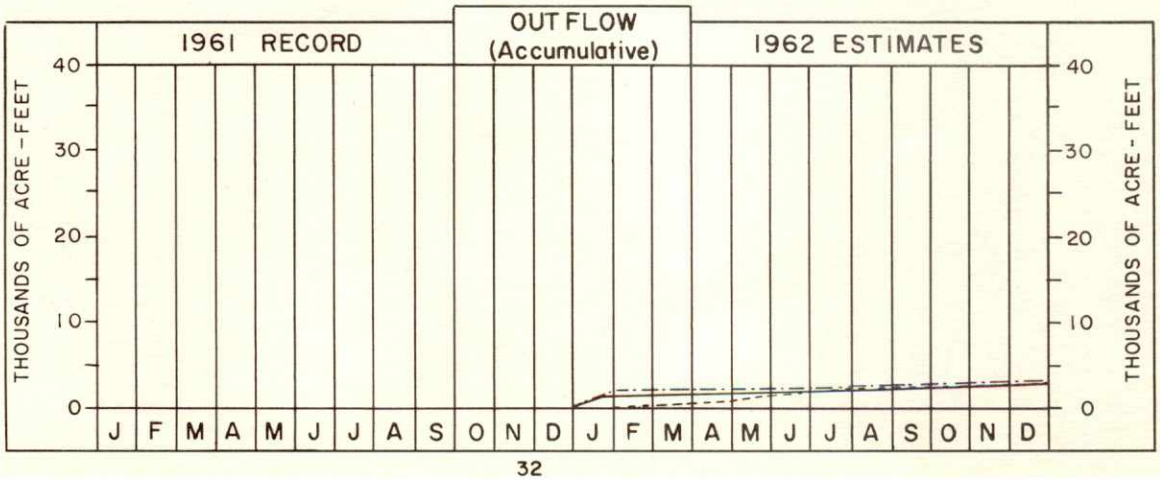



Exhibit 6

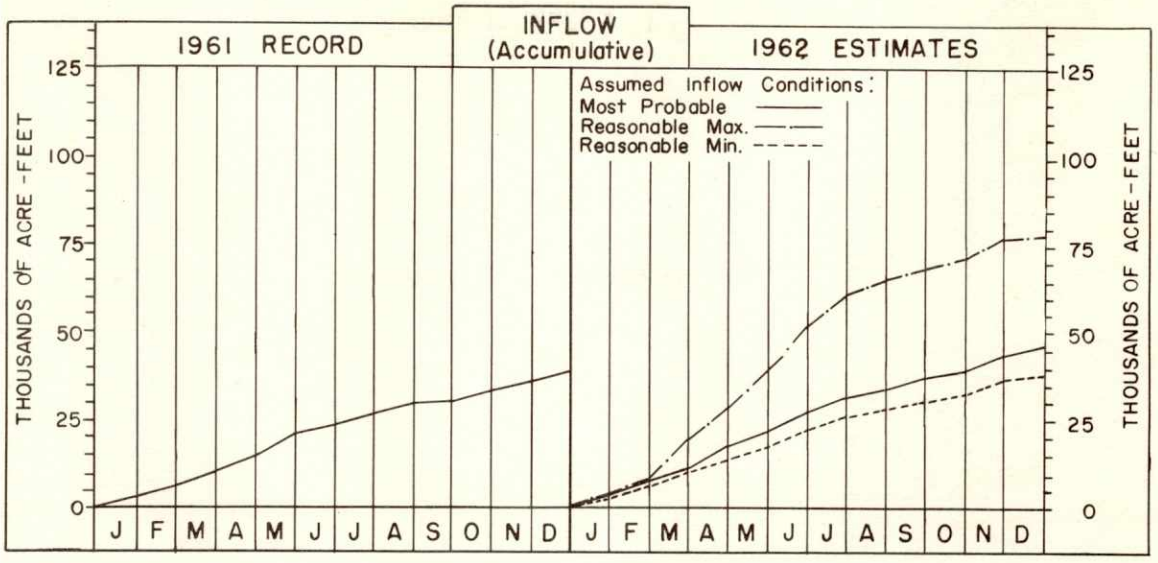
# HUGH BUTLER LAKE OPERATION

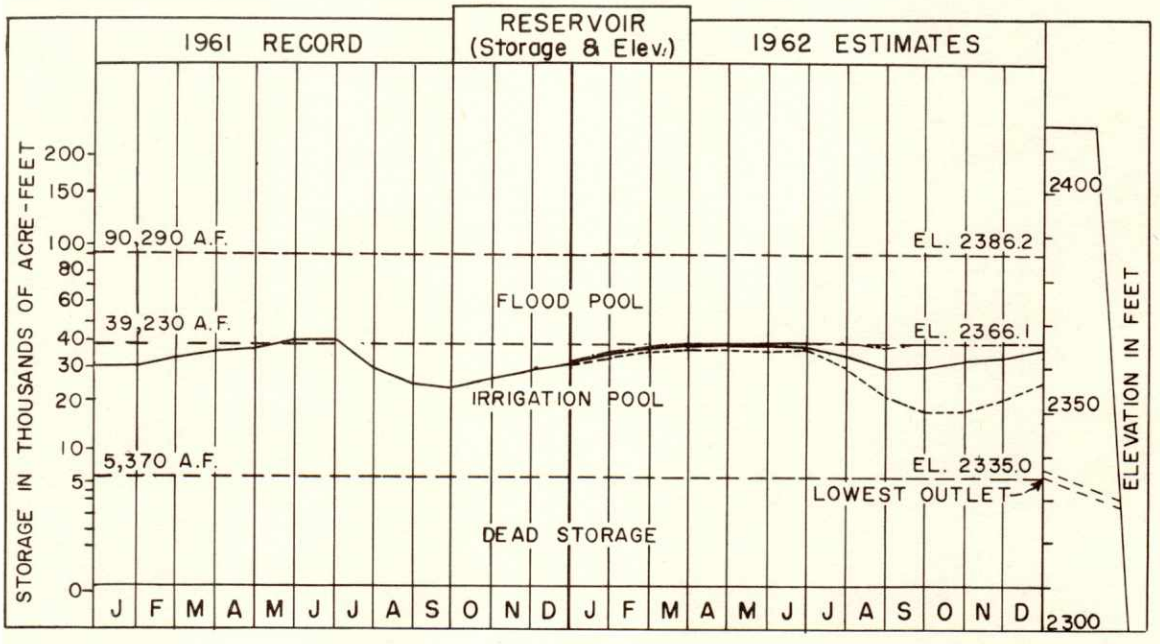


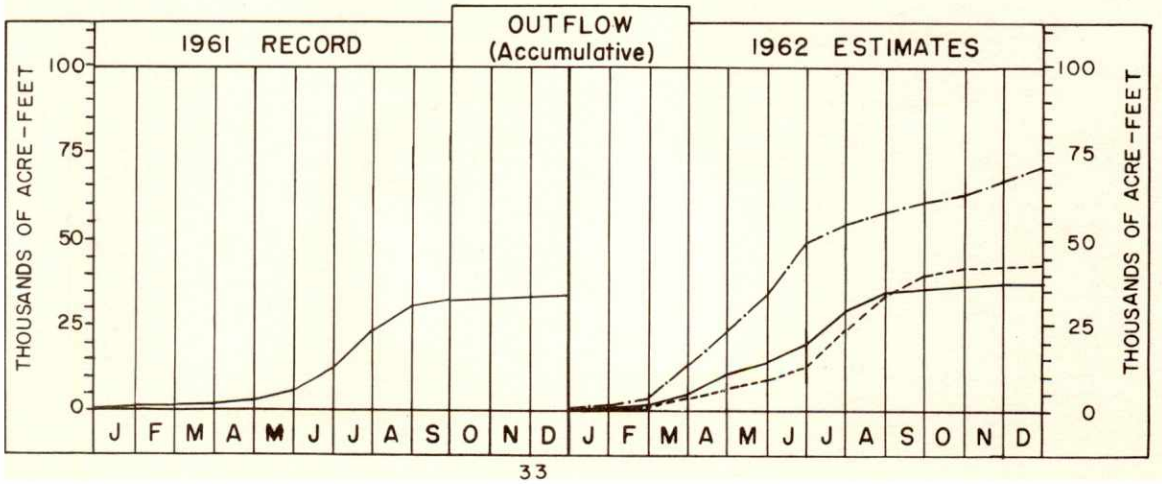



# HARRY STRUNK RESERVOIR OPERATION



# HARRY STRUNK LAKE
## OPERATION HYDROGRAPHS

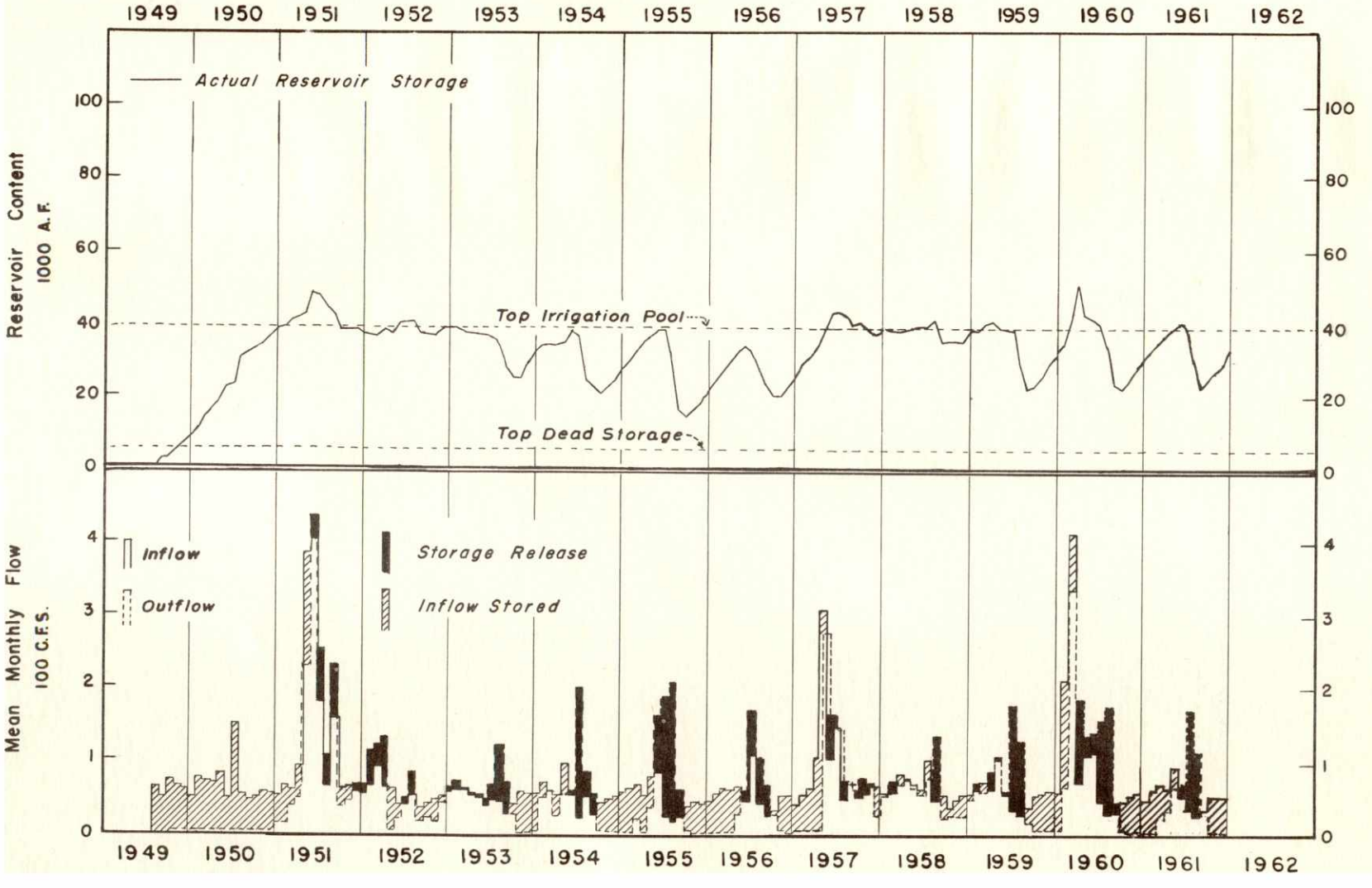
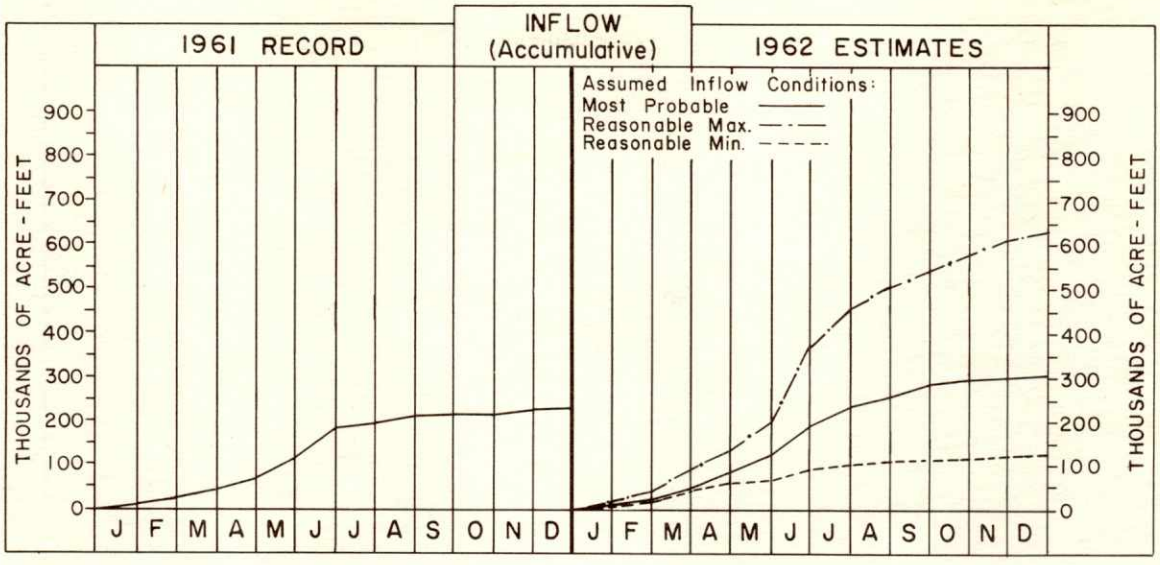
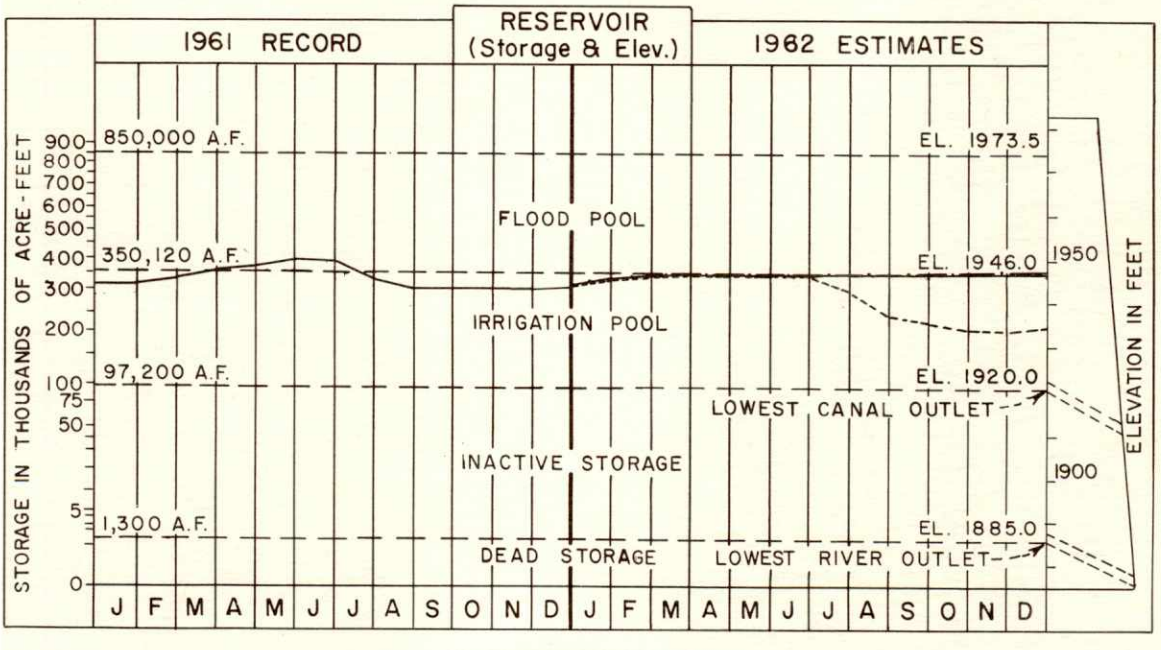


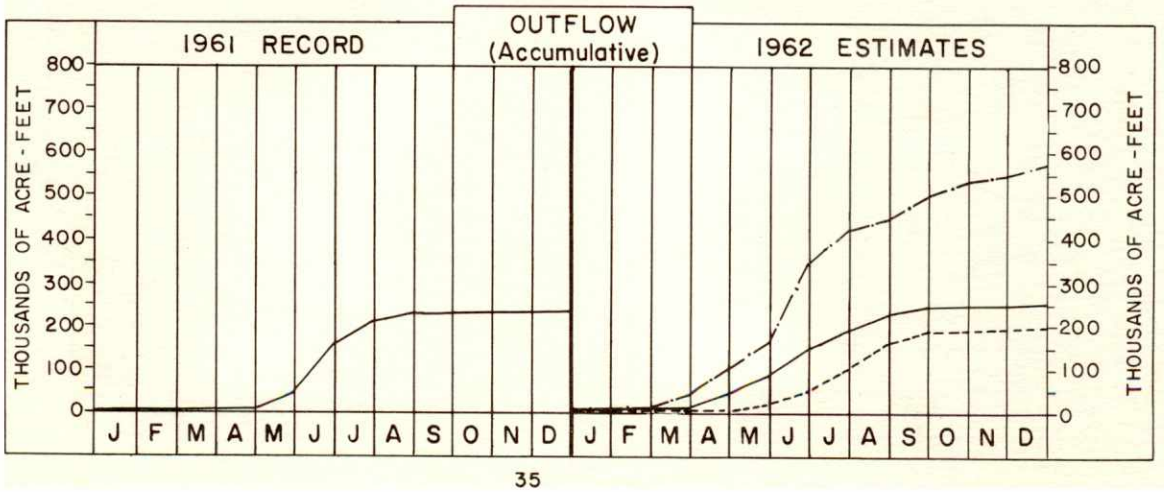

Exhibit 9

Exhibit 10

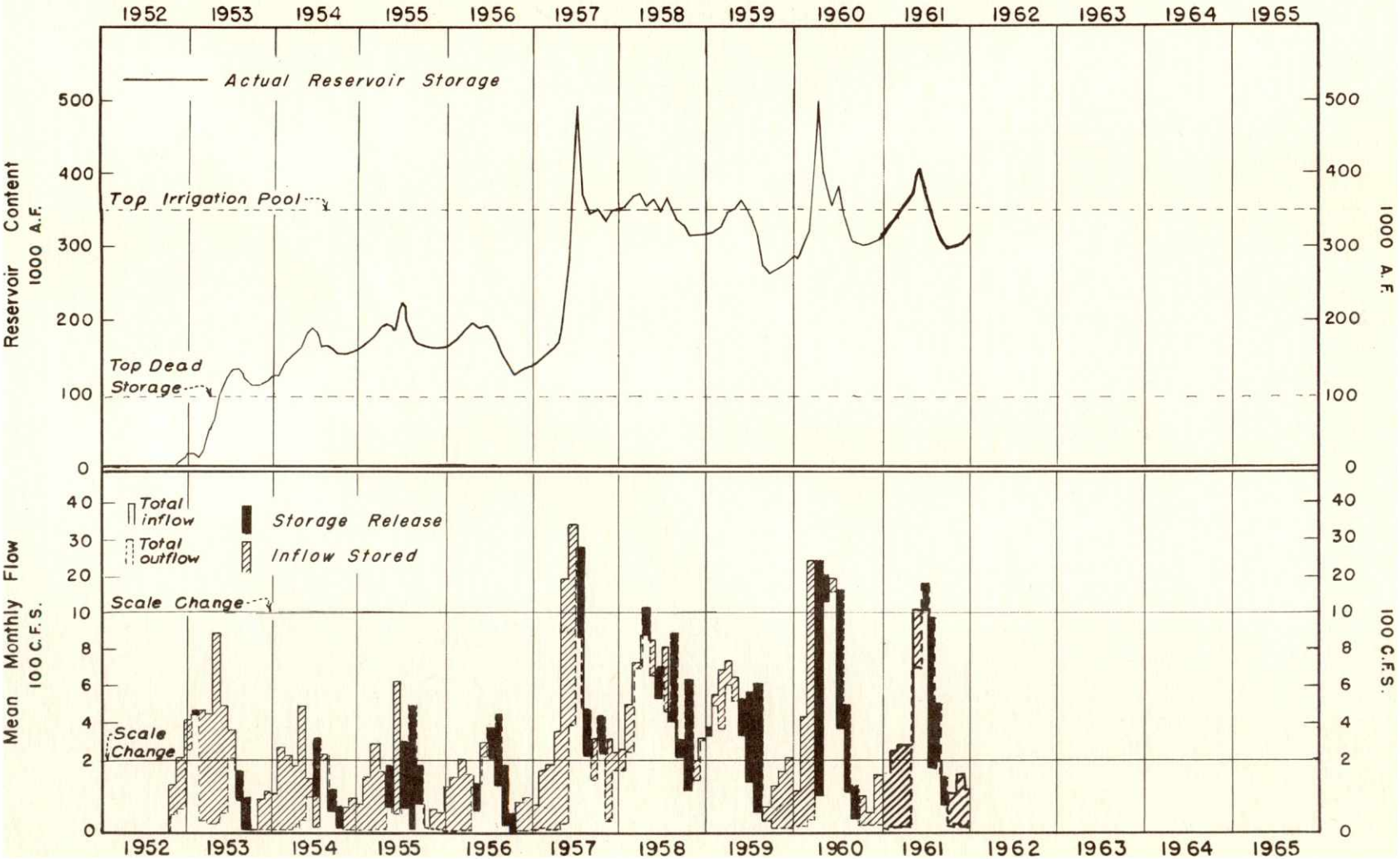
# HARLAN COUNTY RESERVOIR OPERATION



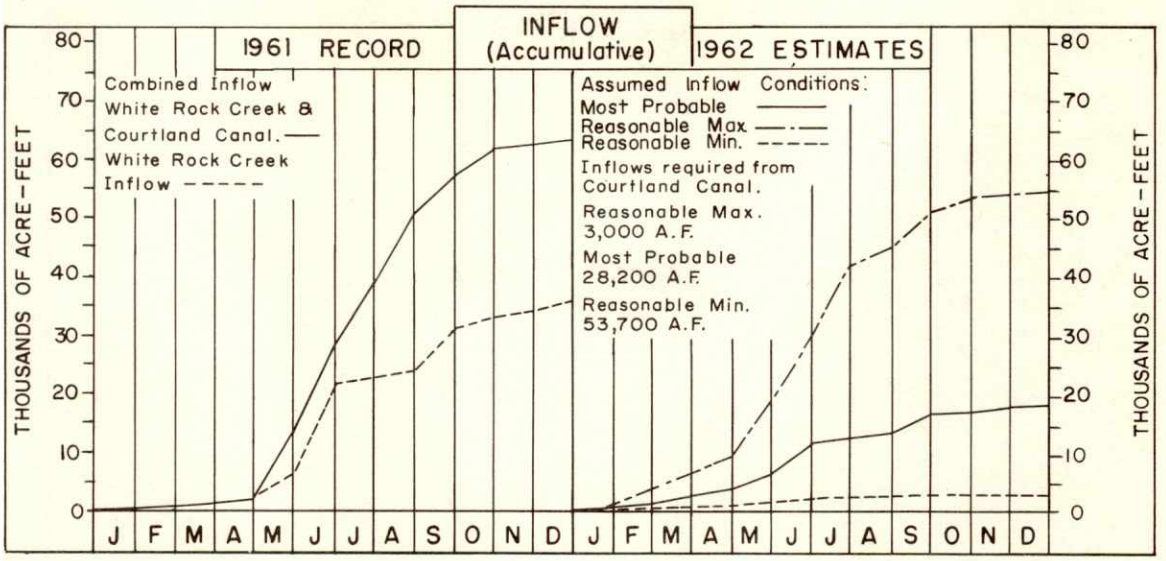



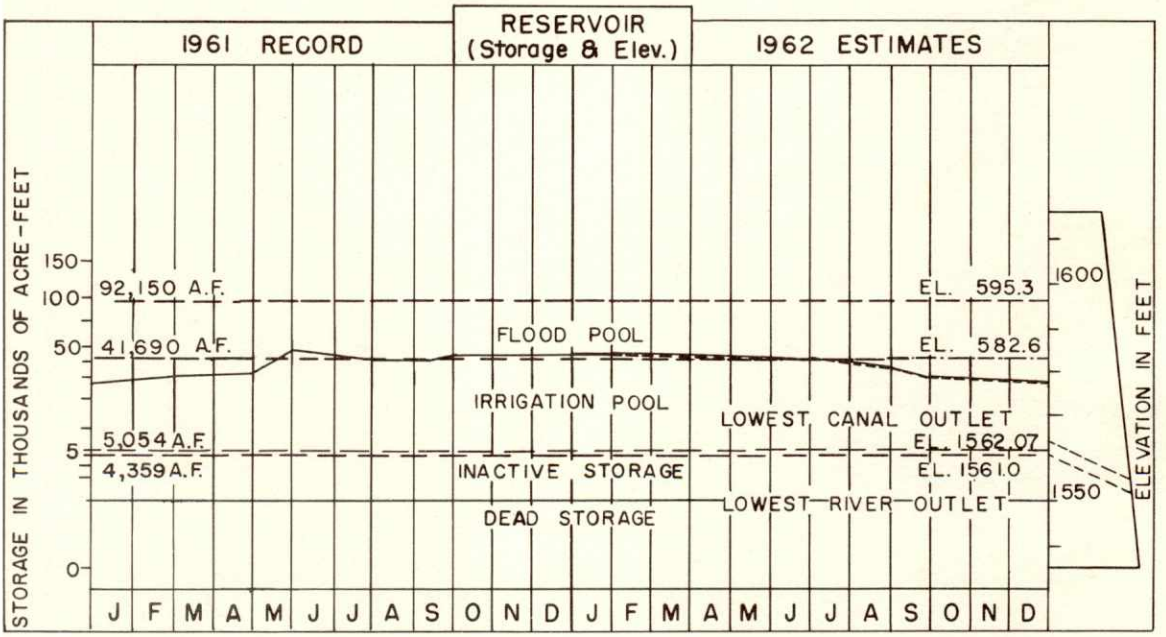



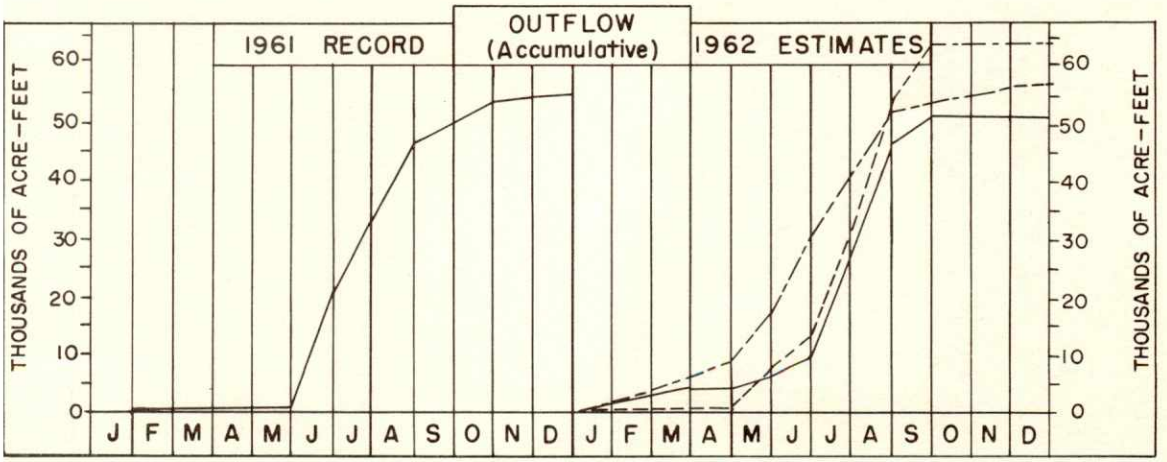
# HARLAN COUNTY RESERVOIR
# OPERATION HYDROGRAPHS



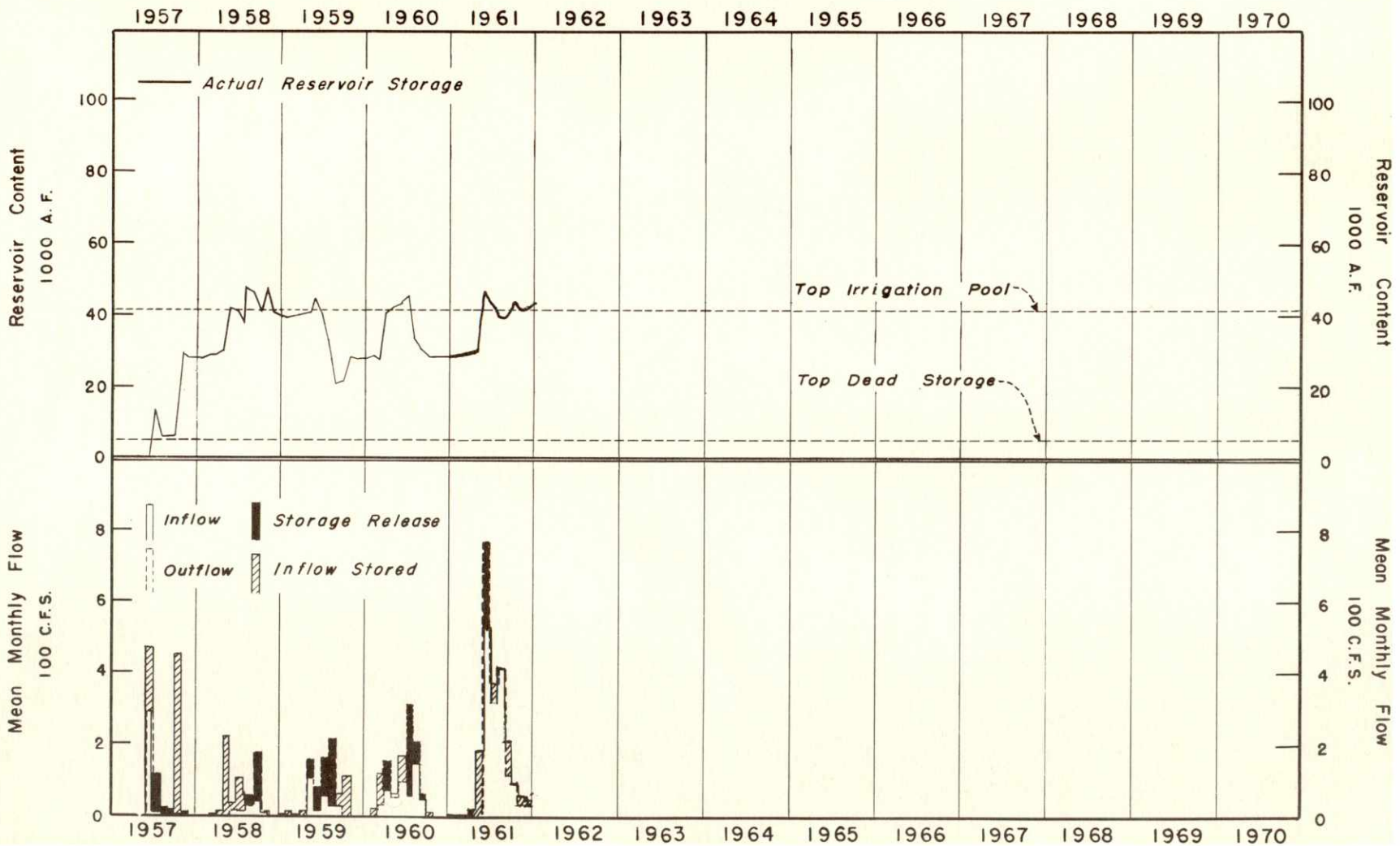
# LOVEWELL RESERVOIR OPERATION



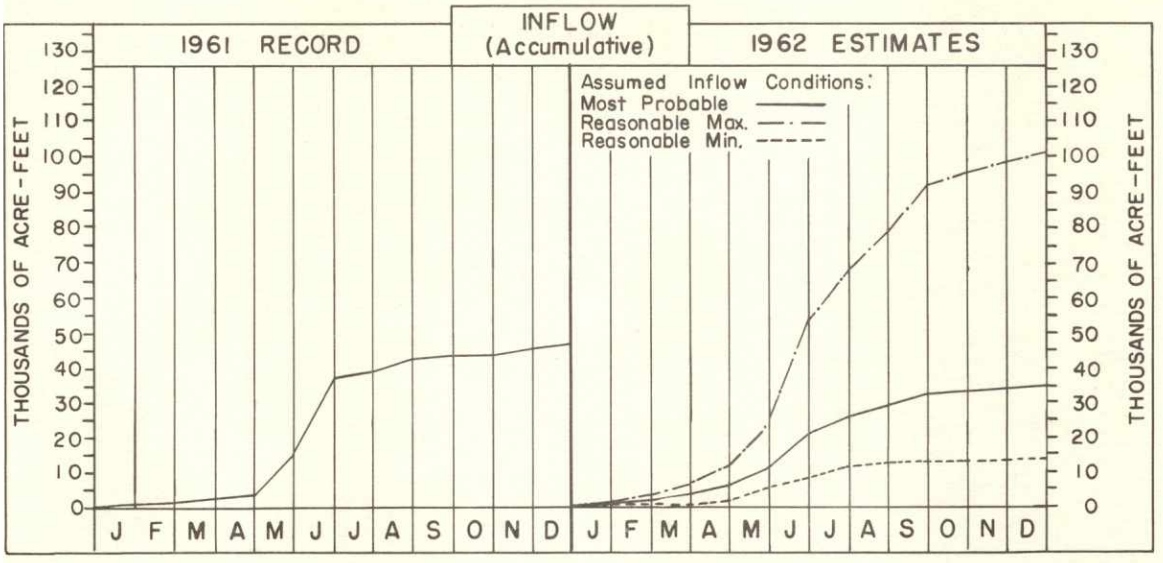



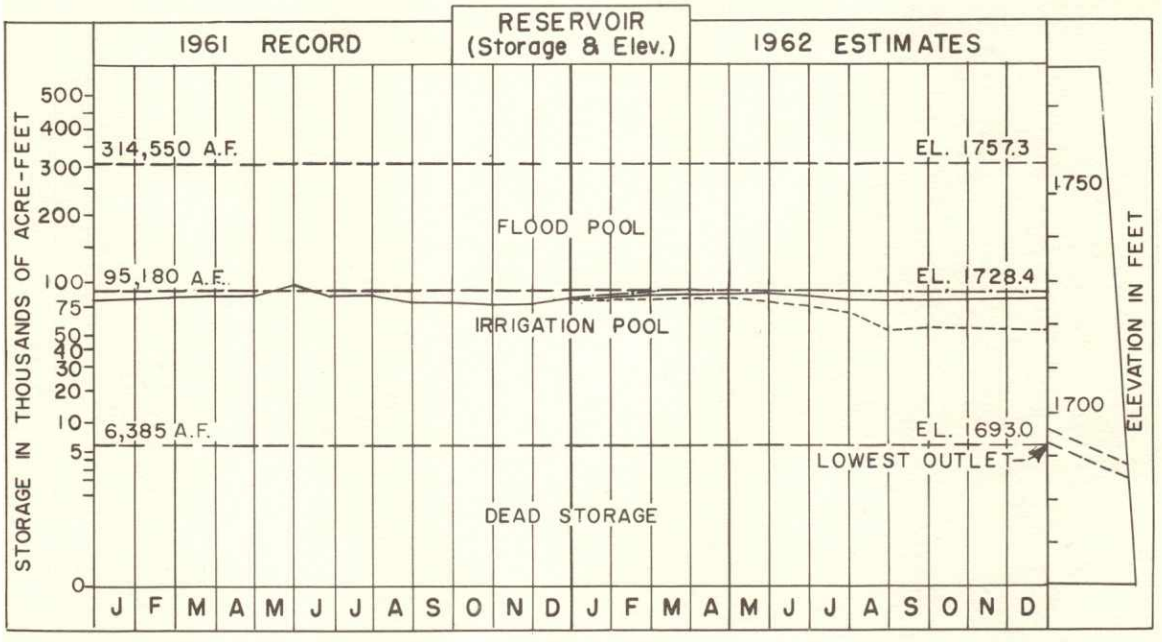



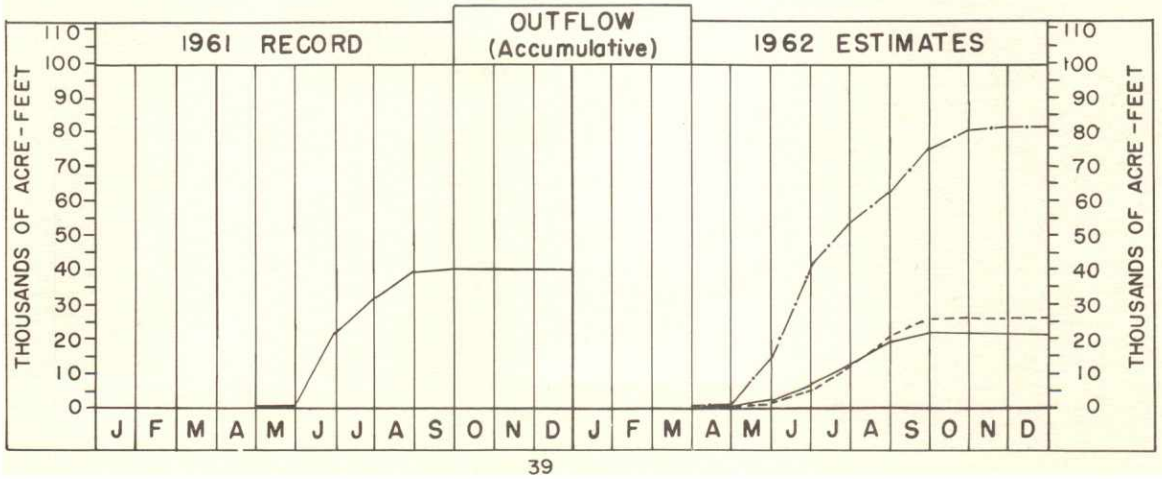
# LOVEWELL RESERVOIR
# OPERATION HYDROGRAPHS



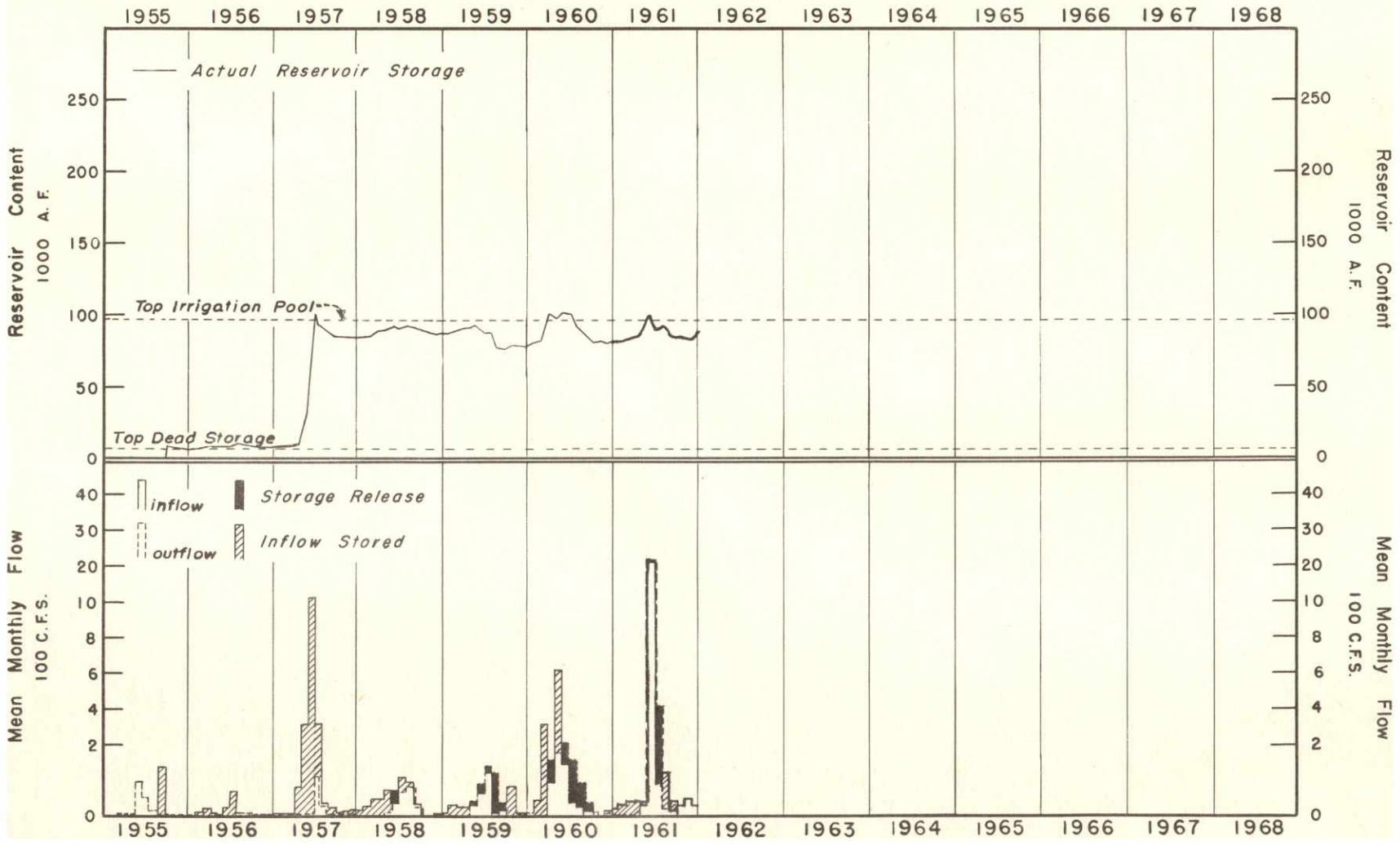
# KIRWIN RESERVOIR OPERATION



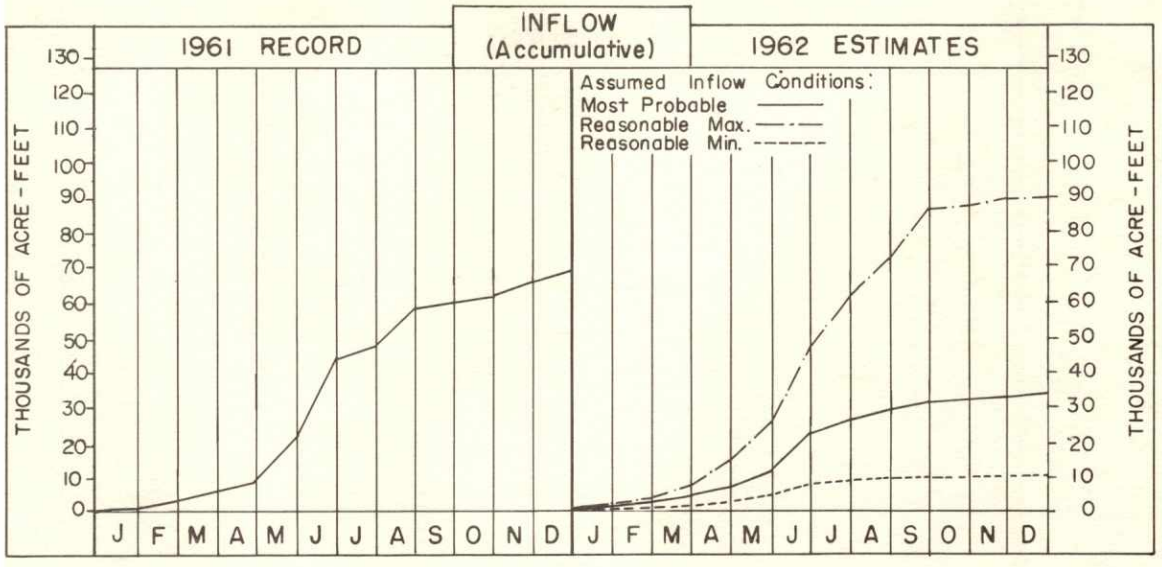



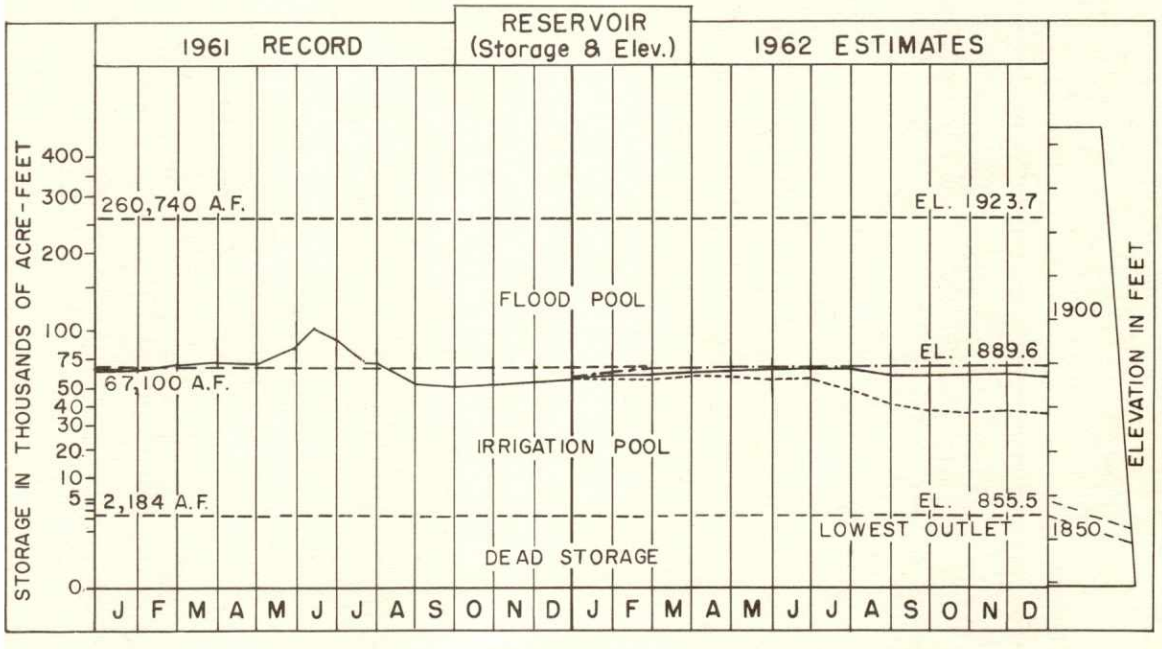



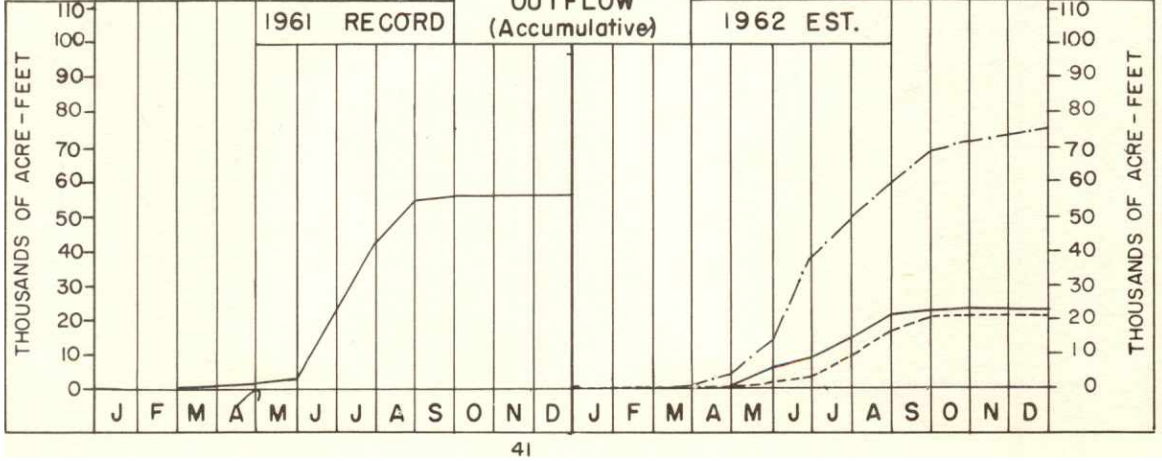
# KIRWIN RESERVOIR
# OPERATION HYDROGRAPHS



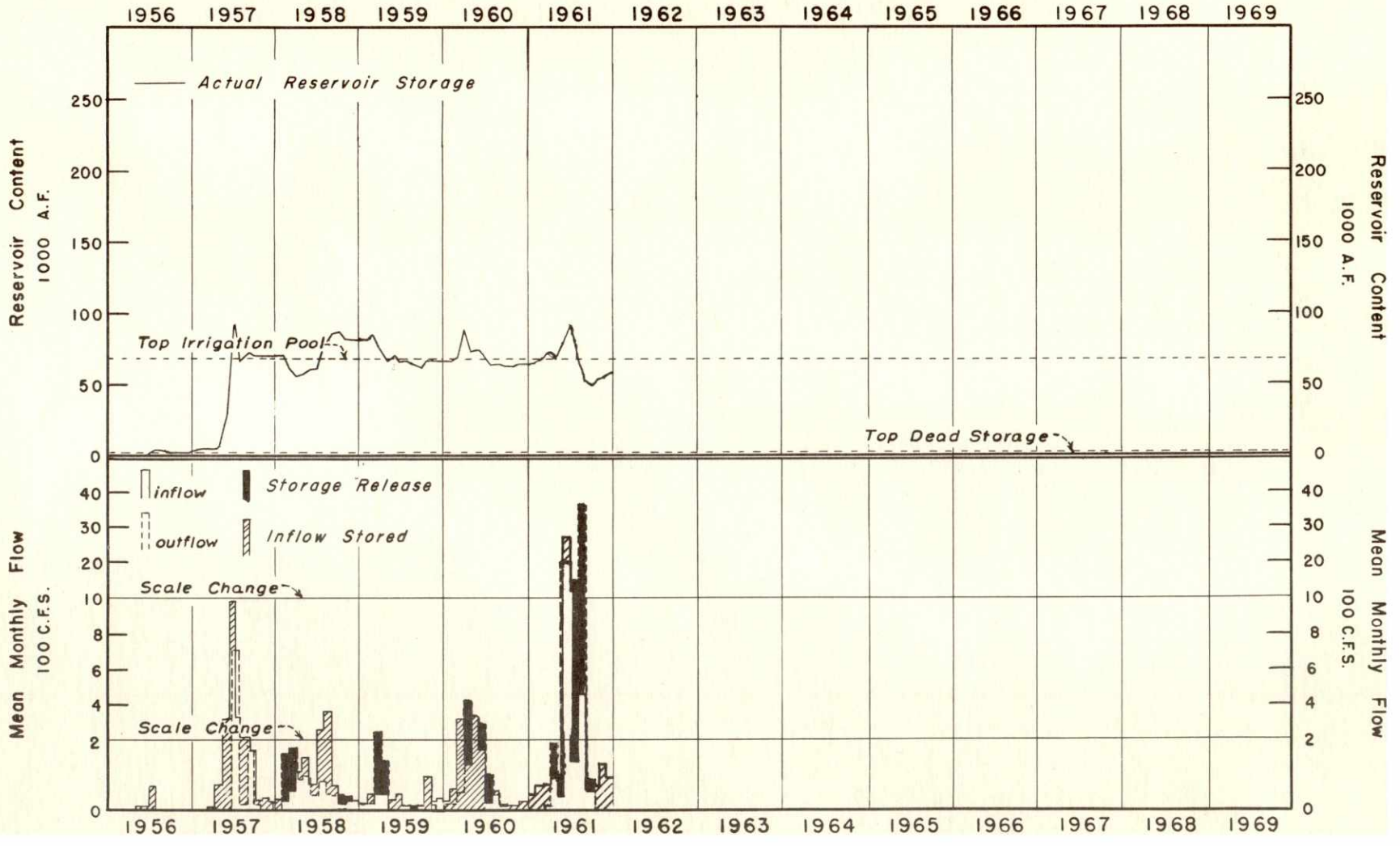
# WEBSTER RESERVOIR OPERATION



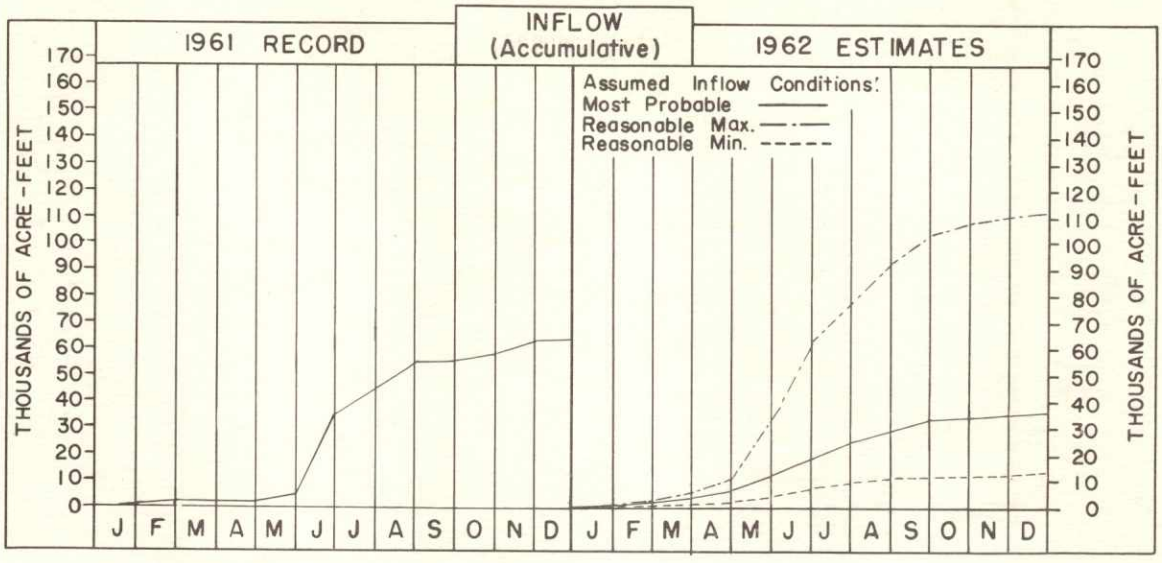



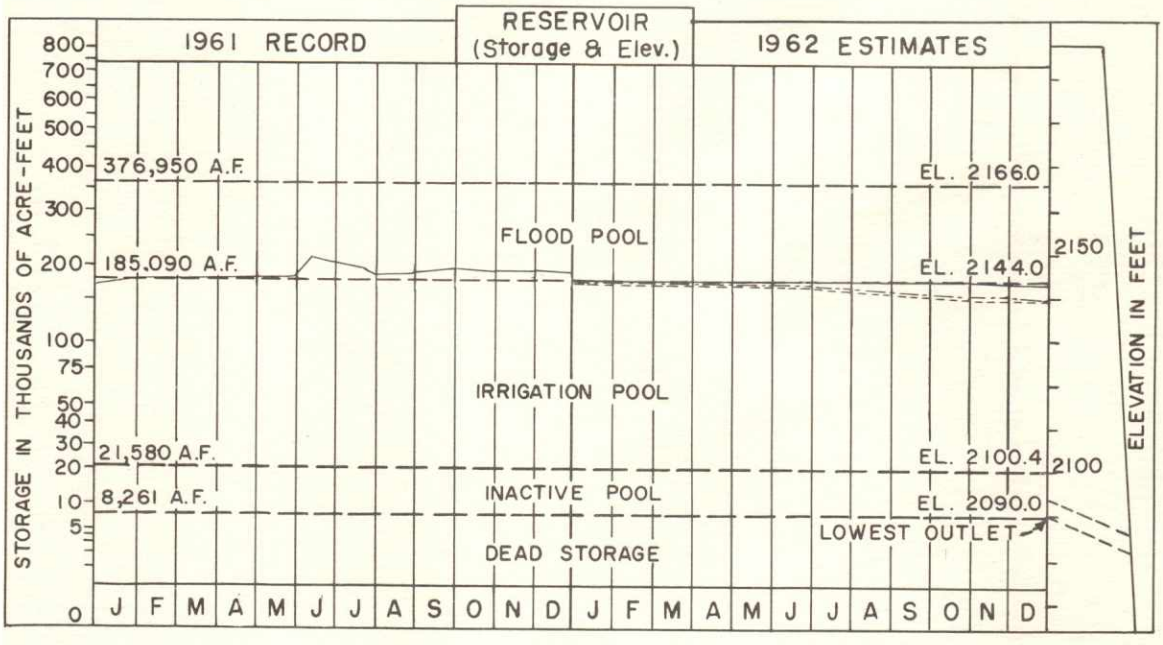



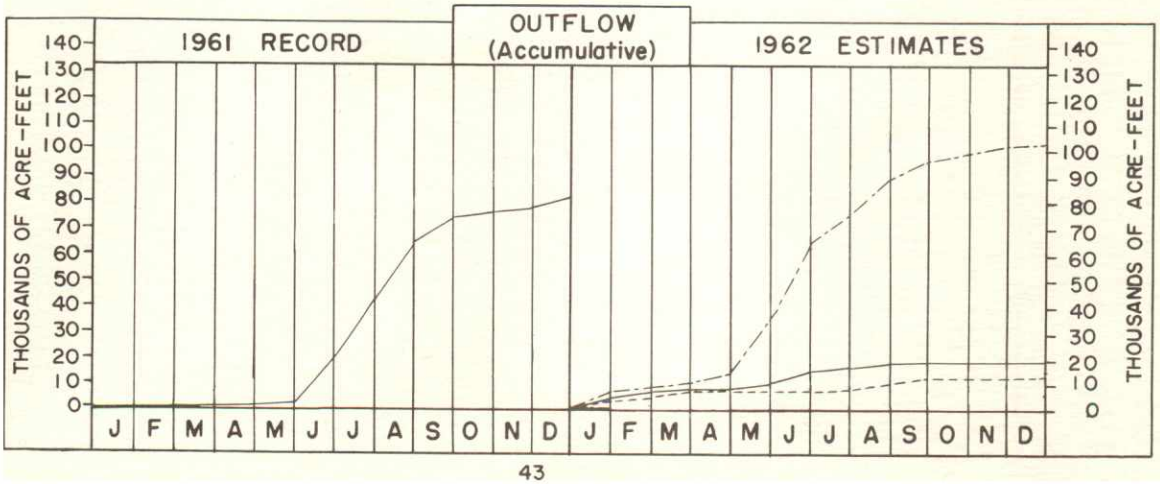
# WEBSTER RESERVOIR
# OPERATION HYDROGRAPHS



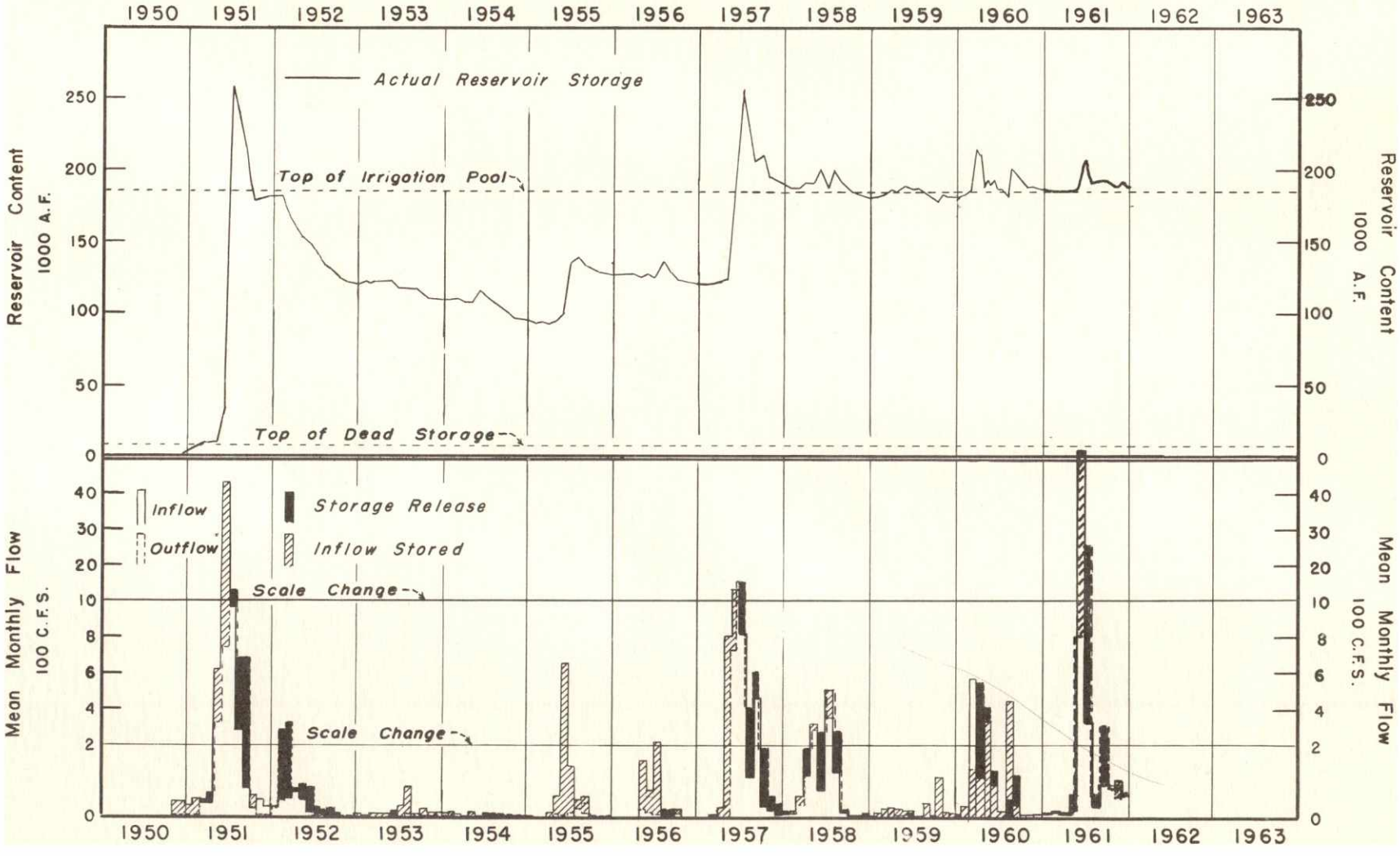
# CEDAR BLUFF RESERVOIR OPERATION



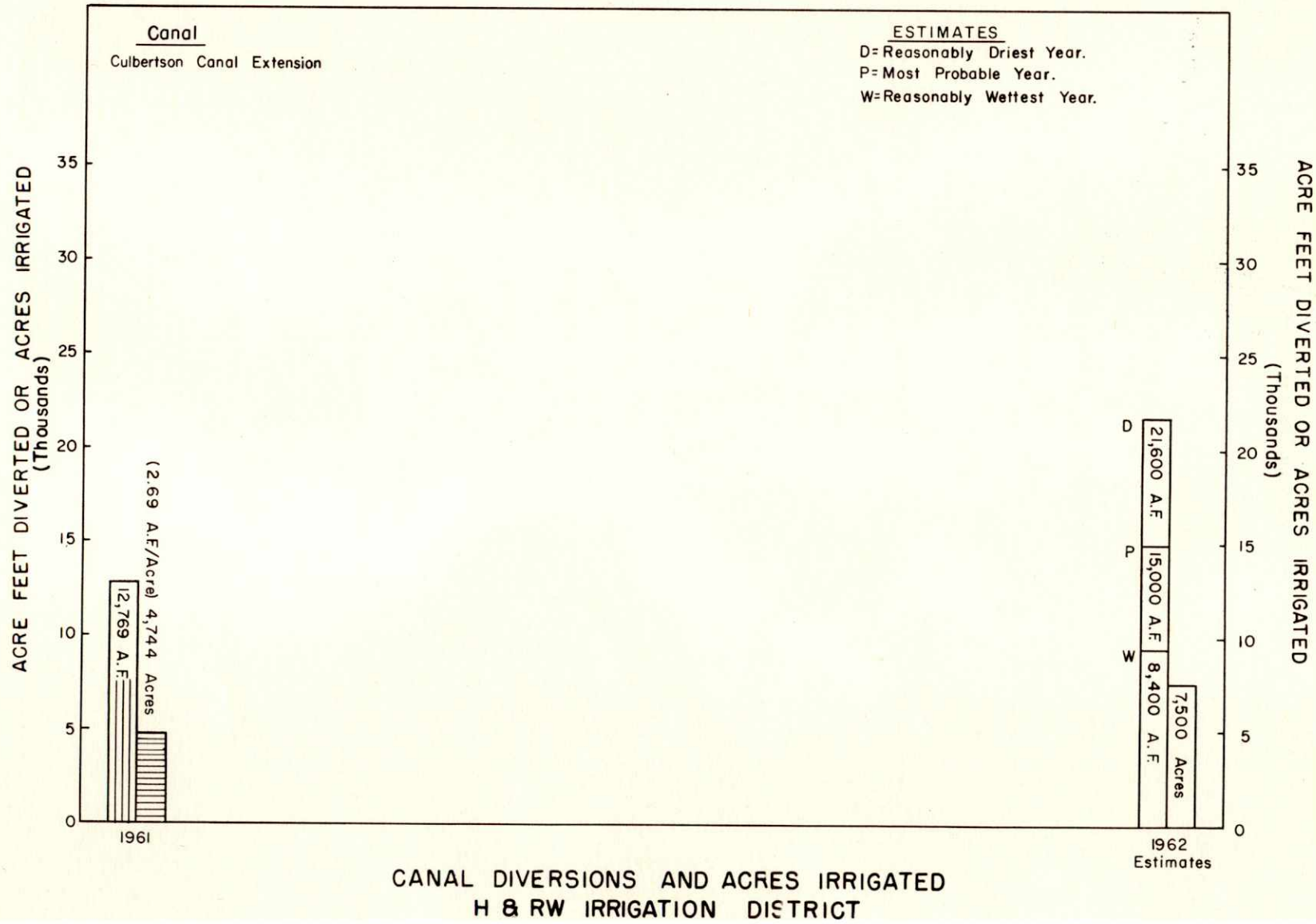



# CEDAR BLUFF RESERVOIR
# OPERATION HYDROGRAPHS



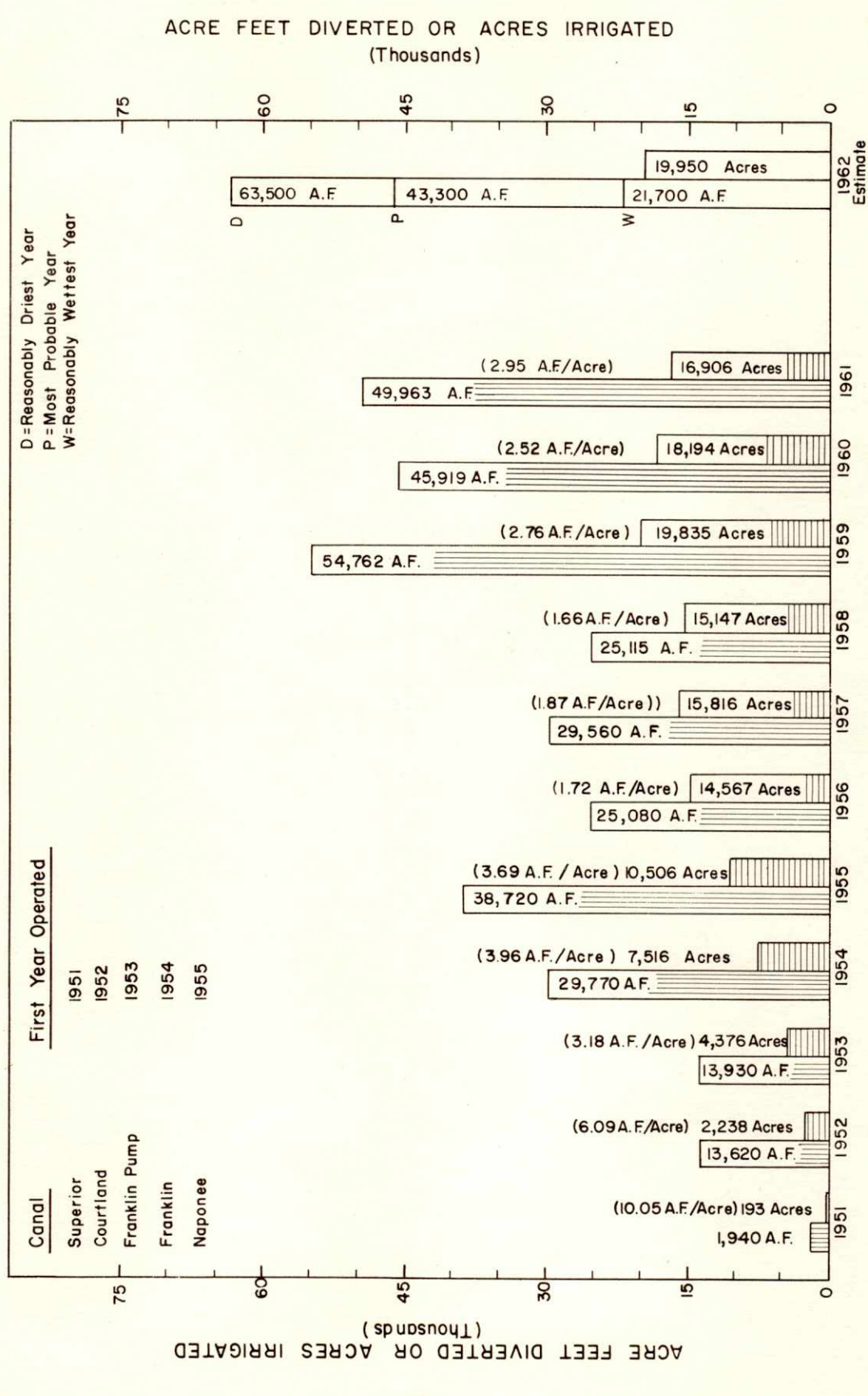
CANAL DIVERSIONS AND ACRES IRRIGATED
KANSAS RIVER PROJECTS

CANAL DIVERSIONS AND ACRES IRRIGATED
FRENCHMAN VALLEY IRRIGATION DISTRICT



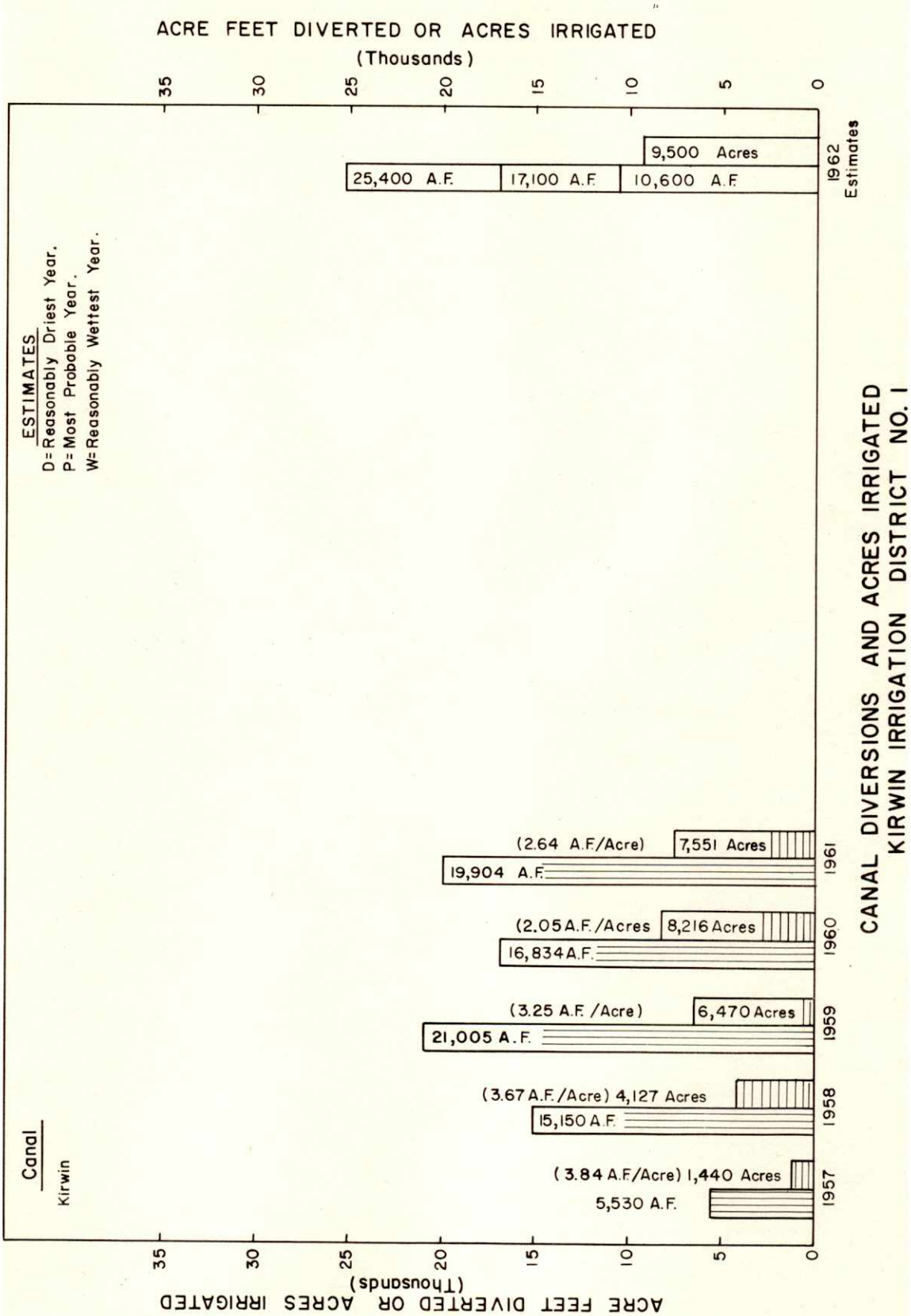

CANAL DIVERSIONS AND ACRES IRRIGATED
H & RW IRRIGATION DISTRICT

CANAL DIVERSIONS AND ACRES IRRIGATED
FRENCHMAN-CAMBRIDGE IRRIGATION DISTRICT



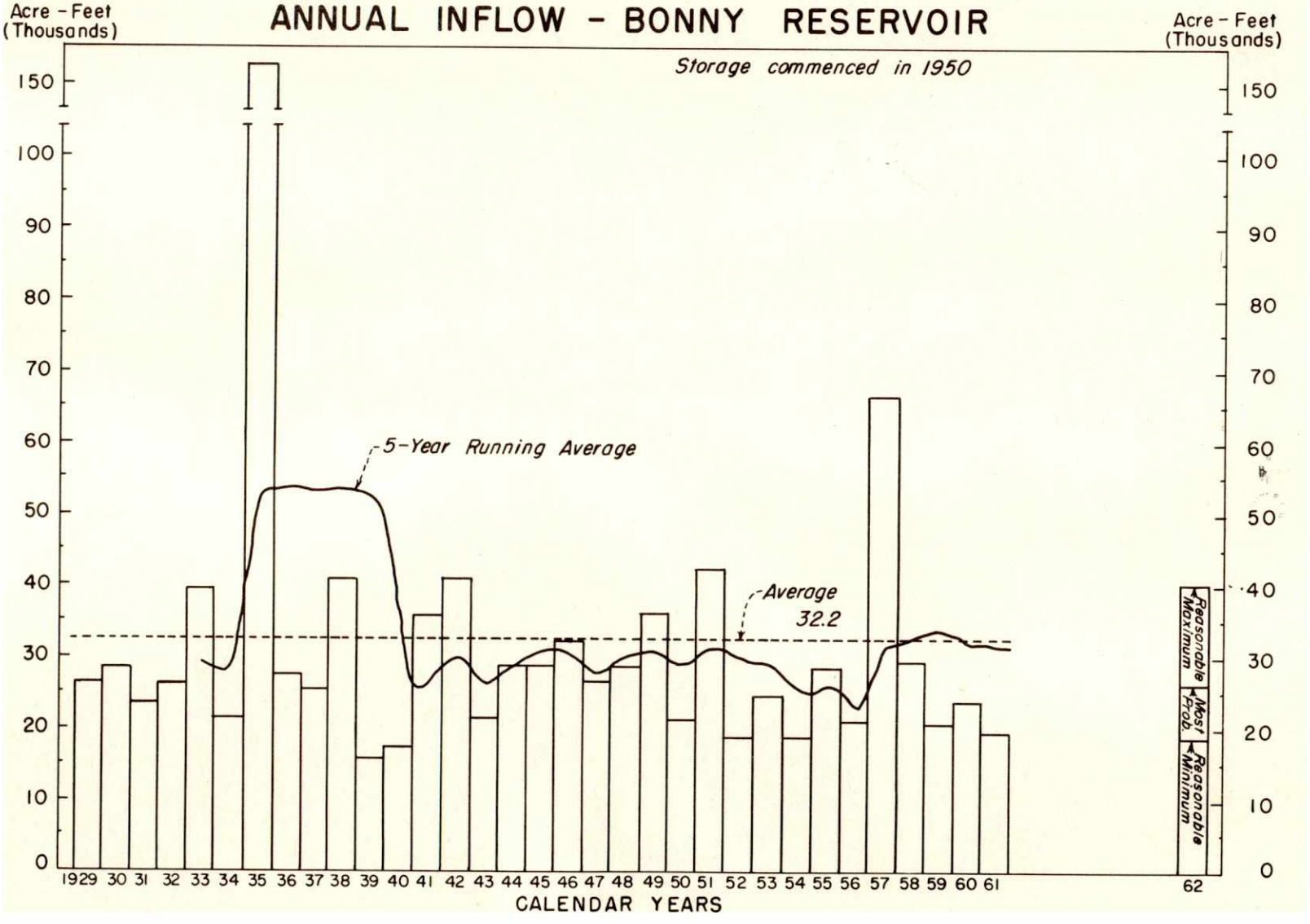

CANAL DIVERSIONS AND ACRES IRRIGATED
BOSTWICK IRRIGATION DISTRICT IN NEBRASKA

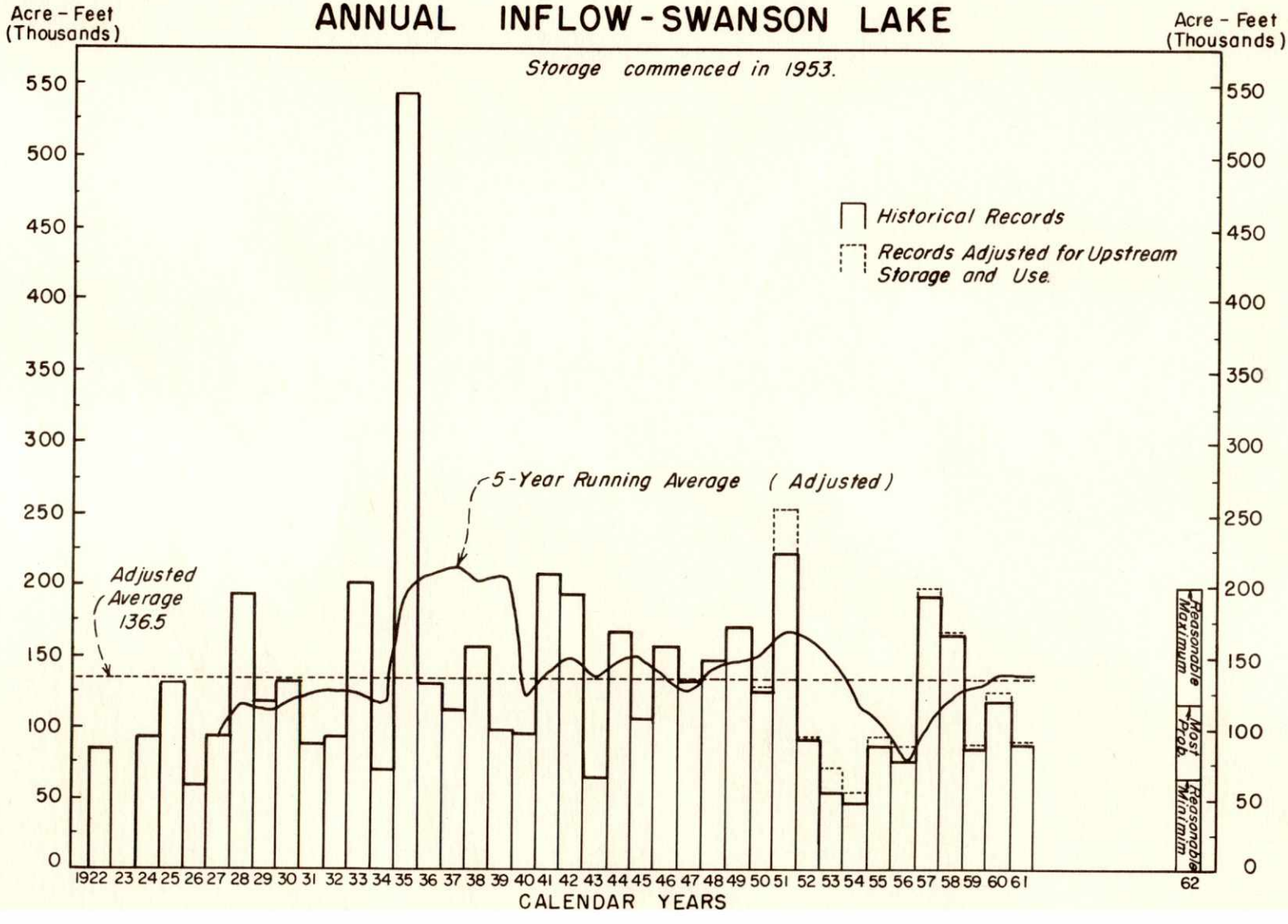
CANAL DIVERSIONS AND ACRES IRRIGATED
KANSAS-BOSTWICK IRRIGATION DISTRICT NO. 2


ACRE FEET DIVERTED OR ACRES IRRIGATED
(Thousands)
35
30
25
20
15
10
5
0
ESTIMATES
D= Reasonably Driest Year.
P= Most Probable Year.
W= Reasonably Wettest Year.
Canal
Kirwin
1962 Estimates
9,500 Acres
25,400 A.F.
17,100 A.F.
10,600 A.F.
1961
(2.64 A.F./Acre)
7,551 Acres
19,904 A.F.
1960
(2.05 A.F./Acres
8,216 Acres
16,834 A.F.
1959
(3.25 A.F./Acre)
6,470 Acres
21,005 A.F.
1958
(3.67 A.F./Acre) 4,127 Acres
15,150 A.F.
1957
(3.84 A.F/Acre) 1,440 Acres
5,530 A.F.
CANAL DIVERSIONS AND ACRES IRRIGATED
KIRWIN IRRIGATION DISTRICT NO. 1

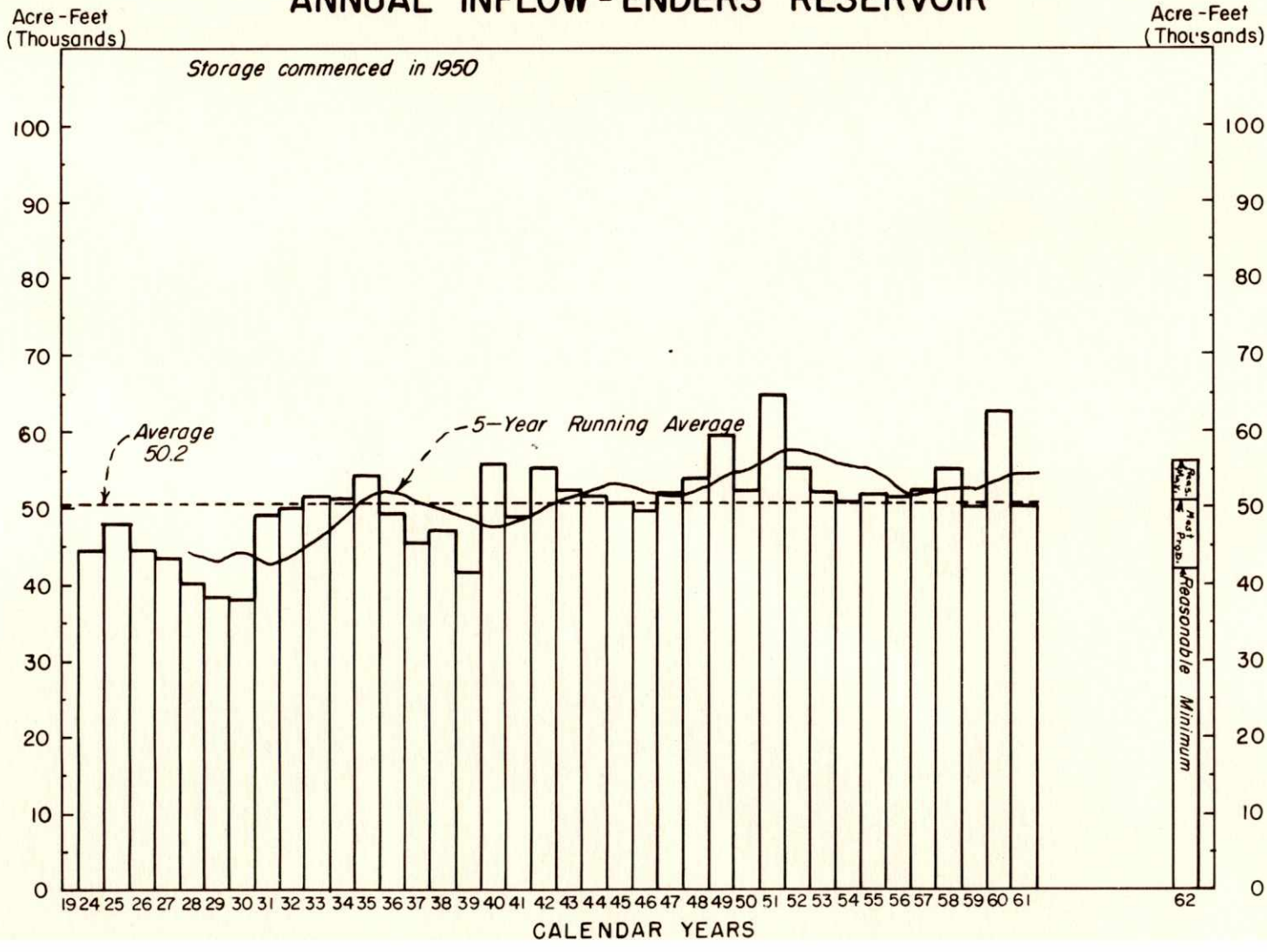
CANAL DIVERSIONS AND ACRES IRRIGATED
WEBSTER IRRIGATION DISTRICT NO. 4

# ANNUAL INFLOW - BONNY RESERVOIR




ANNUAL INFLOW - SWANSON LAKE
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1953.
Historical Records
Records Adjusted for Upstream Storage and Use.
5-Year Running Average ( Adjusted )
Adjusted Average 136.5
Reasonable Maximum
Most Prob.
Reasonable Minimum
550
500
450
400
350
300
250
200
150
100
50
0
1922 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
CALENDAR YEARS

# ANNUAL INFLOW - ENDERS RESERVOIR



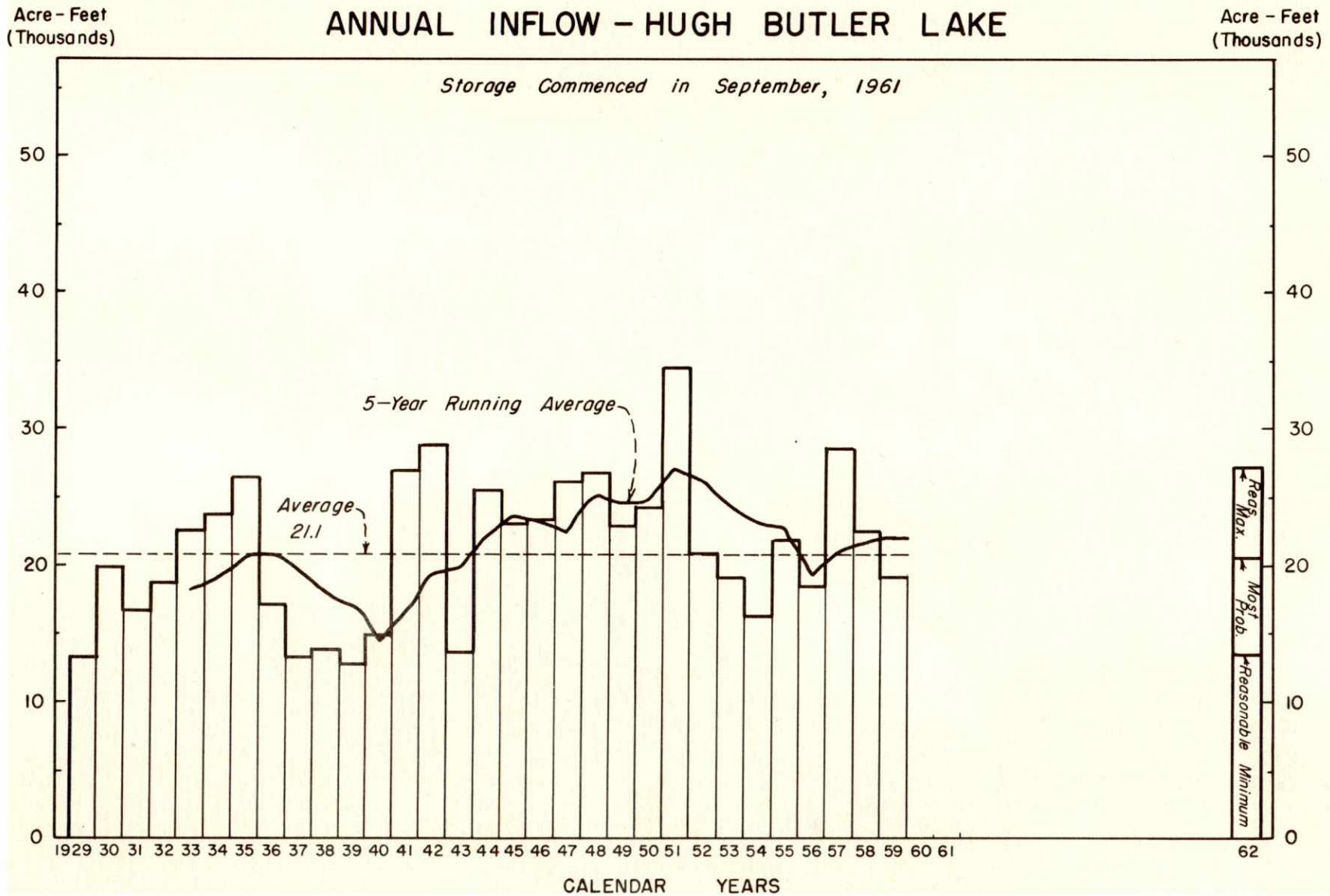

ANNUAL INFLOW – HUGH BUTLER LAKE
Acre – Feet (Thousands)
Acre – Feet (Thousands)
Storage Commenced in September, 1961
5–Year Running Average
Average 21.1
Reas. Max.
Most Prob.
Reasonable Minimum
50
40
30
20
10
0
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
CALENDAR YEARS

Exhibit 31

# ANNUAL INFLOW — HARRY STRUNK LAKE

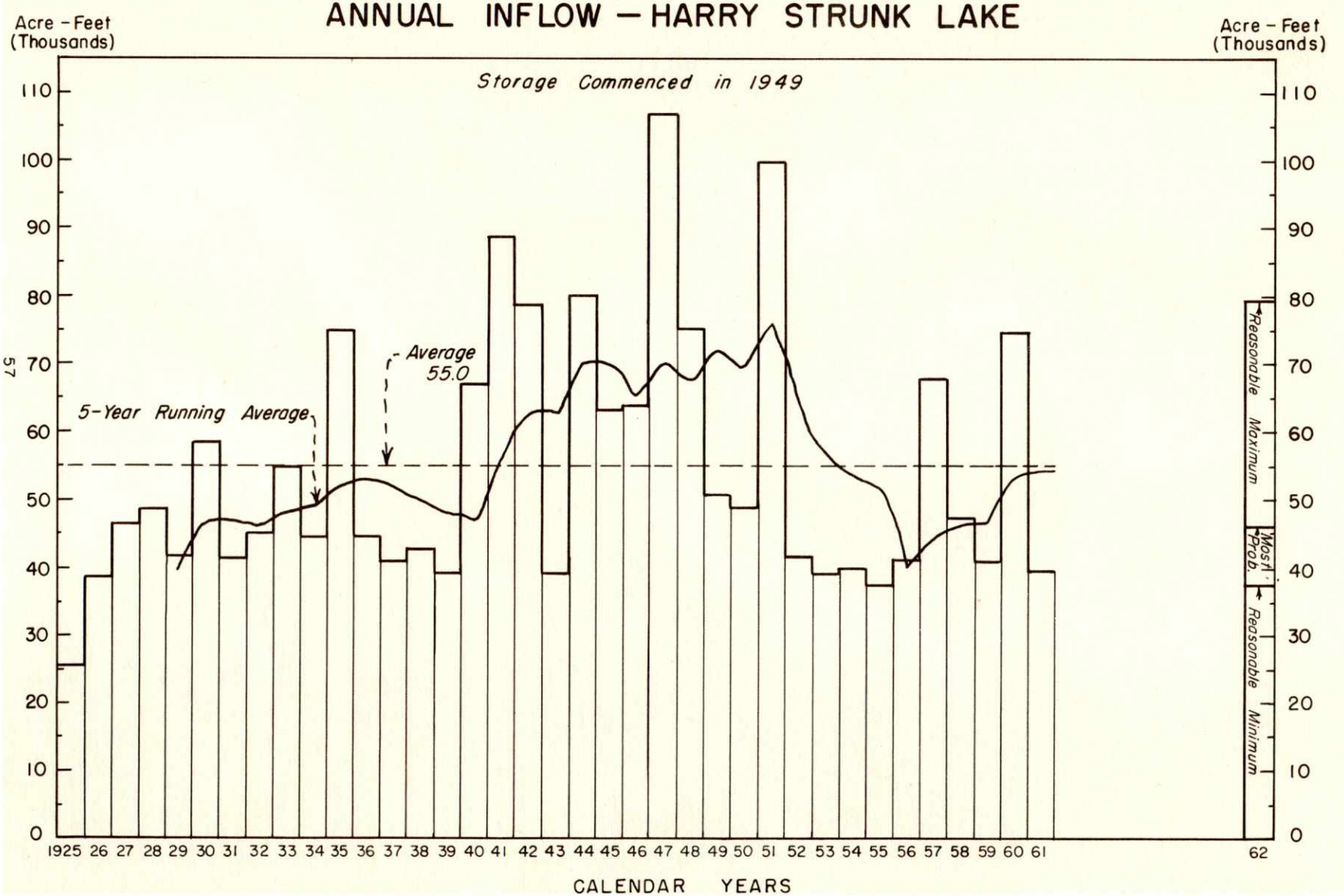
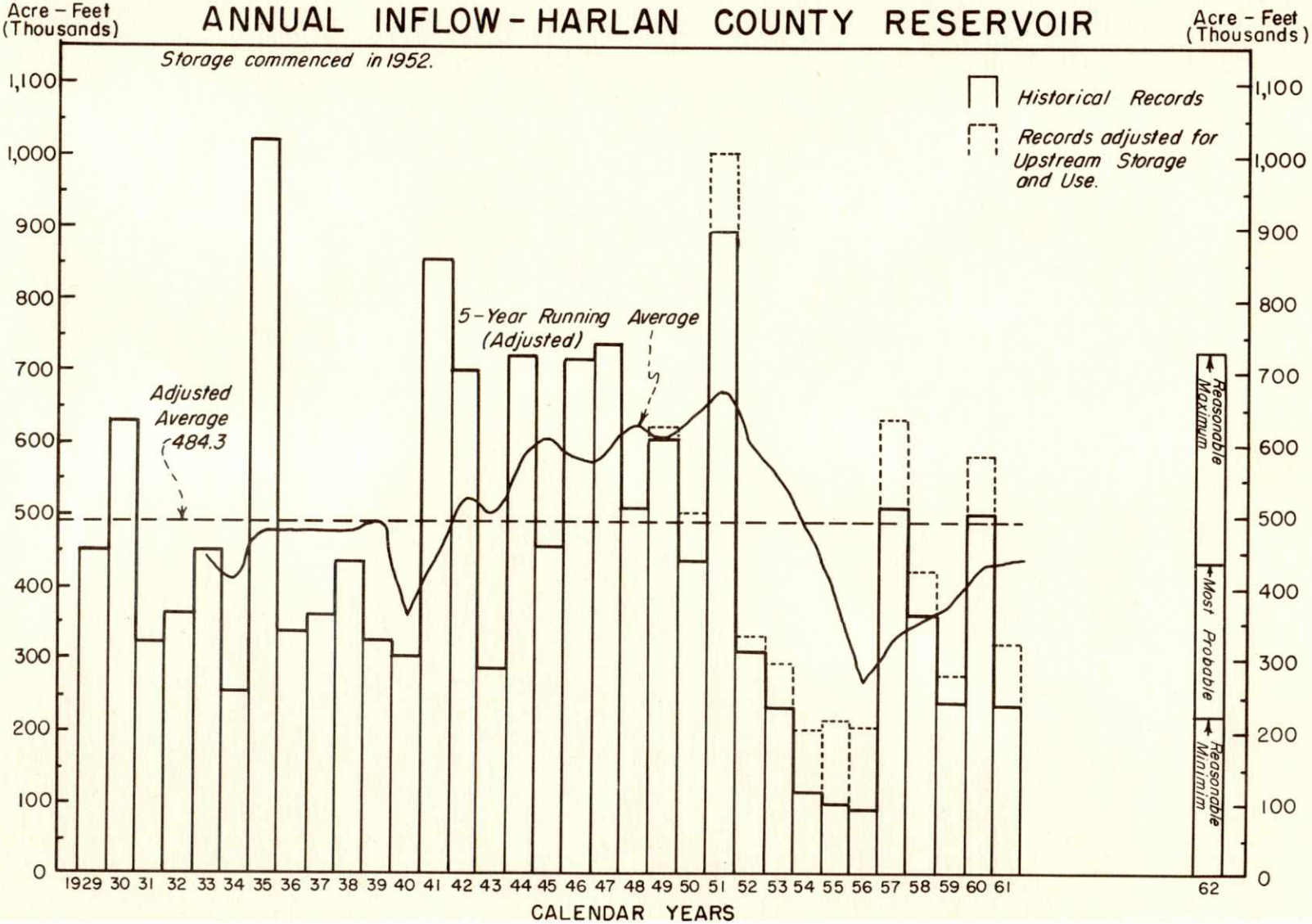


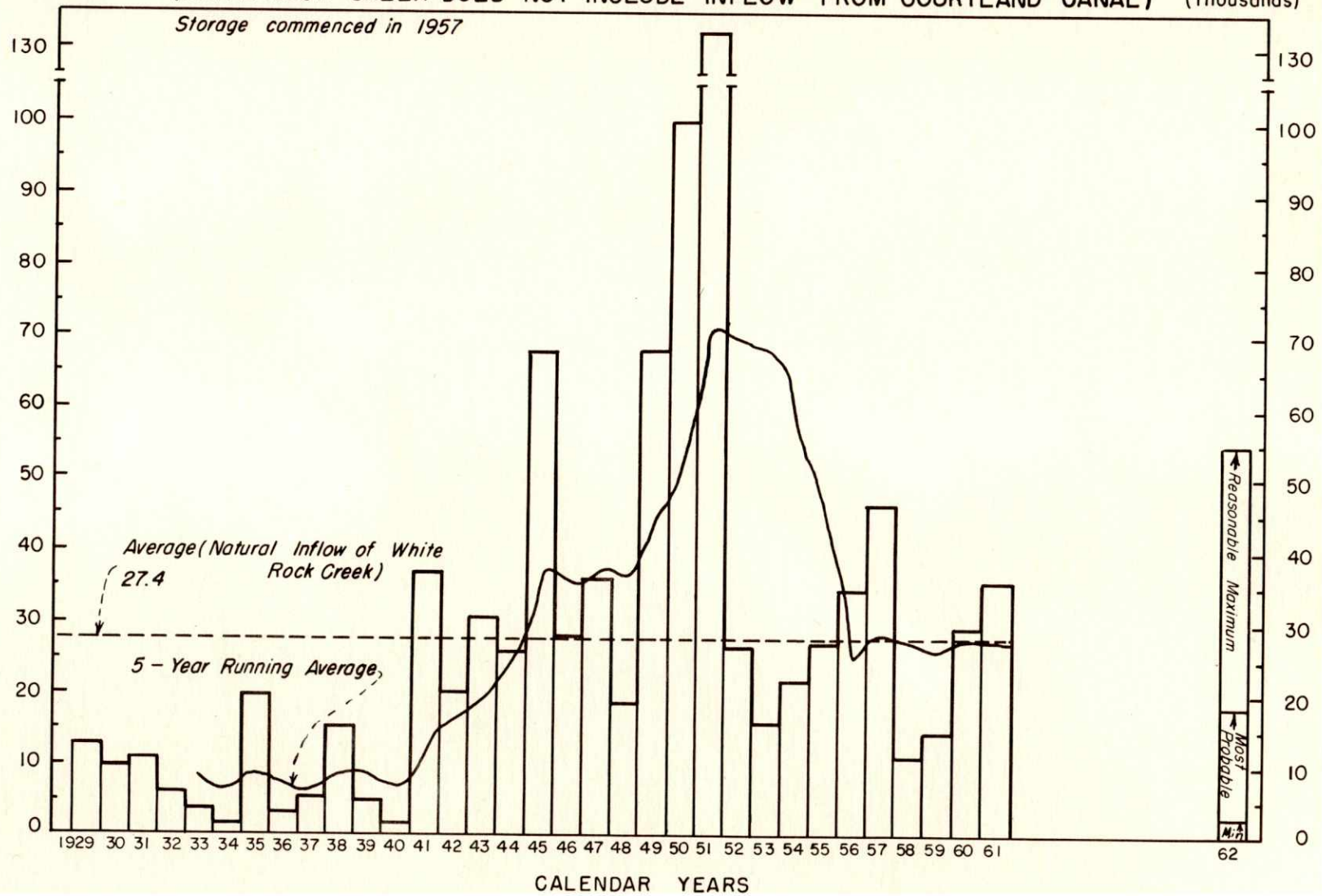


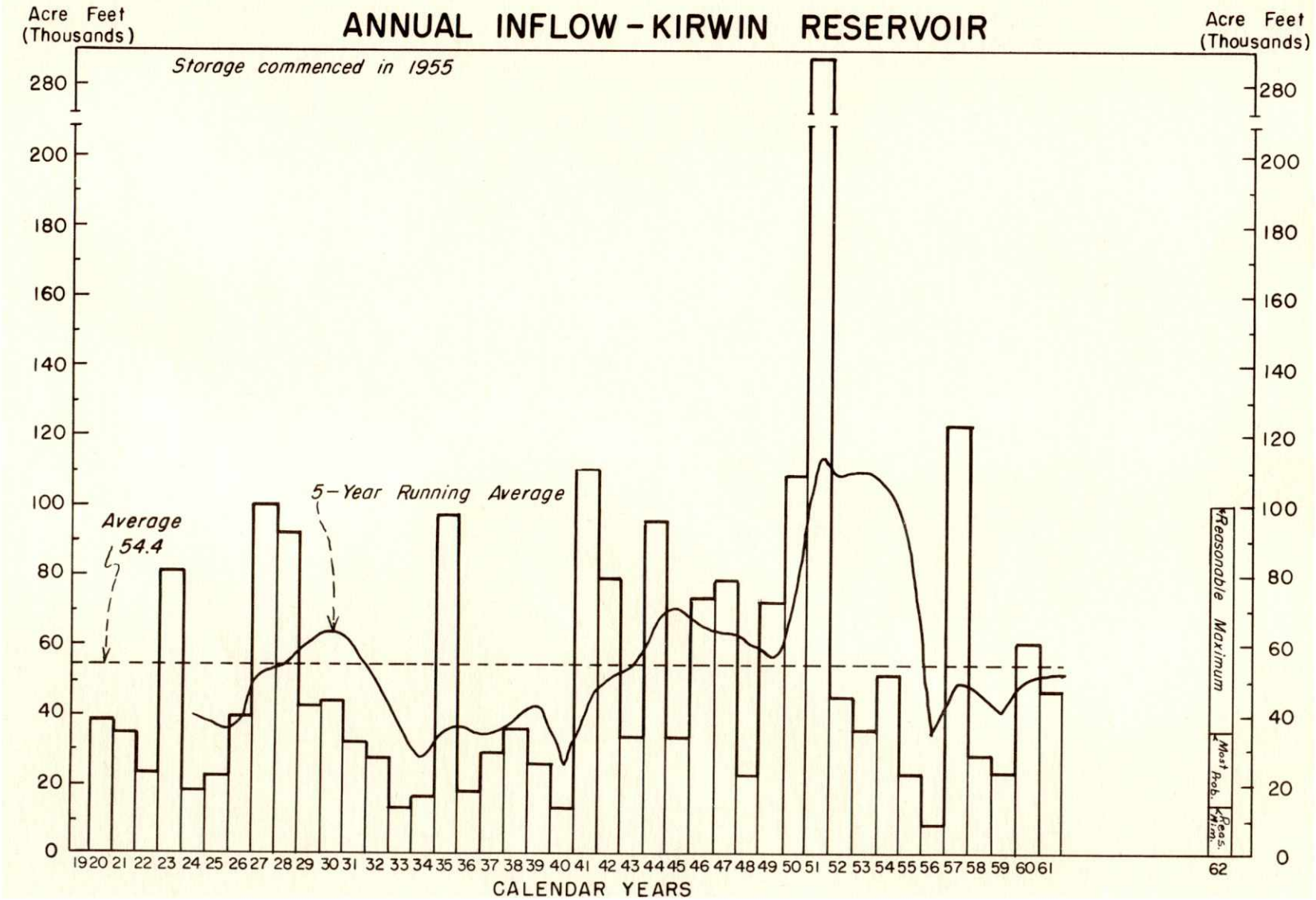

Exhibit 32

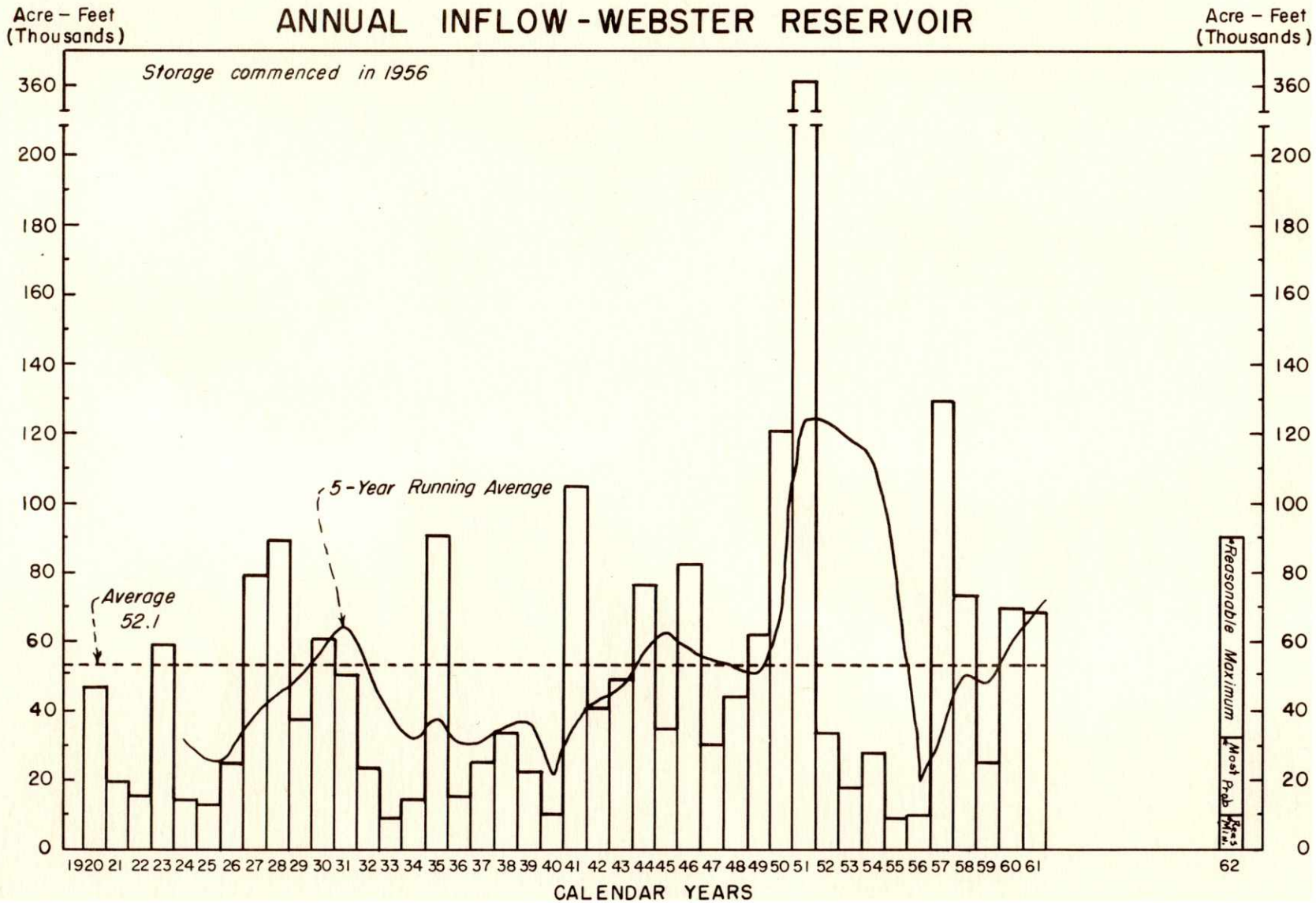

ANNUAL INFLOW - HARLAN COUNTY RESERVOIR
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1952.
Historical Records
Records adjusted for Upstream Storage and Use.
5-Year Running Average (Adjusted)
Adjusted Average 484.3
Reasonable Maximum
Most Probable
Reasonable Minimum
1,100
1,000
900
800
700
600
500
400
300
200
100
0
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
CALENDAR YEARS

# ANNUAL INFLOW - LOVEWELL RESERVOIR

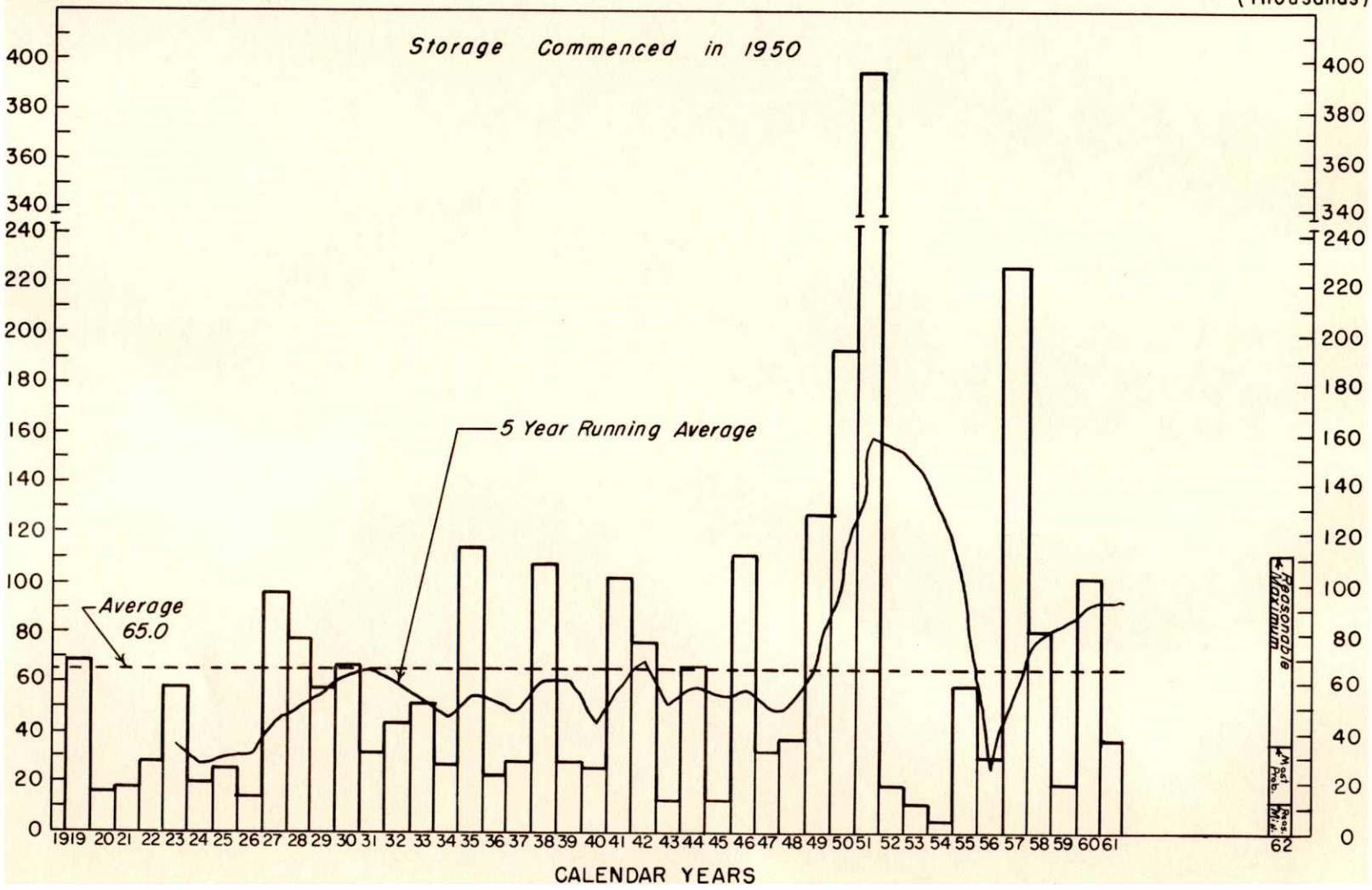
(WHITE ROCK CREEK DOES NOT INCLUDE INFLOW FROM COURTLAND CANAL)




ANNUAL INFLOW - KIRWIN RESERVOIR
Acre Feet (Thousands)
Acre Feet (Thousands)
Storage commenced in 1955
5-Year Running Average
Average 54.4
Reasonable Maximum
Most Prob.
Pres. Lim.
0
20
40
60
80
100
120
140
160
180
200
280
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
CALENDAR YEARS


ANNUAL INFLOW - WEBSTER RESERVOIR
Acre – Feet (Thousands)
Acre – Feet (Thousands)
Storage commenced in 1956
5 - Year Running Average
Average 52.1
Reasonable Maximum
Most Prob. Max.
360
200
180
160
140
120
100
80
60
40
20
0
1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61
62
CALENDAR YEARS

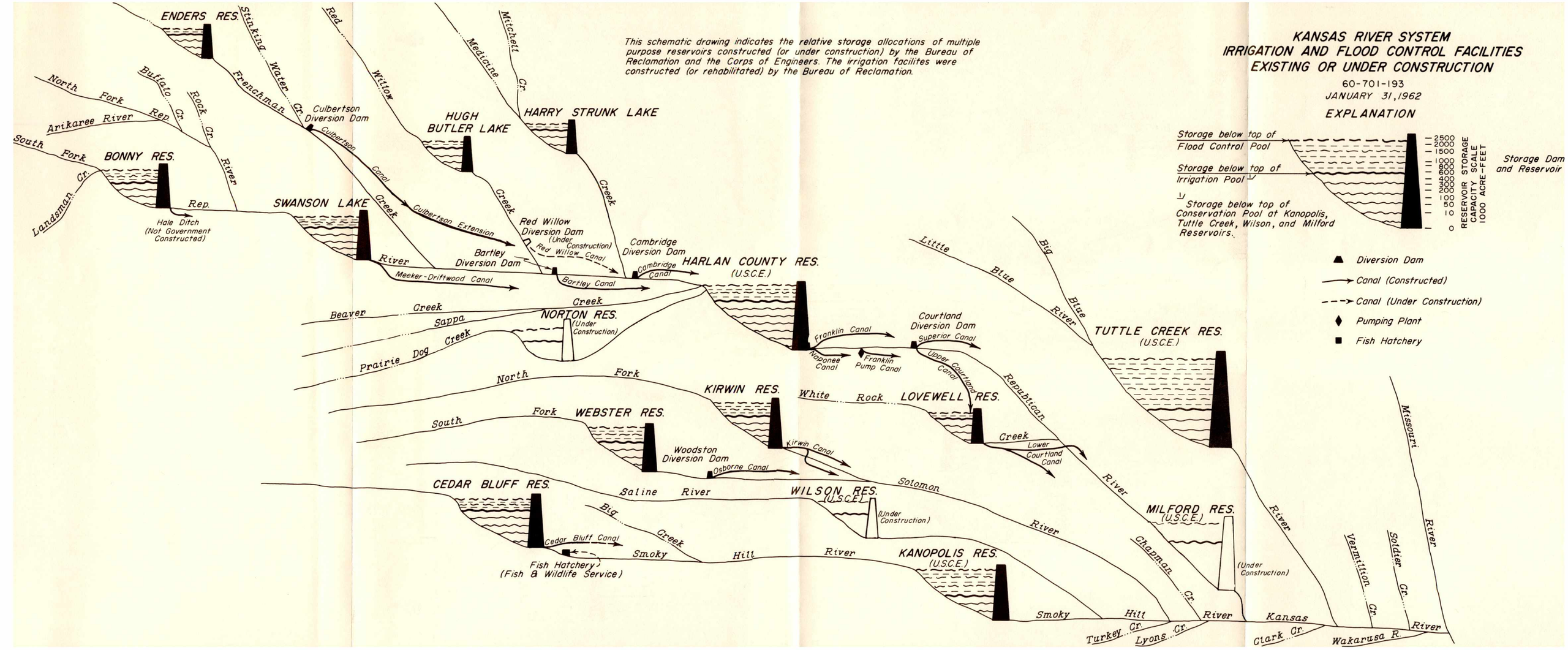
# ANNUAL INFLOW - CEDAR BLUFF RESERVOIR



# KANSAS RIVER SYSTEM
# IRRIGATION AND FLOOD CONTROL FACILITIES
# EXISTING OR UNDER CONSTRUCTION

60-701-193
JANUARY 31, 1962

This schematic drawing indicates the relative storage allocations of multiple purpose reservoirs constructed (or under construction) by the Bureau of Reclamation and the Corps of Engineers. The irrigation facilites were constructed (or rehabilitated) by the Bureau of Reclamation.




## EXPLANATION




Storage Dam and Reservoir

1/ Storage below top of Conservation Pool at Kanopolis, Tuttle Creek, Wilson, and Milford Reservoirs.

- Diversion Dam
- Canal (Constructed)
- Canal (Under Construction)
- Pumping Plant
- Fish Hatchery