Save

ANNUAL

OPERATING

PLAN

Kansas River Projects

1962 Operations

1963 Outlook

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

February 1963

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

BUREAU OF RECLAMATION
Floyd E. Dominy, Commissioner

Region 7 - Denver, Colorado
H. P. Dugan, Regional Director

ANNUAL OPERATING PLAN

KANSAS RIVER PROJECTS

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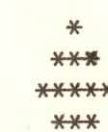

February 1963

MEDICINE CREEK DAM
AND
HARRY STRUNK LAKE

SYNOPSIS

ANNUAL OPERATING PLAN - KANSAS RIVER PROJECTS

1962 OPERATIONS - 1963 OUTLOOK

GENERAL

This is the tenth Annual Operating Plan for irrigation units in the Kansas River Projects area. The facilities that are completed or under construction are featured as Exhibit 29 which can be folded out for easy reference. 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. The following reservoirs are operated by the Bureau of Reclamation:

(a) Bonny, Enders and Lovewell Reservoirs; Swanson, Hugh Butler, and Harry Strunk Lakes in the Republican River Basin

(b) Kirwin and Webster Reservoirs in the Solomon River Basin

(c) Cedar Bluff Reservoir on the Smoky Hill River.

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 the scope of this report.

Chapter I, the introduction, gives a brief description of the irrigation units in the Kansas River Projects area. Chapter II summarizes the 1962 Operations and Chapter III presents the plan of operation for 1963.

1962 OPERATIONS

The water supply was more than adequate to meet the 1962 irrigation requirements of 99,779 acres in the Kansas River Projects. The total precipitation for 1962 was well above normal at all of the reservoirs. The average diversion rate per acre was 1.93 acre-feet while the deliveries to the farms varied from about 0.7 to 1.1 acre-feet per acre.

All of the reservoirs spilled in 1962 except Bonny and Hugh Butler Lake. Major flooding was prevented during June, July, and August of 1962 in the Nebraska portion of the Republican River basin by the impoundment of heavy flood runoff in Swanson, Hugh Butler, and Harry Strunk Lakes and Harlan County Reservoir. Some Republican River

tributaries, without reservoir protection, experienced floods of near record magnitude and created minor flood damages in the Republican River Valley until stored in the next downstream reservoir.

1963 OUTLOOK

Facilities are completed to serve 147,344 acres of which 112,950 acres are expected to be irrigated in 1963. The carry-over storage and the inflow that can reasonably be expected on a dry year will be more than adequate to meet demands of these acres. Bonny, Enders, Swanson Lake, Harry Strunk Lake, Harlan County, Kirwin, and Webster Reservoirs are expected to be spilling at the start of the 1963 Irrigation Season. The conservation storage space in Lovewell Reservoir is expected to be filled by the end of June.

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ANNUAL OPERATING PLAN - KANSAS RIVER PROJECTS

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CHAPTER 1 - INTRODUCTION

PURPOSE OF THE REPORT

The purpose of this tenth Annual Operating Plan is to advise water users, cooperating agencies, and other interested groups or persons of the irrigation operations during 1962 and of the plan of operations for 1963 in the Kansas River Projects area.

OPERATIONAL RESPONSIBILITIES

The Bureau of Reclamation is responsible for irrigation operation at all Federal reservoirs in the basin. The Corps of Engineers holds like responsibility for flood control operation. The constructing agency is solely responsible for guidance or accomplishment of all other project functions such as: recreation, sanitation, water quality and project safety.

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, fifteen canal systems, and six diversion dams are in operation. Red Willow Canal construction will be completed in 1964. The railroad relocation in the Norton Reservoir area is nearing completion. Norton Dam is now under construction and is expected to be finished in 1964. Construction will be started on the Almena Diversion Dam and Canal in 1963. Construction will also be started on Glen Elder Dam on the Solomon River this year. Milford Dam on the Republican River, Wilson Dam on the Saline River and Perry Dam on the Delaware Creek 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 in this report. Storage allocations for the ten reservoirs presently serving irrigated areas are shown in Table 1. The reservoirs and main irrigation canals are shown in Exhibit 29.

IRRIGATION DISTRICTS

Nine Irrigation Districts in the Kansas River Projects have contracted with the Bureau of Reclamation for construction of irrigation facilities. Table No. 5 shows the status of the repayment and water service contracts with the development periods, where appropriate. Table 6 shows the planned ultimate acreage, the acres irrigated in 1962 and the anticipated acreage for 1963 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. The H&RW Irrigation District will operate and maintain the Culbertson Extension System for the first time in 1963. 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

This irrigation district has 43,190 acres of land which will ultimately be served. These lands are in the Republican River Valley from Swanson Lake to Harlan County Reservoir. Swanson, Harry Strunk and Hugh Butler Lakes provide storage for these lands. The district is operating Meeker-Driftwood, Bartley and Cambridge Canal Systems to irrigate 39,040 acres. The Bureau of Reclamation will operate a portion of Red Willow Canal with service to 947 acres. All of the major construction will be complete by June of 1964.

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 22,755 acres in Nebraska. These lands are in the Republican River Valley from Harlan Co. Dam to Kansas-Nebraska state line. Courtland Canal was also constructed to serve lands in the Kansas-Bostwick Irrigation District.

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 36,912 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 is constructed to serve 11,641 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 25,271 acres of land. The Kansas-Bostwick Irrigation lands are in the Republican River and White Rock Creek Basins from Superior, Nebraska to five miles south of Courtland 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. The project area of 11,500 acres is 1,500 acres larger than the area originally planned for irrigation with the available water supply, and successful operation will at times be dependent upon several years of carryover reservoir storage. 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 construction of Norton Dam is expected to be completed in 1964. Construction of the Almena Diversion Dam and irrigation facilities will be started in 1963.

Cedar Bluff Irrigation District No. 6

Cedar Bluff Reservoir provides storage water for 6,600 acres in the Smoky Hill Basin served by the Cedar Bluff Canal. Construction will be completed in July of 1963.

IRRIGATION SEASON

The normal irrigation season for Frenchman Valley, H&RW, and Frenchman-Cambridge Irrigation Districts is from May 1 to October 15, and 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 to furnish 1600 acre-feet annually.

City of Beloit, Kansas

A long term contract has been signed to furnish a municipal water supply to the City of Beloit, Kansas from Glen Elder Reservoir. An iterim contract has been executed for a supply of storage water not to exceed 1,000 acre-feet per year from Webster Reservoir until such time as Glen Elder Dam is constructed.

City of Russell, Kansas

The City of Russell has recently approved the draft of a long term contract for a municipal water supply not to exceed 2000 acre-feet per year.

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 1962 OPERATIONS

PRECIPITATION

The annual precipitation was well above normal at all of the reservoirs. These data are shown on table 4.

RESERVOIR INFLOW

The inflows varied from 94% of most probable at Cedar Bluff Reservoir to 284% at Webster. The inflow into Harry Strunk was greater than the reasonable maximum and has been exceeded only once during the 38 years of historical record. Table 2 shows the 1962 inflows compared to historical averages and the forecasts for 1963. Exhibits 19 through 28 graphically present the 1962 inflows as compared to historical inflows for the period of record.

RESERVOIR OPERATIONS

All of the reservoirs except Bonny and Hugh Butler spilled in the spring of 1962. The operations were all within the scope of the plan of operation except Harry Strunk Lake where the inflow exceeded the reasonable maximum. There were no shortages for the 99,779 acres irrigated. Table 3 shows the 1962 reservoir contents by months. The operation hydrographs are plotted on exhibits 1 through 10.

Major flooding was experienced on Republican tributaries during June, July and August of 1962, but flooding was prevented in the Nebraska portion of the Republican River Basin by storage of heavy flood run-off in Swanson, Hugh Butler, Harry Strunk, and Harland County Reservoirs.

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 1961-1962. Releases were made from March to mid-July to maintain the desired pool elevation.

The reservoir water surface was lowered to the desired spring operating level of two feet or 3,950 acre-feet below the top of the irrigation pool in March. Natural flow bypasses as required for irrigation were made to Hale Ditch from June to mid-November. Only 95 acre-feet of storage water was sold under Warren Act Contracts as a supplemental water supply for 590 acres served by Hale Ditch. The releases and reservoir losses lowered the reservoir level to elevation 3669.0 (35,500 acre-feet) which is 3 feet below the top of the irrigation pool by the end of October.

Swanson Lake

Record run-off from Indian Creek area above Stratton, Nebraska in July and other flood events in June and August were stored in the flood control pool. The reservoir reached a record depth of 5.4 feet (28,640 acre-feet) in the flood control pool during August. This flood storage was later released when downstream conditions permitted. Major flooding was avoided downstream from Swanson Lake as a result of this operation.

The 18,633 acres irrigated under the Bartley and Meeker-Driftwood Canals were provided a full water supply from the controlled spills and irrigation releases. The water surface was drawn down about 4 feet (18,990 acre-feet) in the conservation pool by the end of the irrigation season. No storage water was sold under Warren Act Contracts.

Enders Reservoir

Controlled spills were made from mid-April to late July. Releases were made during August and early September to lower the pool level from elevation 3112.3 to 3097.0 to facilitate the repair and repainting of the six radial gates in the spillway. This pool level was maintained until early November when the maintenance work was completed. Studies were made of the channel erosion problem on Frenchman Creek as afforded by the special releases during August and September.

The storage was more than adequate to meet the demands of 16,987 acres irrigated by the Frenchman Valley and H&RW Irrigation Districts. No storage water was sold under Warren Act Contracts.

Hugh Butler Lake

Flood inflows to Hugh Butler Lake were stored in the conservation pool during June, July and August. Major flood damage to construction of the diversion dam on Red Willow Creek was prevented. Downstream flow requirements were met by seepage and groundwater flow. By December 31, 1962, the pool level had raised to elevation 2570.64 (22,523 acre-feet) or 11.18 feet (15,280 acre-feet) below the top of the conservation pool.

Harry Strunk Lake

Heavy floods into Harry Strunk Lake during June and July resulted in the highest inflow since the reservoir was put into operation in 1949. The maximum water surface was 6.6 feet (13,270 acre-feet) in the flood control pool during July. Major flood damage on Medicine Creek and Republican River was prevented. Controlled spills emptied the flood storage in August. Irrigation demands only lowered the pool level about one foot below the top of the conservation pool by the end of the irrigation season.

During April of 1962, a re-survey was made of the reservoir to determine sediment accumulations since 1952. Because of the sediment deposited by the heavy inflows during the spring and summer months, another survey of the reservoir was made during December.

Harlan County Reservoir (U.S.C.E.)

Flood releases from upstream reservoirs together with heavy flood inflows during June, July and August from uncontrolled areas resulted in a maximum pool level of elevation 1950.29 on July 5, which was 4.29 feet (61,579 acre-feet) above the top of the conservation pool. Harlan County, Harry Strunk, Hugh Butler, and Swanson in combination prevented what would have been a near record flood on the Republican River. Controlled releases were made when downstream tributary flood flows had receded. Irrigation demands and special releases lowered the pool to elevation 1943.0 by late September to facilitate repainting of the spillway gates.

Releases were sufficient throughout the year to meet minimum sanitation needs and to provide recreational opportunities between the dam and the beginning of significant inflows.

Lovewell Reservoir

Controlled spills occurred from January to late July. The pool level was lowered to elevation 1578.0 (29,480 acre-feet) by the end of October and maintained at this elevation to facilitate the completion of erosion control structures in the upper reaches of the reservoir. Only 5,488 acre-feet of Republican River flows were required to meet the demands of 14,989 acres irrigated below Lovewell Reservoir.

Kirwin Reservoir

Controlled spills were made from mid-June through July. The storage was more than adequate to meet the demands of 7,227 acres irrigated from Kirwin system. The pool level was only 1.2 feet (5,810 acre-feet) below the top of the conservation pool at the end of the irrigation season.

Webster Reservoir

Controlled spills were made during parts of March, April, May, June, July, August, September and October. Spills made during June, July and August were coordinated with Project Surface Drain Construction on the Osborne system. The maximum 1962 pool level of elevation 1898.00 (100,060 acre-feet) was reached on August 7. This was 8.4 feet (32,960 acre-feet) above the top of the conservation pool.

Cedar Bluff Reservoir

The storage in Cedar Bluff Reservoir was more than adequate to meet the demands of the Fish Hatchery. Small releases were made to Cedar Bluff Canal from mid-August to mid-September to prime and puddle the new system. There were no demands by the City of Russell, Kansas, during 1962. The Fish Hatchery operated by the Bureau of Sport Fisheries and Wildlife diverted 3,848 acre-feet with 2,955 acre-feet passing back to the river below Cedar Bluff Dam.

CANAL OPERATIONS

A total of 192,696 acre-feet of water was diverted into fourteen canal systems that irrigated 99,779 acres of land in the Kansas River Projects. This is 72 percent of the area that had service available in 1962, and 62 percent of the ultimate area. The following table presents the irrigable acreage and diversions and farm delivery data for each of the irrigation districts.

Irrigation District	Acres Irrigated	Acre-feet Diverted	Diversion Rate Acre-feet/acre	Farm delivery Acre-feet/acre
Frenchman Valley	8,310	22,928	2.76	(no records)
H&RW	8,677	13,474	1.55	1.00
Frenchman-Cambridge	32,103	52,869	1.65	0.95
Bostwick in Nebraska	16,827	36,635	2.17	0.67
Kansas-Bostwick	22,395	45,593	2.04	1.07
Kirwin	7,227	13,219	1.83	0.80
Webster	4,240	7,978	1.88	1.01
TOTAL Kansas River Projects	99,779	192,696	1.93	

Water supplied to the Hale Ditch amounted to 3,372 acre-feet of which 95 acre-feet were sold under Warren Act Contract.

The acres irrigated in 1962 and estimated for 1963 are compared to the planned and service available acreage on table 6. A graphic representation of development by irrigation districts is presented in Exhibits 11 through 18.

Table 7 presents the monthly diversions and acres irrigated for each canal system. Table 8 tabulates the irrigation development by canal systems for the past five years and shows estimates for 1963.

RECREATION

During the 1962 recreation season, the total visitation to Kansas River Project Reservoirs was greater than recorded in 1961. These impoundments drew 1,441,171 visitors in 1962 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 1963

WATER SUPPLY

The water supply outlook for 1963 is excellent at all reservoirs. Even under extremely dry conditions, no shortages are expected in meeting the demands of 112,950 acres of Kansas River Project lands which are expected to be irrigated, and any demands for municipal water by both Beloit 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 rain 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 1963 are shown in Table 2 and are graphically compared with the historical inflow records on Exhibits 19 through 28.

RESERVOIR OPERATIONS

The normal storage limitations at each of the reservoirs for irrigation and municipal purposes will be at the top of the conservation 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 stream flows.

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 conservation pool by the first of April. This plan is not used for Bonny Reservoir, as winter releases are undesirable.

In 1963, Bonny is the only reservoir where we expect to have storage surplus to project needs. This surplus storage will be made available to non-project lands under Warren Act contract in the immediate area downstream from Bonny Dam.

Exhibits 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 show the probable effects on each reservoir for 1963 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 conservation pool in the fall. To reduce the chances of a large fall drawdown, the reservoir pool is lowered to elevation 3670.0 (37,504 acre-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 18,200 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 11 feet (48,580 acre-feet) below the top of the conservation pool. The conservation storage pool is filled and controlled spills will be made as dictated by the inflow.

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 8,400 acres in the Frenchman Valley Irrigation District and 9,500 acres in the H&RW Irrigation District. The demands by these 17,900 acres can cause a drawdown of about 19 feet (25.500 acre-feet) under reasonable minimum inflow conditions.

Hugh Butler Lake

The only demands expected on Hugh Butler Lake are small releases to meet the requirements of senior appropriations and the first year demands of 600 acres served by Red Willow Canal. The conservation pool is not expected to fill under reasonable minimum or most probable inflow conditions.

The water surface of Hugh Butler Lake has been restricted to elevation 2600.0 until foundation tests can be made with a full conservation pool.

Harry Strunk Lake

The conservation pool is practically full and controlled spills will be made as dictated by the inflow. The storage and available inflow will be more than adequate to meet the demands of 13,200 acres expected to be irrigated from the Cambridge Canal. The outlet works will be out of service after October 15 to facilitate the repair of the stilling basin.

Harlan County Reservoir

The conservation pool is full. Releases will be made as necessitated by available inflow. Therefore, an ample water supply is available to irrigate 17,050 acres in the Bostwick Irrigation District in Nebraska, and 27,500 acres in Kansas-Bostwick Irrigation District. Of the 27,500 acres in Kansas, 18,406 acres are served by Courtland Canal system below Lovewell Reservoir. Part of the demand on the Courtland Canal system below Lovewell Reservoir is met by White Rock Creek inflows.

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 18,406 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.

In early May, the Republican River flows will be regulated through the upper Courtland Canal into Lovewell Reservoir to supplement the White Rock Creek inflow to insure that the conservation pool will be filled by the end of June. As hydrologic conditions dictate, the pool level will be maintained as high as possible in the conservation pool. The pool level is not expected to be below elevation 1577 at the end of the irrigation season.

Kirwin Reservoir

The carryover storage and available inflow are more than adequate to meet the irrigation demand of 9,500 acres in 1963. The reservoir is expected to spill if greater than reasonable minimum inflows occur.

Webster Reservoir

The water supply is adequate for both the 6,500 acres under the Osborne Canal and the municipal demand by Beloit, Kansas. The conservation pool is full at the present time. The available inflows will be passed through the reservoir.

The spillway outflow gage will be discontinued and a 'bubbler' gage installed at a new site below the confluence of the spillway and Outlet Works Channel. The gage on the Outlet Works Channel will be operated only as a low flow auxiliary to the new station.

Cedar Bluff Reservoir

The storage and available inflow will be more than adequate to meet the first year demands of 2,500 acres expected to be irrigated from the Cedar Bluff Canal; supplement the municipal water supply of Russell, Kansas; and furnish a water supply for certain functions of the Cedar Bluff Fish Cultural Station. A well is used as a supply to those functions requiring clear water.

A contract will be let this year to install a radial gate in the ungated orifice in the spillway.

CANAL OPERATIONS

It is estimated that 112,950 acres under Kansas River Projects will be irrigated in 1963. Of this, 49,050 acres are in Nebraska and 63,900 acres in Kansas. The acres expected to be irrigated in 1963 are shown by canals in Table 6. The irrigable acres and probable canal diversions for 1963 under the "most probable," "reasonable driest year," and "reasonable wettest year" are shown graphically on Exhibits 11 through 18. The status of the Repayment Contracts is shown on Table 5.

The expected canal operations for 1963 are discussed in the following paragraphs for each irrigation district.

Frenchman Valley and H&RW Irrigation Districts

The lands in these two districts are served from the Culbertson Canal and the Culbertson Extension Canal. The two systems are operated under joint management. The transportation losses of the main Culbertson Canal are shared by both districts. The H&RW Irrigation District assumed the responsibility of operation and maintenance of the Culbertson Extension Canal System on February 1, 1963. There are 8,400 acres in the Frenchman Valley Irrigation District and 9,500 acres in the H&RW Irrigation District which are expected to be irrigated.

Frenchman-Cambridge Irrigation District

The irrigation district will operate and maintain the Bartley, Cambridge, and Meeker-Driftwood Canal Systems. We estimate 31,400 acres will be irrigated by these three systems in 1963.

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 17,050 acres will be irrigated in 1963. The Kansas-Bostwick Irrigation District will operate 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. The maintenance of the Diversion Dam and main Courtland Canal in Nebraska is shared by the Kansas-Bostwick and Nebraska-Bostwick Irrigation Districts.

Kansas-Bostwick Irrigation District No. 2

27,500 acres are expected to be irrigated in 1963, of which 9,094 acres are above Lovewell Reservoir and 18,406 acres below.

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 1963 irrigation season.

Webster Irrigation District No. 4

Of the 8,500 acres available for service in the Osborne Canal System, 6,500 acres are expected to be irrigated this year. Kirwin and Webster Irrigation Districts are under joint management.

Cedar Bluff Irrigation District No. 6

This will be the first year of operation for the Cedar Bluff Canal and 2,500 acres are expected to be irrigated. The operation and maintenance will be performed by the Bureau of Reclamation.

TABLE 1
RESERVOIR DATA - KANSAS RIVER PROJECTS

RESERVOIR	STORAGE ALLOCATIONS		
	DEAD 1/	CONSERVATION 1/	FLOOD CONTROL
Bonny			
Elevation (Ft.)	3635.5	3672.0	3710.0
Total Acre Feet	1,420	41,340	170,160
Net Acre Feet	1,420	39,920	128,820
Swanson Lake			
Elevation (Ft.)	2710.0	2752.0	2773.0
Total Acre Feet	4,100	120,160	253,950
Net Acre Feet	4,100	116,060	133,790
Enders			
Elevation (Ft.)	3080.0	3112.3	3127.0
Total Acre Feet	8,470	44,480	74,520
Net Acre Feet	8,470	36,010	30,040
Hugh Butler			
Elevation (Ft.)	2552.0	2581.8	2604.9
Total Acre Feet	6,310	37,780	86,630
Net Acre Feet	6,310	31,470	48,850
Harry Strunk			
Elevation (Ft.)	2335.0	2366.1	2386.2
Total Acre Feet	5,370	39,230	90,920
Net Acre Feet	5,370	33,860	51,690
Harlan County			
Elevation (Ft.)	1920.0 2/	1946.0	1973.5
Total Acre Feet	97,200 3/	350,120	850,000
Net Acre Feet	97,200 3/	252,920	499,880
Lovewell			
Elevation (Ft.)	1562.07 4/	1582.6	1595.3
Total Acre Feet	5,050 5/	41,690	92,150
Net Acre Feet	5,050 5/	36,640	50,460
Kirwin			
Elevation (Ft.)	1693.0	1728.4	1757.3
Total Acre Feet	6,380	95,180	314,550
Net Acre Feet	6,380	88,800	219,370
Webster			
Elevation (Ft.)	1855.5	1889.6	1923.7
Total Acre Feet	2,180	67,100	260,740
Net Acre Feet	2,180	64,920	193,640
Cedar Bluff			
Elevation (Ft.)	2100.4 4/	2144.0	2166.0
Total Acre Feet	21,580 6/	185,090	376,950
Net Acre Feet	21,580 6/	163,510	191,860
Total Storage (A.F.)	158,060	1,022,170	2,570,570
Total Net Acreage Feet	158,060	864,110	1,548,401

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 13,649 A.F. to river and fish hatchery.

Note: Reservoir storage data based on latest reservoir surveys.

TABLE 2

INFLOW INTO RESERVOIRS - 1962 RECORDS, 1963 ESTIMATES

1	2	3	4	5	6	7
	1,000 Acre-Feet					
	1962 Records		1963 Estimates 1/			
Reservoir	Actual	Adjusted	Reasonable Minimum	Most Probable	Reasonable Maximum	Average for period of Record 2/
Bonny	29.0		14.7	26.7	42.2	32.3
Swanson Lake	177.1	186.9 3/	67.0	114.0	205.0	133.1 3/
Enders	56.8		43.0	50.0	57.8	50.2
Hugh Butler Lake	29.6		14.8	20.7	29.1	21.4
Harry Strunk Lake	101.4		37.4	49.5	80.4	54.6
Harlan County	536.5	667.0 3/	211.0	399.0	760.0	450.0 3/
Lovewell	44.0 4/	38.5 5/	4.3	18.2	63.8	27.6 5/
Kirwin	40.4		17.0	40.0	115.0	54.2
Webster	106.9		15.1	37.6	90.0	52.4
Cedar Bluff	38.2		11.0	40.6	146.2	64.9

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 1961.
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.

TABLE 3

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

Month	TOTAL STORAGE END OF MONTH 1961	TOTAL STORAGE END OF MONTH 1962	TOTAL 1962 OUTFLOW	INFLOW 1962 ACTUAL	INFLOW Most PROBABLE	DAM AND RESERVOIR INFORMATION
Jan.	38.2	39.0	0.4	2.0	2.2	DAM: BONNY
Feb.	39.7	40.5	0.3	2.1	2.2	
Mar.	37.4	37.4	5.1	2.2	2.9	RESERVOIR: BONNY
Apr.	37.4	37.3	1.7	2.6	2.5	
May	37.7	37.4	1.3	2.7	3.0	STORAGE CAPACITY
June	36.9	39.0	3.8	6.5	3.0	
July	35.9	36.8	3.1	2.3	1.7	
Aug.	34.6	36.1	0.9	1.5	1.8	DEAD 1.4
Sept.	33.8	35.3	1.0	1.0	1.5	IRRIGATION 39.9
Oct.	34.2	35.3	1.0*	1.7*	1.7	SUB-TOTAL 41.3
Nov.	35.9	36.8	0.4*	2.4*	2.0	FLOOD 128.8
Dec.	37.5	38.12	0.4*	2.0*	2.2	TOTAL 170.1
Total			19.4	29.0	26.7	
Jan.	86.5	97.6	0.1	6.1	9.2	DAM: TRENTON
Feb.	94.0	107.1	0.1	10.3	11.8	
Mar.	105.7	120.6	0.5	15.8	14.9	RESERVOIR: SWANSON LAKE
Apr.	115.7	120.6	7.4	9.5	12.4	
May	125.6	121.8	4.6	6.9	15.6	STORAGE CAPACITY
June	120.8	123.6	30.0	31.0	14.2	
July	104.1	124.3	39.2	46.2	5.5	
Aug.	86.7	113.4	43.4	26.8	6.0	DEAD 4.1
Sept.	79.8	105.2	10.1	4.1	5.1	IRRIGATION 116.1
Oct.	81.5	108.2	1.7*	5.7*	4.2	SUB-TOTAL 120.2
Nov.	87.5	114.5	0.2*	7.7*	7.3	FLOOD 133.8
Dec.	92.8	119.9	0.9*	7.0*	7.8	TOTAL 254.0
Total			138.2	177.1 a/	114.0	
Jan.	42.0	37.0	0.6	4.5	4.9	DAM: ENDERS
Feb.	43.6	39.8	0.5	4.1	4.3	
Mar.	45.0	43.0	0.6	4.1	4.4	RESERVOIR: ENDERS
Apr.	45.3	44.3	1.4	3.6	4.2	
May	44.9	45.1	3.3	4.1	4.1	STORAGE CAPACITY
June	44.0	46.1	6.3	6.7	4.2	
July	33.7	41.8	11.4	6.6	3.8	
Aug.	24.0	27.8	19.2	3.5	3.6	DEAD 8.5
Sept.	21.3	21.7	11.5	4.0	3.6	IRRIGATION 36.0
Oct.	25.9	22.4	4.3*	5.1*	3.9	SUB-TOTAL 44.5
Nov.	28.9	26.0	1.5*	5.3*	4.3	FLOOD 30.0
Dec.	33.2	30.6	0.4*	5.2*	4.7	TOTAL 74.5
Total			61.0	56.8	50.0	

a/ Recorded inflow; - Adjusted inflow for upstream depletions = 186,900 A.F.

*Computed from Reservoir Operation Data

TABLE 3
RESERVOIR OPERATIONS
HUGH BUTLER, HARRY STRUNK AND HARLAN COUNTY RESERVOIRS
(Units in 1,000 Acre-Feet)

Month	TOTAL STORAGE END OF MONTH 1961	1962	TOTAL 1962 OUTFLOW	INFLOW 1962 ACTUAL	MOST PROBABLE	DAM AND RESERVOIR INFORMATION
Jan.		2.6	0.9*	1.0	1.5	DAM: RED WILLOW
Feb.		3.9	0.1*	1.8	1.6	RESERVOIR:
Mar.		5.4	0.1*	2.2	2.1	HUGH BUTLER LAKE
Apr.		6.2	0.2*	1.7	1.9	
May		8.2	0.1*	2.6	2.3	STORAGE CAPACITY
June		17.2	0.2*	8.4	3.1	
July		20.5	0.3*	4.5	1.9	DEAD 6.3
Aug.		22.2	0.4*	3.7	1.1	IRRIGATION 31.5
Sept.		21.7	0.2*	1.3	1.0	SUBTOTAL 37.8
Oct.		21.6	0.2*	0.5*	1.2	FLOOD 48.8
Nov.		22.0	0.2*	0.9*	1.4	TOTAL 86.6
Dec.		22.5	0.3*	1.0*	1.6	
Total			0.7	29.6	20.7	
Jan.	32.0	35.0	0.4	3.2	3.6	DAM: MEDICINE CREEK
Feb.	34.7	37.8	0.3	3.4	3.8	RESERVOIR:
Mar.	37.2	39.2	3.9	4.9	4.3	HARRY STRUNK LAKE
Apr.	38.5	39.1	2.8	3.6	4.5	
May	41.8	41.8	4.6	8.6	5.4	STORAGE CAPACITY
June	39.9	42.9	26.0	29.5	6.8	
July	30.8	43.1	25.2	24.2	5.0	DEAD 5.4
Aug.	24.9	38.9	15.9	9.2	3.4	IRRIGATION 33.8
Sept.	24.7	38.0	3.7	3.5	3.0	SUBTOTAL 39.2
Oct.	27.1	37.9	3.3*	3.7*	3.0	FLOOD 51.7
Nov.	29.8	38.3	3.1*	3.9*	3.2	TOTAL 90.9
Dec.	32.6	38.2	3.5*	3.7*	3.5	
Total			92.7	101.4	49.5	
Jan.	326.9	320.0	0.6	7.2	20.7	DAM: HARLAN COUNTY
Feb.	340.1	334.2	0.6	13.6	30.7	RESERVOIR:
Mar.	357.0	359.2	0.6	22.5	35.5	HARLAN COUNTY
Apr.	370.6	349.6	27.3	20.6	36.6	
May	399.4	349.7	20.9	25.9	55.3	STORAGE CAPACITY
June	376.1	385.5	108.0	130.5	98.0	
July	325.7	359.7	175.0	136.3	38.2	DEAD 1.3
Aug.	305.5	345.4	115.1	102.8	23.7	INACTIVE 95.9
Sept.	297.6	313.3	50.0	22.3	17.6	IRRIGATION 252.9
Oct.	299.6	319.2	11.6*	20.9*	9.8	SUBTOTAL 350.1
Nov.	307.4	331.2	3.0*	18.2*	16.1	FLOOD 499.9
Dec.	313.4	341.8	3.1*	15.7*	16.8	TOTAL 850.0
Total			515.8	536.5	399.0	

* Computed from reservoir operation data.

a/ Measured inflow, adjusted inflow for upstream depletions = 666,800 A.F.

TABLE 3
RESERVOIR OPERATIONS
LOVEWELL, KIRWIN AND WEBSTER RESERVOIRS
(Units in 1,000 Acre-feet)

Month	TOTAL STORAGE END OF MONTH 1961	TOTAL STORAGE END OF MONTH 1962	TOTAL 1962 OUTFLOW	INFLOW 1962 ACTUAL	INFLOW MOST PROBABLE	DAM AND RESERVOIR INFORMATION	
Jan.	28.3	48.6	1.3	7.1	0.2	DAM: LOVEWELL	
Feb.	28.7	41.7	9.0	0.9	0.5		
Mar.	29.5	41.8	3.1	1.4	0.5	RESERVOIR: LOVEWELL	
Apr.	29.7	41.7	0.8	0.5	0.6		
May	46.6	42.0	2.2	1.7	7.0		STORAGE CAPACITY
June	43.1	43.5	15.1	9.1	9.3		
July	39.8	39.2	13.2	6.8	9.8		
Aug.	39.6	31.0	14.8	6.0	9.7	DEAD	4.4
Sept.	43.6	31.4	2.4	2.1	1.9	INACTIVE	0.7
Oct.	42.0	29.5	6.6*	5.2*	0.6	IRRIGATION	36.6
Nov.	42.4	30.0	0.7*	1.8*	0.3	SUB-TOTAL	41.7
Dec.	42.6	29.5	1.7*	1.4*	0.3	FLOOD	50.5
Total			70.9	44.0 a/	40.7 b/	TOTAL	92.2
Jan.	81.3	87.8	0	0.6	0.9	DAM: KIRWIN	
Feb.	82.4	90.4	0	2.3	1.8		
Mar.	84.3	94.0	0	2.8	2.1	RESERVOIR: KIRWIN	
Apr.	85.2	94.7	0	1.7	2.8		
May	99.1	93.4	1.1	1.1	4.6		STORAGE CAPACITY
June	90.3	98.1	5.4	9.1	10.3		
July	90.5	95.2	16.7	13.6	6.7		
Aug.	86.7	90.3	4.5	1.4	4.5	DEAD	6.4
Sept.	84.5	90.0	0.6	0.5	2.5	IRRIGATION	88.8
Oct.	83.9	92.2	0*	4.3*	1.6	SUB-TOTAL	95.2
Nov.	84.9	92.8	0*	1.8*	1.2	FLOOD	219.4
Dec.	85.8	93.2	0*	1.2*	1.0	TOTAL	314.6
Total			28.3	40.4	40.0		
Jan.	65.7	62.2	0	2.2	0.8	DAM: WEBSTER	
Feb.	67.6	66.9	0	3.7	1.7		
Mar.	70.1	70.6	3.4	5.5	2.1	RESERVOIR: WEBSTER	
Apr.	67.1	66.8	7.0	3.8	2.9		
May	79.8	67.3	1.8	2.3	6.4		STORAGE CAPACITY
June	90.8	70.8	12.9	16.3	10.4		
July	67.4	99.2	31.0	51.7	4.6		
Aug.	51.1	78.9	23.1	4.4	3.4	DEAD	2.2
Sept.	50.0	78.9	14.9	3.9	2.3	IRRIGATION	64.9
Oct.	51.2	67.1	14.9*	6.5*	1.1	SUB-TOTAL	67.1
Nov.	54.8	67.1	2.9*	3.3*	1.0	FLOOD	193.6
Dec.	57.6	67.1	3.2*	3.3*	0.9	TOTAL	260.7
Total			115.1	106.9	37.6		

a/ Inflow from Courtland Canal - 5,500 A.F. Inflow from White Rock Creek - 38,500 A.F.

b/ Forecasted inflow from Upper Courtland Canal - 22,500 A.F. Forecasted inflow from White Rock Creek - 18,200 A.F.

* Computed from reservoir operation data.

TABLE 3
RESERVOIR OPERATIONS
CEDAR BLUFF RESERVOIR
(Units in 1,000 Acre-Feet)

Month	TOTAL STORAGE END OF MONTH 1961	TOTAL STORAGE END OF MONTH 1962	TOTAL 1962 OUTFLOW	INFLOW 1962 ACTUAL	INFLOW MOST PROBABLE
Jan.	185.1	185.8	1.9	1.3	0.8
Feb.	185.1	185.8	4.9	1.6	1.2
Mar.	185.1	185.8	4.2	1.8	1.3
Apr.	185.1	182.1	4.1	1.5	2.0
May	187.2	180.3	0.5	0.9	4.5
June	205.9	188.6	17.6	14.4	12.0
July	190.4	189.6	2.5	4.3	6.8
Aug.	192.2	181.2	8.4	2.6	4.7
Sept.	193.1	185.8	0.6	7.5	3.9
Oct.	189.9	183.4	0.5*	0.8*	1.5
Nov.	190.3	183.0	0.2*	1.1*	1.8
Dec.	189.7	182.0	0.2*	0.4*	0.8
Total			45.6 a/	38.2	40.6

DAM AND RESERVOIR INFORMATION	
DAM: CEDAR BLUFF	
RESERVOIR: CEDAR BLUFF	
	STORAGE CAPACITY
DEAD	8.3
INACTIVE	13.3
IRRIGATION	163.5
SUB-TOTAL	185.1
FLOOD	191.9
TOTAL	377.0

a/ Cedar Bluff outflow includes releases to Fish Hatchery.

* Computed from reservoir operation data.

TABLE 4
PRECIPITATION DATA

	BONNY DAM				TRENTON				ENDERS DAM				RED WILLOW DAM				MEDICINE CREEK DAM			
MONTH	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962
JAN.	0.35	0.94	T	.26	0.44	0.61	0	.11	0.42	1.70	0	.03	0.50	1.62	0	0.06	0.40	1.38	T	.02
FEB.	0.41	2.94	T	.23	0.52	2.19	0.11	.13	0.46	2.09	0.03	.19	0.59	2.09	0.06	No	0.64	1.39	0.05	.50
MAR.	0.91	0.48	1.16	.66	1.21	0.72	1.41	1.48	1.06	0.67	2.23	1.44	1.35	1.18	1.53	Record	0.99	0.63	1.20	2.37
APR.	1.59	1.08	1.11	.80	1.94	1.07	0.95	1.11	1.94	1.37	1.52	.87	2.06	1.21	1.58	.37	2.31	1.69	2.44	.14
MAY	2.40	2.66	4.04	3.26	3.20	3.12	4.55	5.40	3.38	4.74	3.12	4.99	3.12	1.63	5.63	4.90	3.22	3.08	9.47	4.41
JUNE	2.57	2.51	1.36	5.88	3.19	3.20	2.10	8.88	3.36	2.55	3.06	7.42	3.17	3.77	3.03	7.29	3.52	6.86	1.54	5.70
JULY	2.32	3.90	4.22	2.00	2.61	2.64	2.18	8.53	2.19	1.88	2.03	5.14	2.80	0.72	1.02	4.95	2.79	1.04	0.93	5.48
AUG.	2.27	0.03	1.47	2.07	2.50	0.49	1.78	.97	2.23	1.16	1.46	2.56	2.30	1.38	2.02	3.25	2.61	1.11	1.71	2.93
SEPT.	1.28	0.93	2.20	.66	1.68	1.04	2.30	.96	1.79	0.65	2.48	2.06	1.70	0.57	2.06	1.62	2.02	0.88	1.84	1.01
OCT.	0.74	2.09	0.42	.71	0.87	1.71	0.24	.98	0.80	1.66	0.40	.34	0.87	1.64	0.36	1.06	1.12	1.46	0.61	1.05
NOV.	0.41	0.15	0.78	.40	0.68	0.06	1.04	.47	0.54	0.07	0.66	.42	0.76	0.18	0.80	.20	0.84	0.23	0.68	.16
DEC.	0.39	1.07	0.43	.33	0.45	0.71	0.62	.37	0.45	0.77	0.35	.59	0.53	0.97	0.89	.55	0.57	0.43	0.66	.70
TOTAL	15.64	18.78	17.19	17.26	19.29	17.56	17.28	29.39	18.62	19.31	17.34	26.05	19.75	16.96	18.77	24.19	21.03	20.18	21.13	24.47

	HARLAN CO. DAM				LOVEWELL DAM				KIRWIN DAM				WEBSTER DAM				CEDAR BLUFF DAM			
MONTH	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962	NORM.	1960	1961	1962
JAN.	0.41	0.95	0.03	.26	0.60	1.42	0.06	.85	0.47	1.19	0.04	.57	0.40	1.37	0.05	.59	0.48	0.59	T	.35
FEB.	0.58	0.80	0.40	.90	0.85	1.80	0.56	1.67	0.70	1.01	0.25	1.11	0.78	2.29	0.37	.99	0.62	1.35	0.25	.21
MAR.	0.95	0.72	1.42	1.96	1.26	2.02	2.60	1.07	1.18	0.84	2.16	1.91	1.00	1.01	2.29	1.89	1.26	0.47	1.39	1.41
APR.	2.27	2.23	1.29	.32	2.21	2.70	1.99	.41	2.40	2.13	1.50	.36	2.20	2.45	1.74	.30	2.11	3.55	1.01	.75
MAY	3.21	4.48	6.20	3.69	3.60	3.13	8.38	3.40	2.90	6.18	8.96	1.92	2.90	4.18	8.77	4.20	3.62	1.08	3.72	2.84
JUNE	3.66	5.64	5.31	4.30	4.82	6.50	3.70	6.87	3.75	4.23	5.33	5.22	3.70	4.55	5.09	5.04	3.92	2.66	4.28	5.22
JULY	2.86	1.47	1.28	6.84	2.81	1.34	2.63	6.85	2.87	1.77	1.98	5.63	2.70	0.14	1.96	7.24	2.33	0.14	3.29	7.07
AUG.	2.48	2.58	2.30	4.72	2.68	3.62	3.97	3.89	2.85	3.32	4.30	3.64	2.75	4.94	3.65	1.63	2.43	2.89	4.66	4.27
SEPT.	2.19	1.03	2.94	1.31	2.69	2.53	6.24	4.31	2.27	3.26	2.59	1.92	2.50	1.83	3.94	1.53	2.06	2.40	3.44	1.57
OCT.	1.03	1.17	0.35	1.14	1.45	2.05	1.01	3.54	1.26	1.81	0.65	3.00	1.40	1.78	1.30	1.40	1.16	1.95	1.26	.17
NOV.	0.77	0.36	1.19	.08	1.03	0.32	1.90	.81	0.84	0.19	1.00	.15	0.99	T	1.22	.14	0.86	0.31	1.53	.34
DEC.	0.49	0.34	0.64	.55	0.77	0.29	1.04	.44	0.57	0.41	0.69	.35	0.70	0.49	0.77	.28	0.55	0.32	0.31	T
TOTAL	20.90	21.77	23.35	26.07	24.77	27.72	34.08	34.11	22.06	26.34	29.45	25.78	22.02	25.03	31.15	25.23	21.40	17.71	25.14	24.20

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

TABLE 5
STATUS OF REPAYMENT--WATER SERVICE CONTRACTS
KANSAS RIVER PROJECTS

Table 5

Contracting Organization	Contracts			
	Number	Date Executed	Date Approved By Dist.Crt.	Development Period
Frenchman-Cambridge Irrigation District	I lr-1500 Amendatory No.1 Amendatory No.2 Amendatory No.3	5/29/47 7/19/51 1/4/56 11/1/57	7/19/50(Rej) 2/11/56(Appr)	Blk I 1/1/57-12/31/61 II 1/1/60-12/31/64
Frenchman Valley Irrigation District	14-06-700-1241	11/7/56	10/20/58	None
H&RW Irrigation District	14-06-700-1242 Amendment No. 1	11/7/56 8/12/58	7/19/57	2/1/63-1/31/68
Bostwick Irrigation District in Nebr.	I lr-1079 Amended	2/21/49 11/10/54	2/28/55	1/1/57-12/31/61
Kansas-Bostwick Irrig. Dist. No. 2	I lr-1584 Amendment No. 2	4/20/51 4/24/57	3/9/53 12/20/57	Blk I 1/1/57-12/31/61 II 1/1/60-12/31/64 III 1/1/61-12/31/65 IV 1/1/62-12/31/66
Almena Irrigation District No. 5	14-06-700-1579	3/7/58	11/20/58	
Kirwin Irrigation District No. 1	14-06-W55 Amendatory Amendatory No.2	6/9/53 10/18/55 2/12/59	5/26/54	1/1/60-12/31/64
Webster Irrigation District No. 4	14-06-700-1375	4/24/57	10/22/57	1/1/62-12/31/66
Cedar Bluff Irrigation District No. 6	14-06-700-2118	9/3/59	3/17/60	Not determined
City of Norton, Kansas	14-06-700-1573	3/7/58	Not Required	Not applicable
City of Beloit, Kansas	14-06-700-3215	5/24/62	Not Required	Not Applicable

TABLE 6

IRRIGATION DEVELOPMENT AND OPERATION OF PROJECT CANAL SYSTEMS

Canal System	Acres Planned in Definite Plan Reports	Acres 1962 Irrigation Season Service Avail. 1/	Acres 1962 Irrigation Season Actually Irrig. 2/	Acres 1963 Estimates Service Available	Acres 1963 Estimates Expected to Be Irrigated	System Operations Calendar Years Bureau of Reclamation	System Operations Calendar Years Irrigation District
FRENCHMAN VALLEY IRRIGATION DISTRICT							
Culbertson	9,600	9,600	8,310	9,600	8,400	None	1958-Present 3/
H & RW IRRIGATION DISTRICT							
Culbertson Extension	11,490	11,490	8,677	11,490	9,500	1961	1963
FRENCHMAN-CAMBRIDGE IRRIGATION DISTRICT							
Red Willow 4/	4,150	0	0	947	600		
Meeker-Driftwood	16,440	16,440	13,175	16,440	12,800	1957-59 5/	1960-Present
Bartley	7,000	7,000	5,458	7,000	5,400	1954-56	1957-Present
Cambridge	15,600	15,600	13,470	15,600	13,200	1951-56	1957-Present
Total	43,190	39,040	32,103	39,987	32,000		
BOSTWICK IRRIGATION DISTRICT IN NEBRASKA							
Franklin	11,510	11,350	9,189	11,350	8,100	1954-56	1957-Present
Naponee	1,640	1,564	1,352	1,564	1,300	1955-56	1957-Present
Franklin Pump	2,120	2,091	1,774	2,091	1,750	1953-56	1957-Present
Superior	6,320	5,941	3,896	5,941	4,700	1951-56	1957-Present
Courtland	2,650	1,809	616	1,809	1,200	1952-58 6/	1959-Present
Total	24,240	22,755	16,827	22,755	17,050		
KANSAS-BOSTWICK IRRIGATION DISTRICT							
Courtland (above Lovewell Res.)	15,270	11,498	7,406	11,641	9,094	1954-58 7/	1959-Present
Courtland (below Lovewell Res.)	33,730	24,915	14,989	25,271	18,406	1958	1959-Present
Total	49,000	36,413	22,395	36,912	27,500		
KIRWIN IRRIGATION DISTRICT							
Kirwin	10,000 8/	11,500	7,227	11,500	9,500	1957-59	1960-Present
WEBSTER IRRIGATION DISTRICT							
Osborne	8,500	8,500	4,240	8,500	6,500	1960-61	1962-Present
CEDAR BLUFF IRRIGATION DISTRICT							
Cedar Bluff 9/	6,200	0	0	6,600	2,500	1963	
TOTAL OF PROJECTS	162,220	139,298	99,779	147,344	112,950		

(See attached sheet for footnotes.)

Footnotes for Table 6

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

2/ Determined by crop census.

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

4/ Construction will be completed in 1963. The first section will be operated and maintained by the Bureau of Reclamation in 1963.

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

6/ Nebraska-Bostwick District has operated laterals since 1957. Kansas-Bostwick District has operated the main canal since 1959, and the Superior-Courtland Diversion Dam since 1960.

7/ Kansas-Bostwick District operated lateral system since 1957.

8/ The repayment contract states 11,500 acres.

9/ This system will be operated and maintained by the Bureau of Reclamation in 1963.

TABLE 7
CANAL DIVERSIONS AND ACRES IRRIGATED
KANSAS RIVER PROJECTS
1962

Irrigation District and Canal	State	Diversions-Acre Feet							Acres Irrigated
		April	May	June	July	Aug.	Sept.	Oct.	Total	
NON-PROJECT LANDS										
Hale Ditch (Includes 95 A.F. of Warren Act)	Colorado	103	510	470	591	504	627	567	3,372	590
Warren Act	Nebraska	0	0	0	0	0	0	0	0	0
PROJECT LANDS										
FRENCHMAN VALLEY	Nebraska									
Culbertson Canal		3,052	2,217	0	4,944	7,481	5,234	0	22,928	**8,310**
H&RW	Nebraska									
Culbertson Extension Canal		0	764	0	2,996	7,542	2,172	0	13,474	8,677
FRENCHMAN-CAMBRIDGE	Nebraska									
Meeker-Driftwood Canal		0	1,928	730	6,972	11,044	4,858	317	25,849	13,175
Bartley Canal		0	1,131	444	1,087	4,352	1,261	317	8,592	5,458
Cambridge Canal		0	1,898	1,176	6,458	6,294	2,114	488	18,428	13,470
Total		0	4,957	2,350	14,517	21,690	8,233	1,122	52,869	32,103
NEBRASKA-BOSTWICK	Nebraska									
Franklin Canal		0	2,525	2,862	4,391	8,053	1,930	0	19,761	9,189
Naponee Canal		0	268	186	774	916	8	0	2,152	1,352
Franklin Pump Canal		0	0	0	0	403	0	0	403	1,774
Superior Canal		0	1,353	617	2,406	6,353	393	0	11,122	3,896
Courtland Canal		0	1,089	650	527	1,021	-90	0	3,197	616
Total		0	5,235	4,315	8,098	16,746	2,221	0	36,635	16,827
KANSAS-BOSTWICK	Kansas									
Courtland above Lovewell		0	1,682	1,555	6,812	8,698	630	0	19,377	7,406
Courtland below Lovewell		0	538	1,252	9,124	14,366	936	0	26,216	14,989
Total		0	2,220	2,807	15,936	23,064	1,566	0	45,593	22,395
KIRWIN	Kansas									
Kirwin Canal		0	1,140	694	6,311	4,459	615	0	13,219	7,227
WEBSTER	Kansas									
Osborne Canal		0	744	403	3,138	3,374	319	0	7,978	4,240
Total for Project Lands		3.052	17,277	10,569	55,940	84,356	20,470	1,122	192,786	99,779

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

	COLORADO		NEBRASKA								
Irrig. Dist	(Non-Proj)	(Non-Proj)			Frenchman-Cambridge					Nebr.-Bostwick	
Canal	Hale Ditch 1/	Warren Act 2/	Fr. Valley Culbertson	H & RW Extension	Meeker-Driftwood	Red Willow	Bartley	Cambridge	Total	Franklin	Naponee
					1963 Estimates						
Acres	590	1,500	8,400	9,500	12,800	600	5,400	13,200	32,000	8,100	1,300
AF-Dry Yr.	5,200	300	24,100	27,500	34,500	1,700	14,000	33,200	83,400	27,400	4,200
AF-Nor.Yr.	3,800	200	16,700	19,100	24,300	1,200	9,800	22,500	57,800	18,100	3,000
AF-Wet Yr.	2,600	0	10,500	12,000	14,400	600	5,800	13,300	34,100	9,100	1,500
					1962						
Acres	590	0	8,310	8,677	13,175		5,458	13,470	32,103	9,189	1,352
AF Div.	3,340	0	22,928	13,474	25,849		8,592	18,428	52,869	19,761	2,152
AF/Ac	5.66	0	2.76	1.55	1.96		1.57	1.37	1.65	2.15	1.59
					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

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.

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

	NEBRASKA (cont'd)				KANSAS						TOTAL
Irrig.Dist.	Nebraska-Bostwick				Kansas-Bostwick			Kirwin	Webster	Cedar Bl.	FOR
					Courtland Canal						PROJECT
Canal	Franklin Pump	Superior	Courtland	Total	Upper	Lower	Total	Kirwin	Osborne	Cedar Bl.	SYSTEMS 1/
					1963 Estimates						
Acres	1,750	4,700	1,200	17,050	9,094	18,406	27,500	9,500	6,500	2,500	112,950
AF-Dry Yr.	6,000	14,000	3,100	54,700	23,500	47,600	71,100	25,400	20,100	7,800	314,100
AF-Nor Yr.	4,000	10,000	2,200	37,300	16,800	34,300	51,100	17,100	13,800	5,600	218,500
AF-Wet Yr.	2,000	4,900	1,000	18,500	8,300	16,500	24,800	10,700	8,500	3,600	122,700
					1962						
Acres	1,774	3,896	616	16,827	7,406	14,989	22,395	7,227	4,240	0	99,779
AF Div.	403	11,122	3,197	36,635	19,377	26,216	45,593	13,219	7,978	0	192,696
AF/Ac.	0.23	2.86	5.19	2.18	2.62	1.75	2.04	1.83	1.88	0	1.93
					1961						
Acres	1,739	4,837	1,239	16,906	7,910	14,052	21,962	7,551	2,912		94,002
AF Div.	2,322	13,436	6,161	49,963	20,983	28,103	49,086	19,904	9,270		237,415
AF/Ac.	1.34	2.78	4.97	2.95	2.65	2.00	2.24	2.64	3.18		2.53
					1960						
Acres	1,903	5,029	1,427	18,194	7,020	12,935	19,955	8,216	1,159		89,622
AF Div.	2,676	13,124	5,230	45,919	18,592	26,529	45,121	16,834	4,185		207,043
AF/Ac.	1.41	2.61	3.66	2.52	2.65	2.05	2.26	2.04	3.61		2.31
					1959						
Acres	1,930	5,080	1,664	19,835	7,159	9,081	16,240	6,470			79,915
AF Div.	3,110	17,449	5,133	54,762	23,343	26,388	49,731	21,005			218,979
AF/Ac.	1.61	3.43	3.08	2.76	3.26	2.91	3.06	3.25			2.74
					1958						
Acres	1,391	3,978	489	15,147	5,829	2,878	8,707	4,127			60,230
AF Div.	858	8,420	1,620	25,115	13,727	5,690	19,417	15,150			133,210
AF/Ac.	0.62	2.12	3.31	1.66	2.35	1.98	2.23	3.67			2.21

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

TABLE 8

Sheet 1 of 2

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

Irrig. Dist.	NON-PROJECT		NEBRASKA								
			Fr. Valley	H & RW	Frenchman-Cambridge					Nebr.-Bostwick	
Canal	Hale Ditch 1/	Warren Act 2/	Culbertson	Culbertson Extension	Meeker-Driftwood	Red Willow	Bartley	Cambridge	Total	Franklin	Naponee
					1963 Estimates						
Acres	590	0	8,400	9,500	12,800	600	5,400	13,200	32,000	8,100	1,300
AF-Dry Yr.	5,200	0	24,100	27,500	34,500	1,700	14,000	33,200	83,400	27,400	4,200
AF-Nor.Yr.	3,800	0	16,700	19,100	24,300	1,200	9,800	22,500	57,800	18,100	3,000
AF-Wet Yr.	2,600	0	10,500	12,000	14,400	600	5,800	13,300	34,100	9,100	1,500
					1962						
Acres	590	0	8,310	8,677	13,175		5,458	13,470	32,103	9,189	1,352
AF Div.	3,340	0	22,928	13,474	25,849		8,592	18,428	52,869	19,761	2,152
AF/Ac	5.66	0	2.76	1.55	1.96		1.57	1.37	1.65	2.15	1.59
					1961						
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
					1960						
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
					1959						
Acres	575	3,350	9,400		4,750		5,300	12,800	22,850	8,359	930
AF Div.	2,066	226	26,330		18,268		8,550	20,380	47,198	13,810	407
AF/Ac	3.59	0.07	2.80		3.85		1.61	1.59	2.07	1.65	0.44
					1958						
Acres	880	4,187			3,647		5,050	11,855	20,552	6,887	1,220
AF Div.	2,677	388			12,386		8,560	21,430	42,376	13,150	1,940
AF/Ac	3.04	0.09			3.40		1.70	1.81	2.06	1.91	1.59

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.

TABLE 8

Sheet 2 of 2

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

	NEBRASKA (cont'd)				KANSAS						TOTAL
Irrig.Dist.	Nebraska-Bostwick				Kansas-Bostwick			Kirwin	Webster	Cedar Bl.	FOR
					Courtland Canal						PROJECT
Canal	Franklin Pump	Superior	Courtland	Total	Upper	Lower	Total	Kirwin	Osborne	Cedar Bl.	SYSTEMS 1/
					1963 Estimates						
Acres	1,750	4,700	1,200	17,050	9,094	18,406	27,500	9,500	6,500	2,500	112,950
AF-Dry Yr.	6,000	14,000	3,100	54,700	23,500	47,600	71,100	25,400	20,100	7,800	314,100
AF-Nor Yr.	4,000	10,000	2,300	37,300	16,800	34,300	51,100	17,100	13,800	5,600	218,500
AF-Wet Yr.	2,000	4,900	1,000	18,500	8,300	16,500	24,800	10,700	8,500	3,600	122,700
					1962						
Acres	1,774	3,896	616	16,827	7,406	14,989	22,395	7,227	4,240	0	99,779
AF Div.	403	11,122	3,197	36,635	19,377	26,216	45,593	13,219	7,978	0	192,696
AF/Ac.	0.23	2.86	5.19	2.18	2.62	1.75	2.04	1.83	1.88	0	1.93
					1961						
Acres	1,903	5,029	1,427	18,194	7,020	12,935	19,955	8,216	1,159		89,622
AF Div.	2,676	13,124	5,230	45,919	18,592	26,529	45,121	16,834	4,185		207,043
AF/Ac.	1.41	2.61	3.66	2.52	2.65	2.05	2.26	2.04	3.61		2.31
					1960						
Acres	1,930	5,080	1,664	19,835	7,159	9,081	16,240	6,470			79,915
AF Div.	3,110	17,449	5,133	54,762	23,343	26,388	49,731	21,005			218,979
AF/Ac.	1.61	3.43	3.08	2.76	3.26	2.91	3.06	3.25			2.74
					1959						
Acres	1,391	3,978	489	15,147	5,829	2,878	8,707	4,127			60,230
AF Div.	858	8,420	1,620	25,115	13,727	5,690	19,417	15,150			133,210
AF/Ac.	0.62	2.12	3.31	1.66	2.35	1.98	2.23	3.67			2.21
					1958						
Acres	1,628	4,685	1,396	15,816	7,272		7,272	1,336			44,976
AF Div.	1,800	10,490	2,180	29,560	18,240		18,250	5,530			95,706
AF/Ac.	1.11	2.24	1.56	1.87	2.51		2.51	4.14			2.13

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

RECREATION USES OF BUREAU OF RECLAMATION RESERVOIRS IN KANSAS RIVER PROJECTS
DURING 1962

Annual Totals

Reservoirs	Visitors	Cars in area	Water Craft	Sport Fish Caught	Season Ducks	Take Geese
COLORADO						
Bonny	21,120	500	7,530	37,500	200	15
KANSAS						
Cedar Bluff	338,174	92,492	7,200	97,296	700	48
Webster	245,982	61,495	4,969	55,672	150	80
Kirwin	137,470	46,600	4,500	200,000	140	136
Lovewell	206,454	51,613	3,879	54,932	1,165	275
NEBRASKA						
Enders	107,828	26,932	1,857	42,660	412	14
Swanson	259,320	64,830	3,280	58,028	387	26
Hugh Butler	47,123	8,750	500	3,000	50	0
Harry Strunk	77,700	19,425	1,488	77,256	50	10
TOTAL	1,441,171	372,637	35,203	626,344	3,254	604

Visitors = Total visitor days which includes fishing, hunting, boating, skiing, camping, picnicking & sightseeing.
Water Craft = Boating days which includes rentals, inboards, outboards, rowboats & sailboats.

Exhibit 1

OPERATION HYDROGRAPHS

BONNY RESERVOIR

1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 ACTUAL | 1963 ESTIMATES

INFLOW

ASSUMED INFLOW CONDITIONS
Reasonable Max. ----------
Most Probable ——————
Reasonable Min. ----------

ACRE FEET — THOUSANDS OF ACRE FEET

40 30 20 10 0

J F M A M J J A S O N D | J F M A M J J A S O N D

STORAGE & ELEVATION

170,160 A.F. Top of Flood Control Pool El. 3710

41,340 A.F. Top of Irrigation Pool El. 3672

1418 A.F. Top of Dead Storage El. 3635.5

THOUSANDS OF ACRE FEET — ELEVATION IN FEET

140 120 100 90 80 70 60 50 40 30 25 20 15 10 5

3742 40 30 20 10 3700 90 80 70 60 50 40 30 20 3614

J F M A M J J A S O N D | J F M A M J J A S O N D

OUTFLOW

THOUSANDS OF ACRE FEET

40 30 20 10 0

1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 ACTUAL | 1963 ESTIMATES

Exhibit 2

OPERATION HYDROGRAPHS

SWANSON LAKE

INFLOW

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

ASSUMED INFLOW CONDITIONS
Reasonable Max.
Most Probable
Reasonable Min.

THOUSANDS OF ACRE FEET: 50, 40, 30, 20, 10, 0

STORAGE & ELEVATION

253,950 A.F. Top of Flood Control Pool El. 2773.0

120,160 A.F. Top of Irrigation Pool El. 2752.0

4101 A.F. Top of Dead Storage El. 2710.0

THOUSANDS OF ACRE FEET: 225, 200, 175, 150, 125, 100, 75, 50, 40, 30, 20, 15, 41

ELEVATION IN FEET: 2793, 90, 80, 70, 60, 50, 40, 30, 20, 10, 2700, 2690

J F M A M J J A S O N D | J F M A M J J A S O N D

OUTFLOW

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

THOUSANDS OF ACRE FEET: 50, 40, 30, 20, 10, 0

Exhibit 3

OPERATION HYDROGRAPHS

ENDERS RESERVOIR

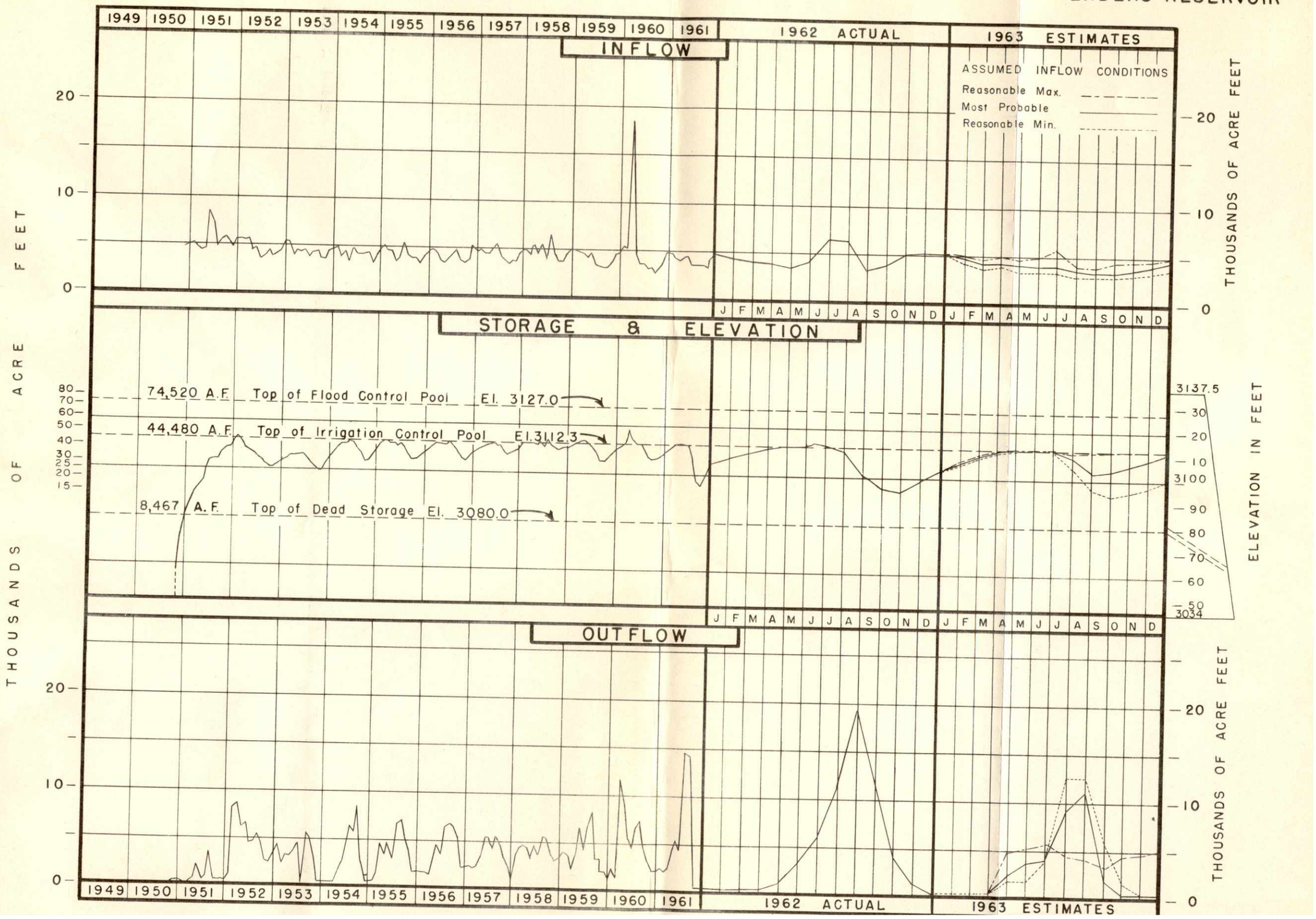


Exhibit 4

OPERATION HYDROGRAPHS

HUGH BUTLER LAKE

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

INFLOW

THOUSANDS OF ACRE FEET

6
4
2

ASSUMED INFLOW CONDITIONS
Reasonable Max. ----------
Most Probable ——————
Reasonable Min. - - - - - -

J F M A M J J A S O N D | J F M A M J J A S O N D

STORAGE & ELEVATION

THOUSANDS OF ACRE FEET

86 — El. 2604.9 Top of the Flood Control Pool — 86,630 A.F.
74
52
37.8 — El. 2581.8 Top of the Irrigation Control pool. — 37,780 A.F.
25
15
6.3 — El. 2552.00 Top of Dead Storage — 6,310 A.F.
3
1

THOUSANDS OF ACRE FEET

6
4
2

2634.00
20
10
2600
90
80
70
60
2550.00
2511.00

ELEVATION IN FEET

J F M A M J J A S O N D | J F M A M J J A S O N D

OUTFLOW

THOUSANDS OF ACRE FEET

8
6
4
2

THOUSANDS OF ACRE FEET

8
6
4
2

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

OPERATION HYDROGRAPHS

HARRY STRUNK LAKE

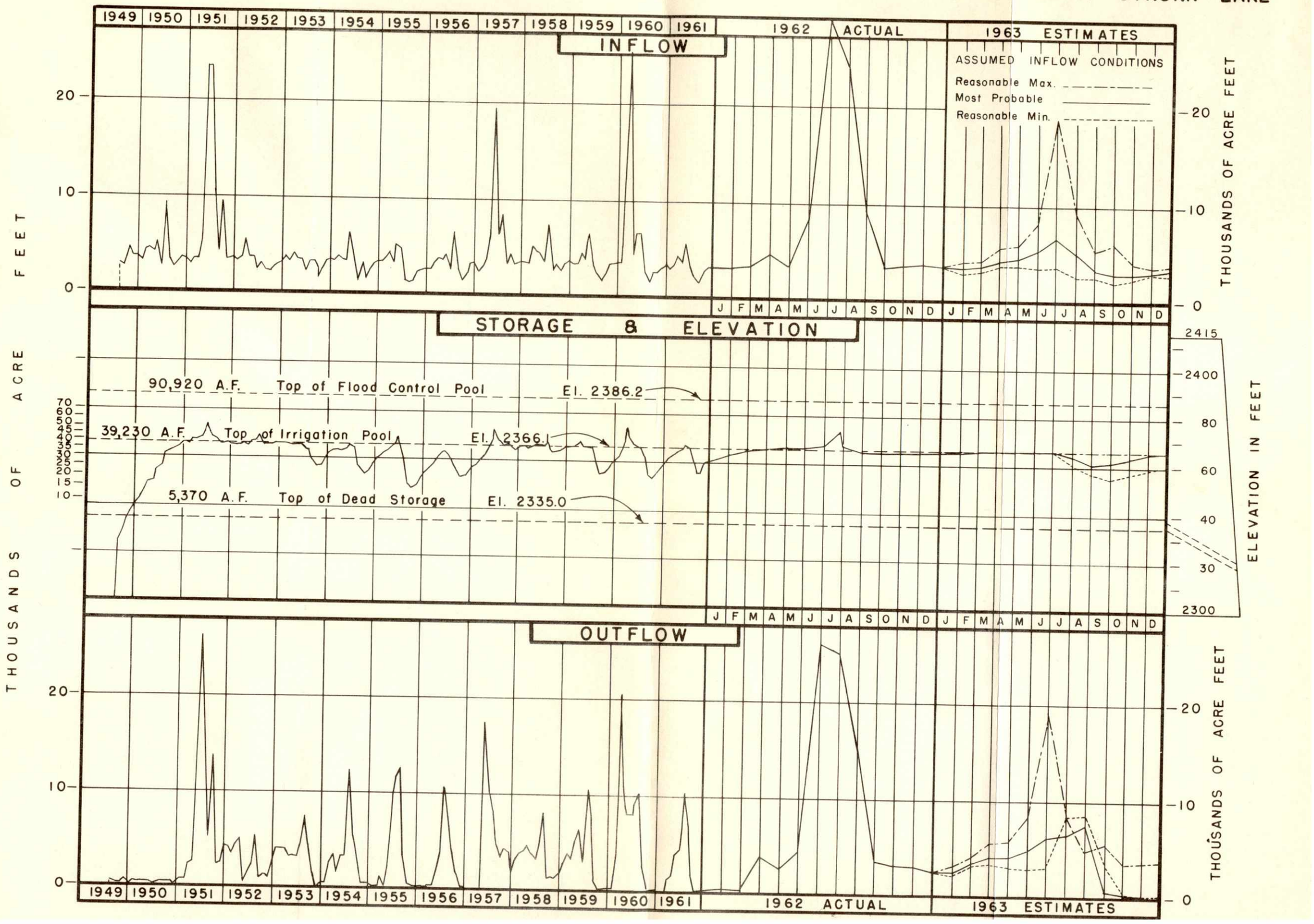


Exhibit 6

OPERATION HYDROGRAPHS

HARLAN COUNTY RESERVOIR

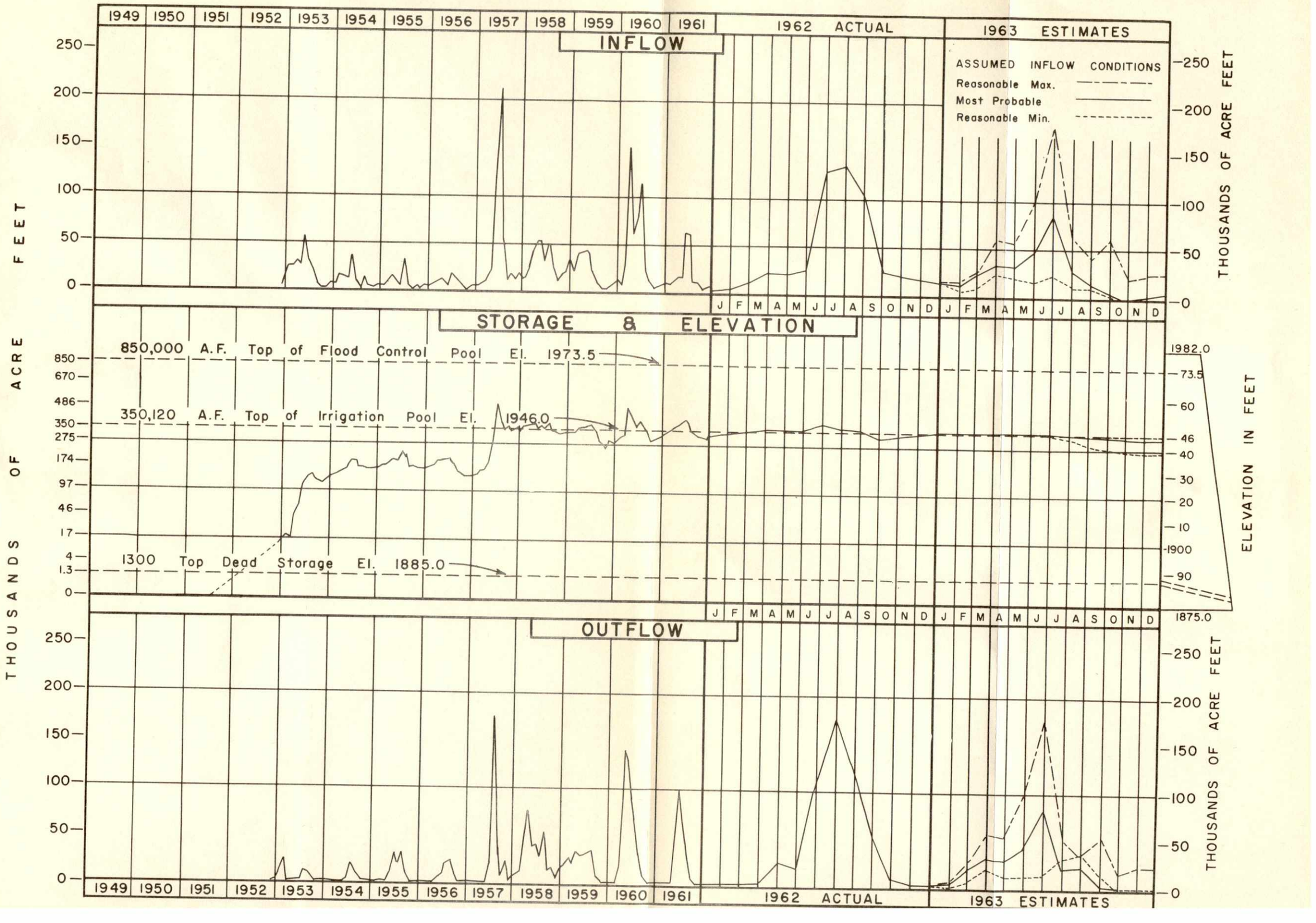


Exhibit 7

OPERATION HYDROGRAPHS

LOVEWELL RESERVOIR

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

INFLOW

Inflow From Courtland Canal

ASSUMED INFLOW CONDITIONS
Reasonable Max.
Most Probable
Reasonable Min.

THOUSANDS OF ACRE FEET — 20 — 15 — 10 — 5

J F M A M J J A S O N D | J F M A M J J A S O N D

STORAGE & ELEVATION

Top of Flood Control Pool El. 1595.3 — 92,150 A.F. — 92.1

Top of Irrigation Pool El. 1582.6 — 41,690 A.F. — 60 — 41.7

Top of Dead Storage El. 1561.0 — 4,359 A.F. — 20 — 10 — 4.4 — 1

THOUSANDS OF ACRE FEET

ELEVATION IN FEET — 1616.0 — 1600 — 1580 — 1560 — 1540 — 1525.0

J F M A M J J A S O N D | J F M A M J J A S O N D

OUTFLOW

20 — 15 — 10 — 5

THOUSANDS OF ACRE FEET

1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 | 1962 ACTUAL | 1963 ESTIMATES

Exhibit 8

OPERATION HYDROGRAPHS

KIRWIN RESERVOIR

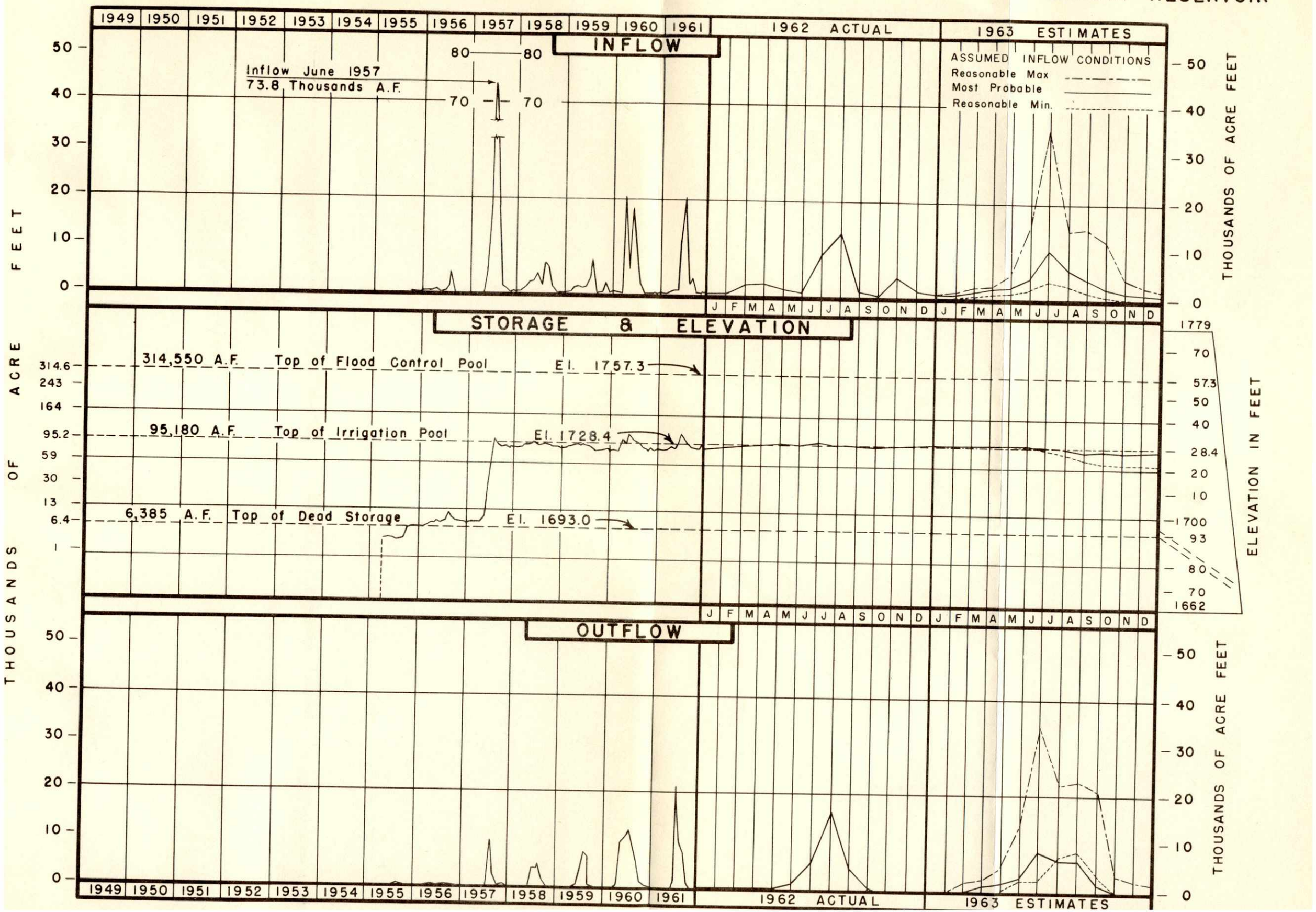


Exhibit 9

OPERATION HYDROGRAPHS

WEBSTER RESERVOIR

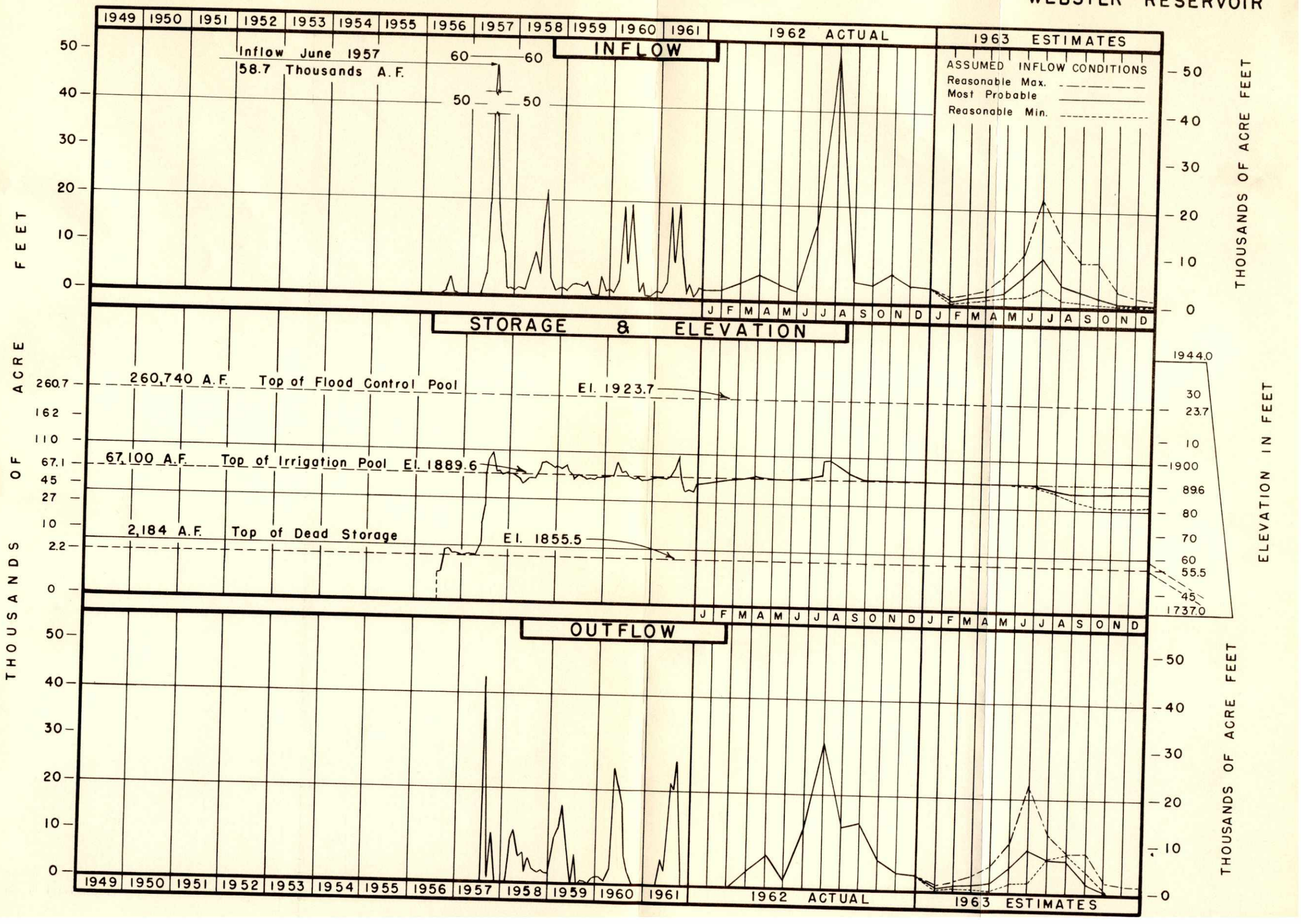


Exhibit 10

OPERATION HYDROGRAPHS

CEDAR BLUFFS RESERVOIR

INFLOW

1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 ACTUAL | 1963 ESTIMATES

THOUSANDS OF ACRE FEET

50 — 40 — 30 — 20 — 10 — 0

300 — 200 — 100 — 0

Inflow June 1951
257.7 Thousands A.F.

100 — 50 — 0

Inflow June 1957
79.4 Thousands A.F.

ASSUMED INFLOW CONDITIONS
Reasonable Max.
Most Probable
Reasonable Min.

J F M A M J J A S O N D | J F M A M J J A S O N D

STORAGE & ELEVATION

THOUSANDS OF ACRE FEET

377 — 270 — 229 — 185 — 141 — 100 — 67 — 40 — 21 — 8.2 — 1 — 0

376,950 A.F. Top of Flood Control Pool El. 2166.0

185,090 A.F. Top of Irrigation Pool El. 2144.0

8,261 A.F. Top of Dead Storage El. 2090.0

50 — 40 — 30 — 20 — 10 — 0

2198.0 — 66 — 44 — 40 — 20 — 10 — 2100 — 90 — 80 — 70 — 2064.0

ELEVATION IN FEET

OUTFLOW

100 — 50

Outflow July 1951
80.6 Thousands A.F.

Outflow July 1957
93.7 Thousands A.F.

THOUSANDS OF ACRE FEET

50 — 40 — 30 — 20 — 10 — 0

1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 ACTUAL | 1963 ESTIMATES

Exhibit II

CANAL DIVERSIONS AND ACRES IRRIGATED

Kansas River Projects

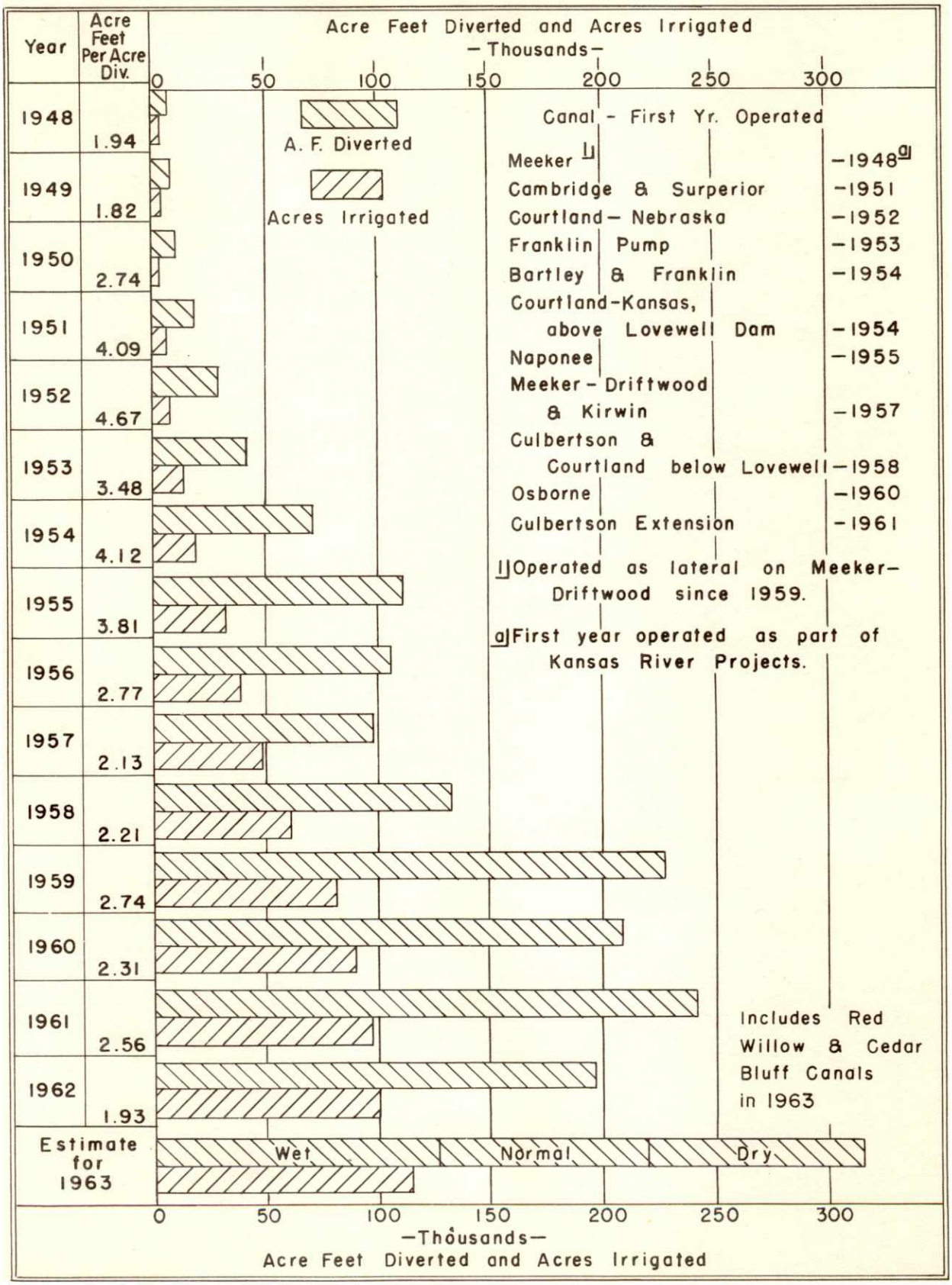


Exhibit 12

CANAL DIVERSIONS AND ACRES IRRIGATED

Frenchman Valley Irrigation District

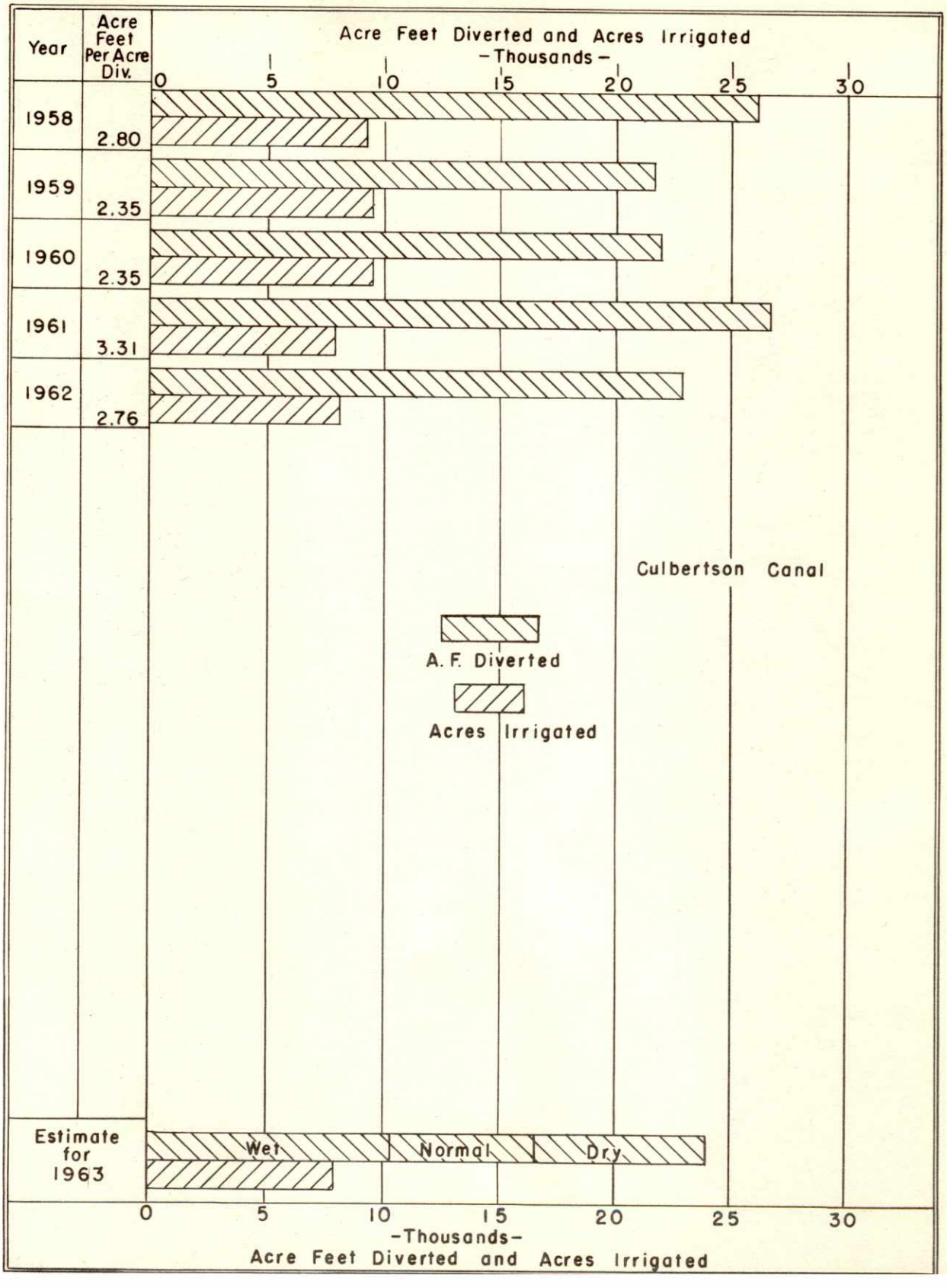
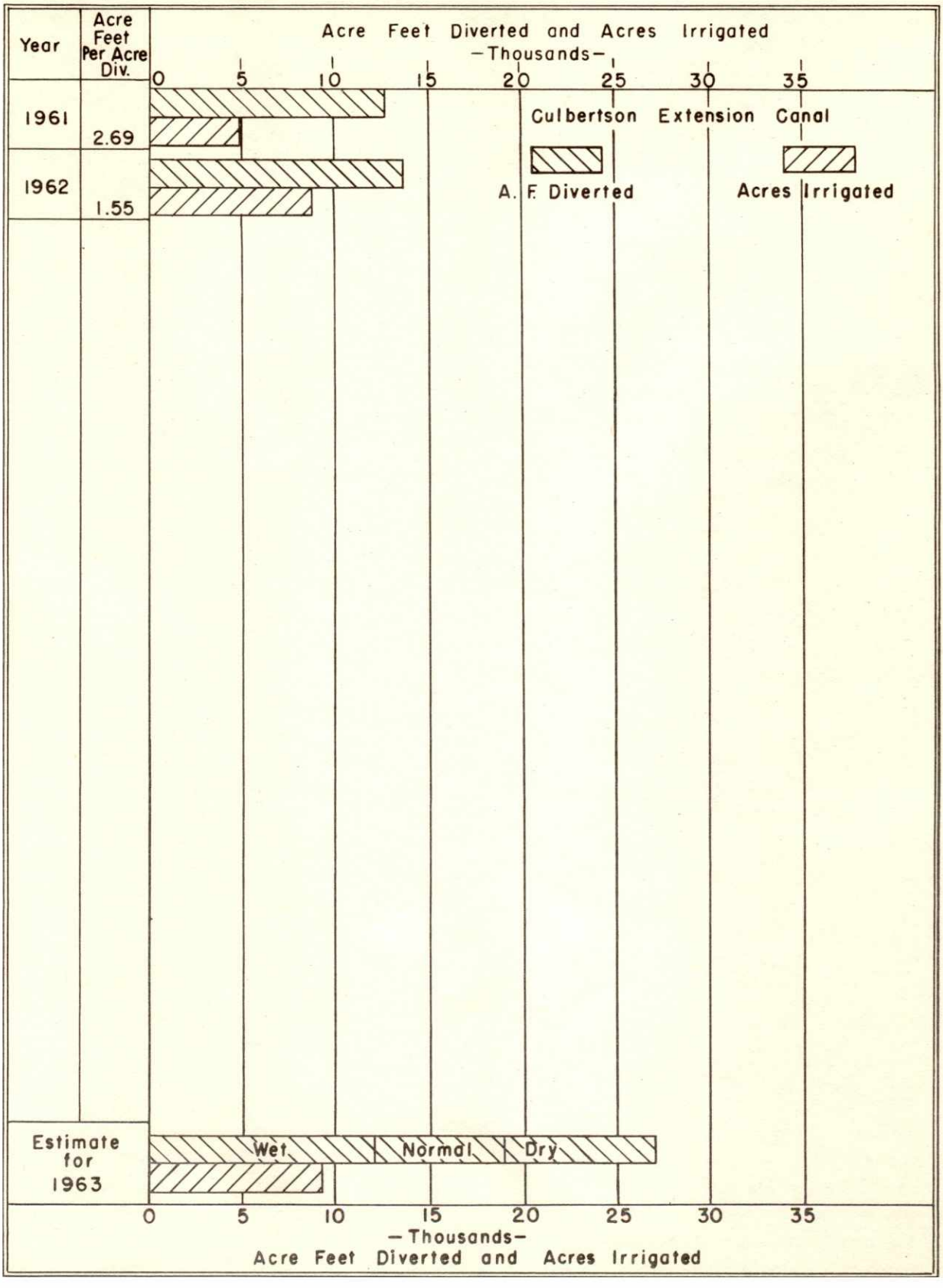


Exhibit 13

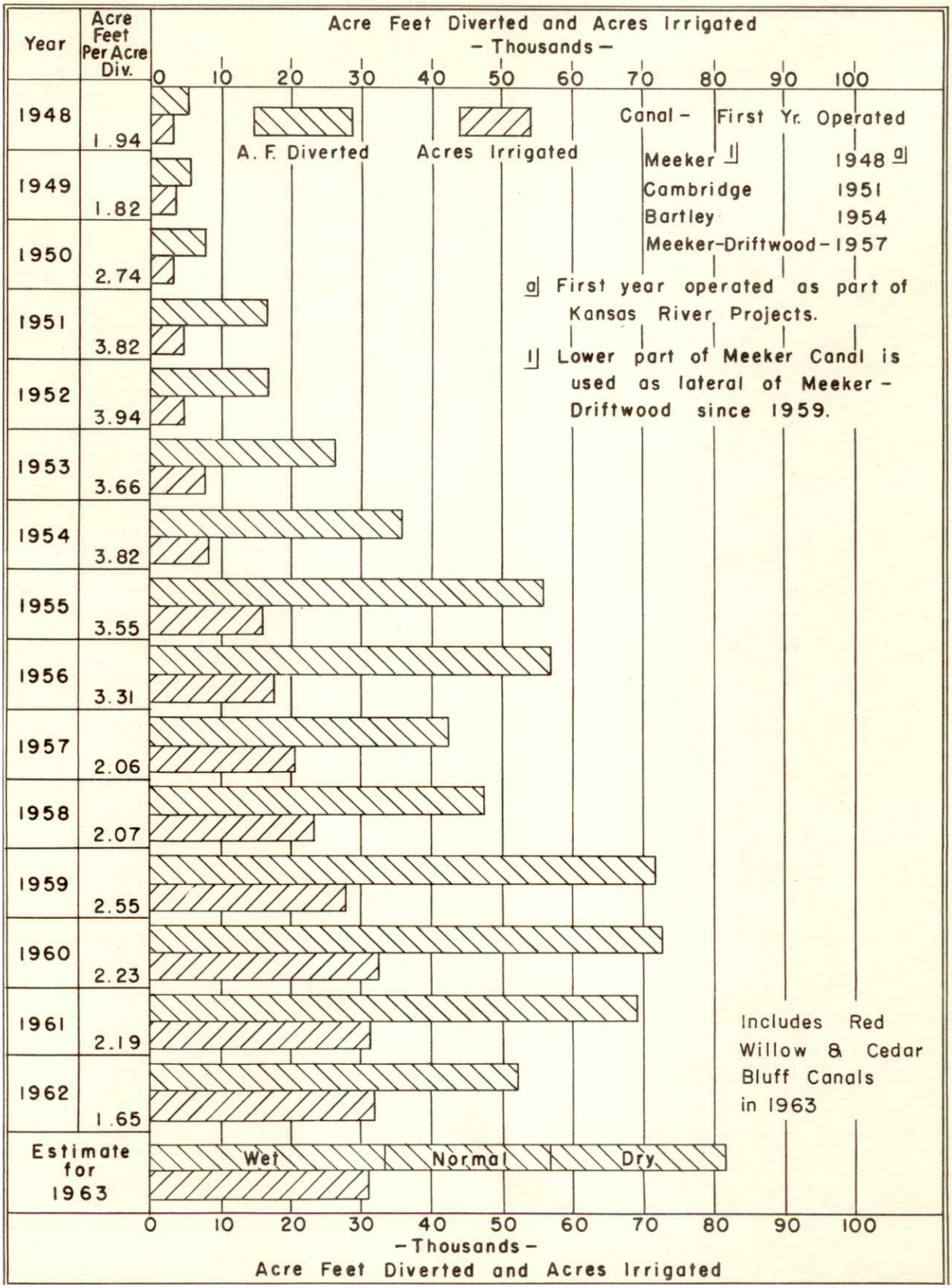
CANAL DIVERSIONS AND ACRES IRRIGATED

H. and R.W. Irrigation District



CANAL DIVERSIONS AND ACRES IRRIGATED

Frenchman-Cambridge Irrigation District



CANAL DIVERSIONS AND ACRES IRRIGATED

Bostwick Irrigation District in Nebraska

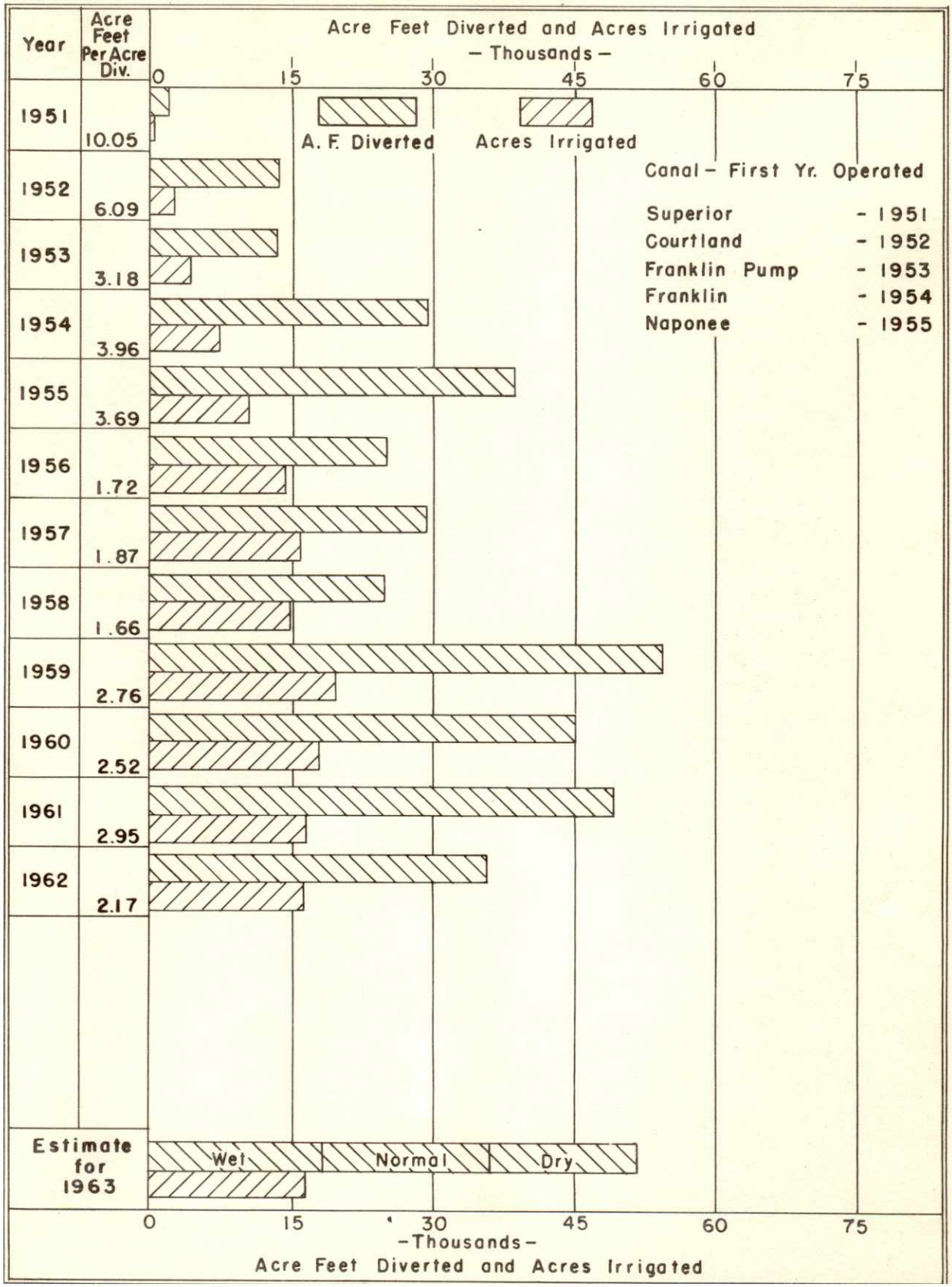
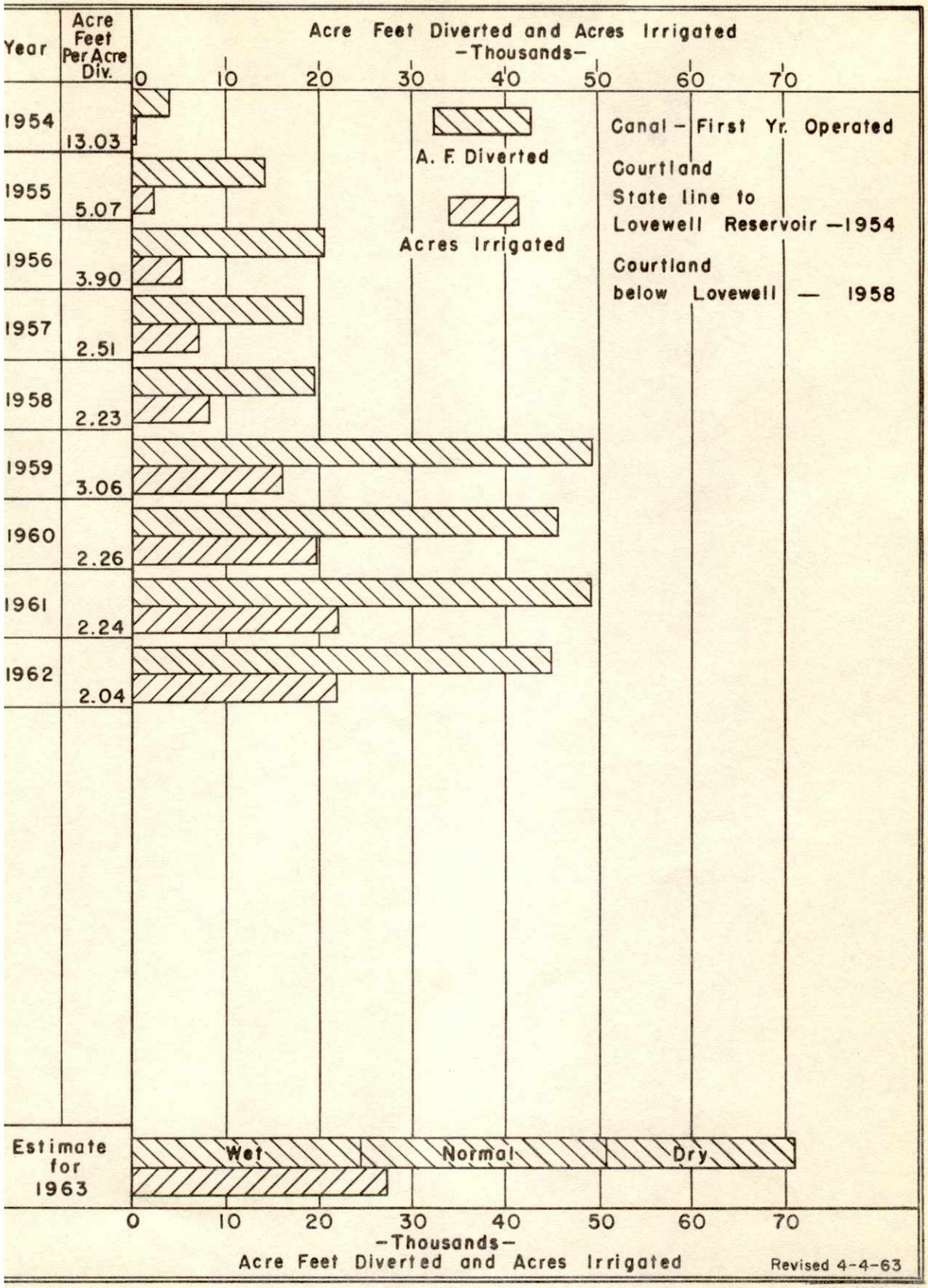


Exhibit 16

CANAL DIVERSIONS AND ACRES IRRIGATED

Kansas-Bostwick Irrigation District

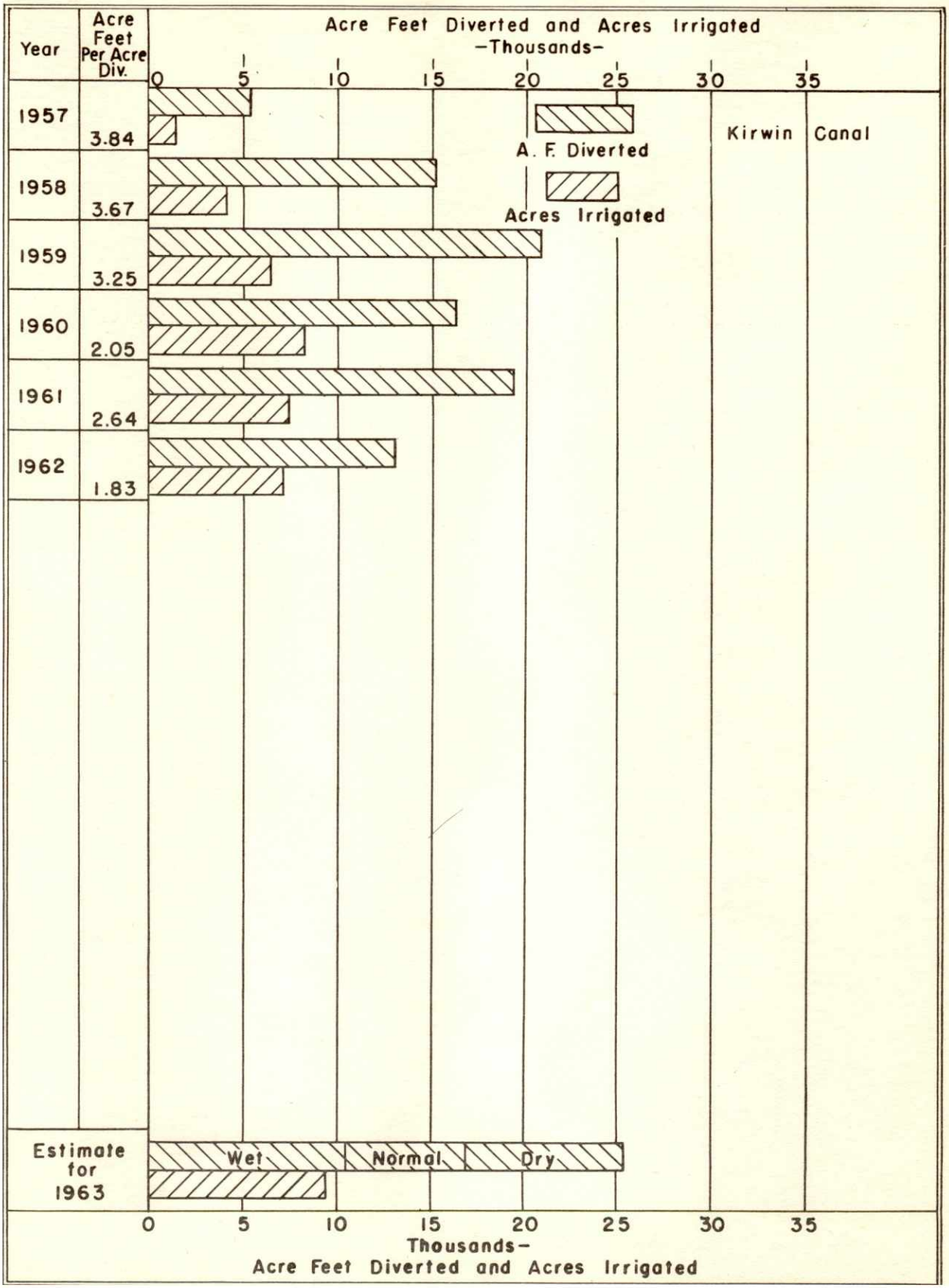


Revised 4-4-63

GPO 832796-71

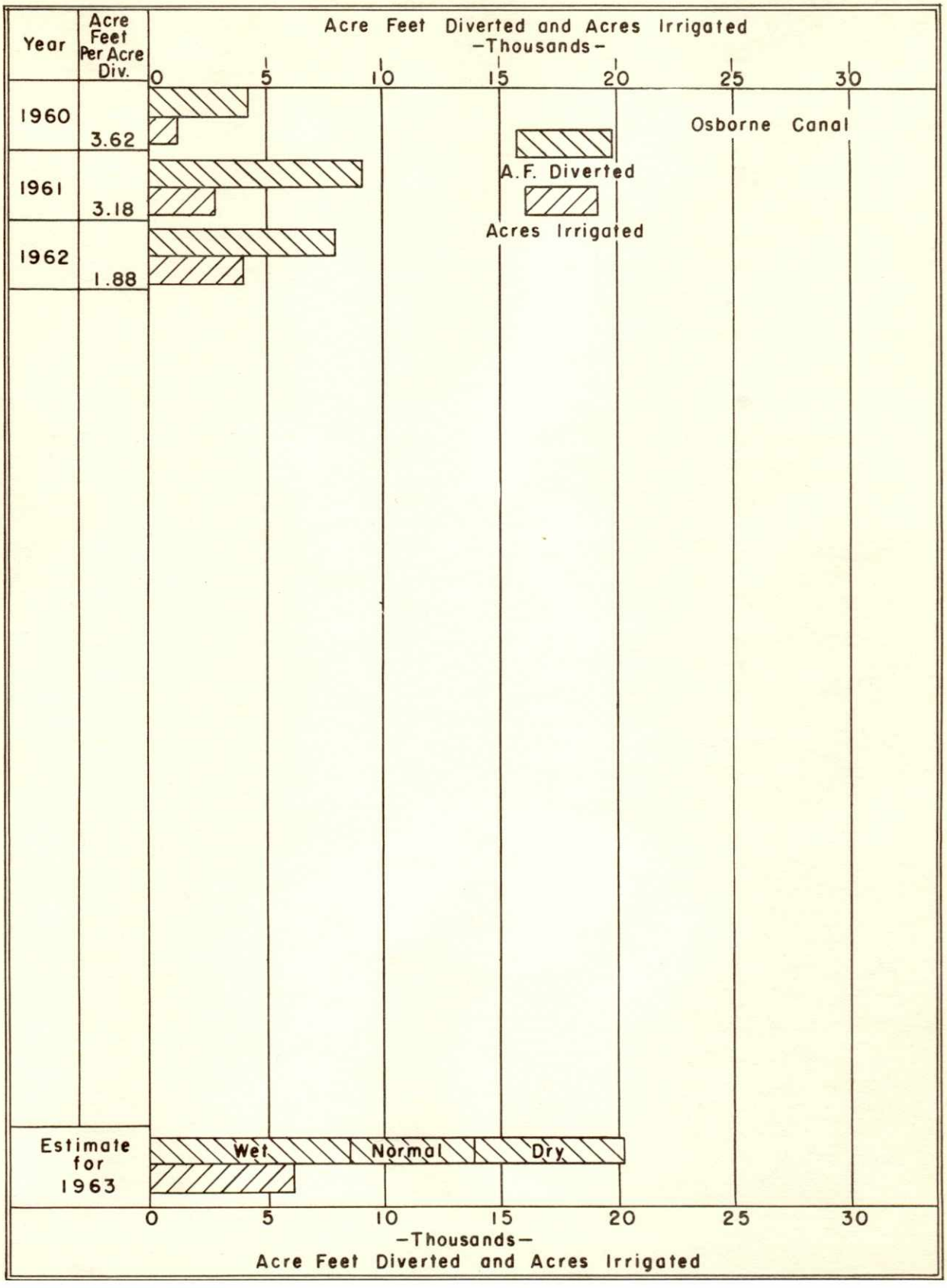
CANAL DIVERSIONS AND ACRES IRRIGATED

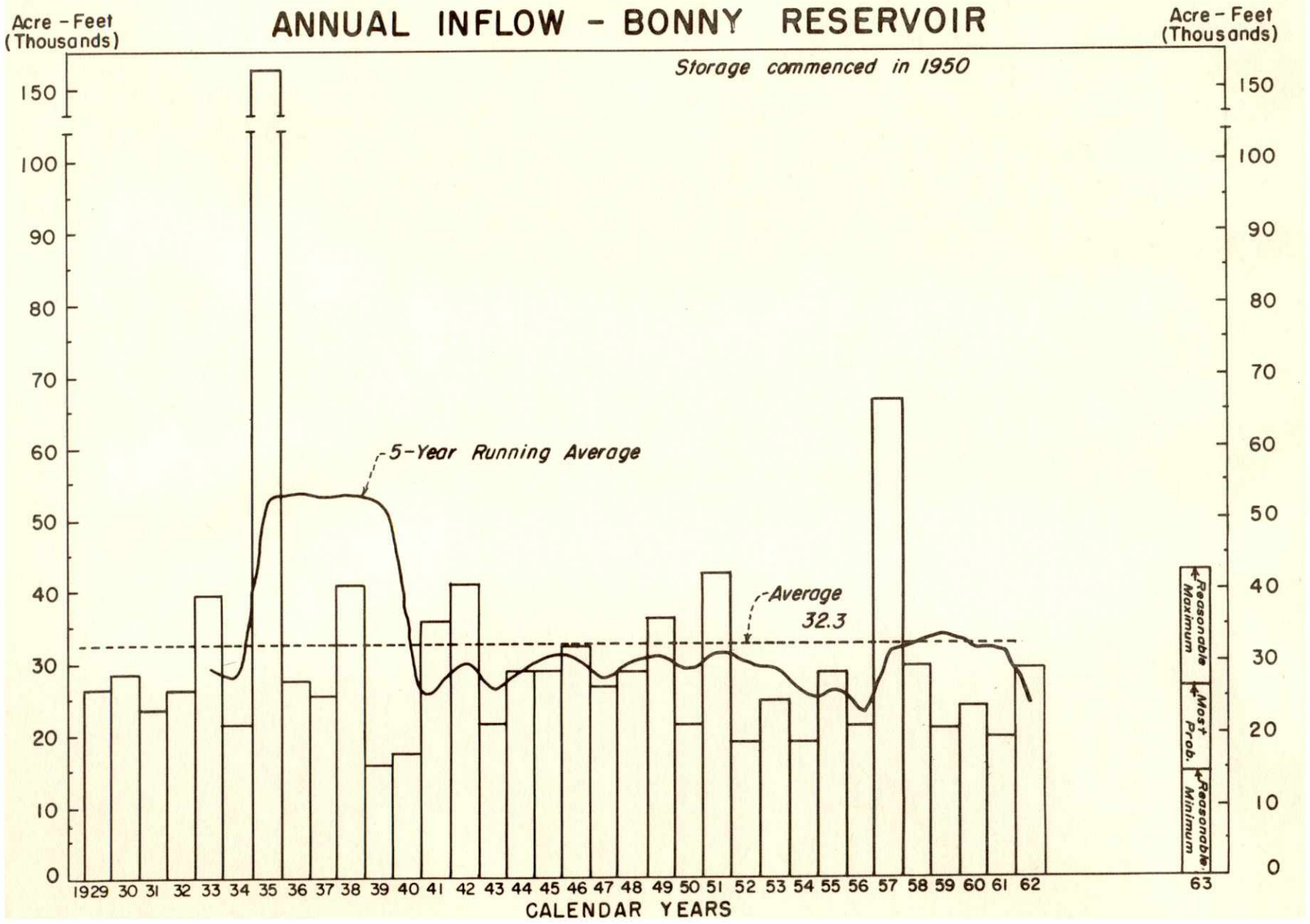
Kirwin Irrigation District



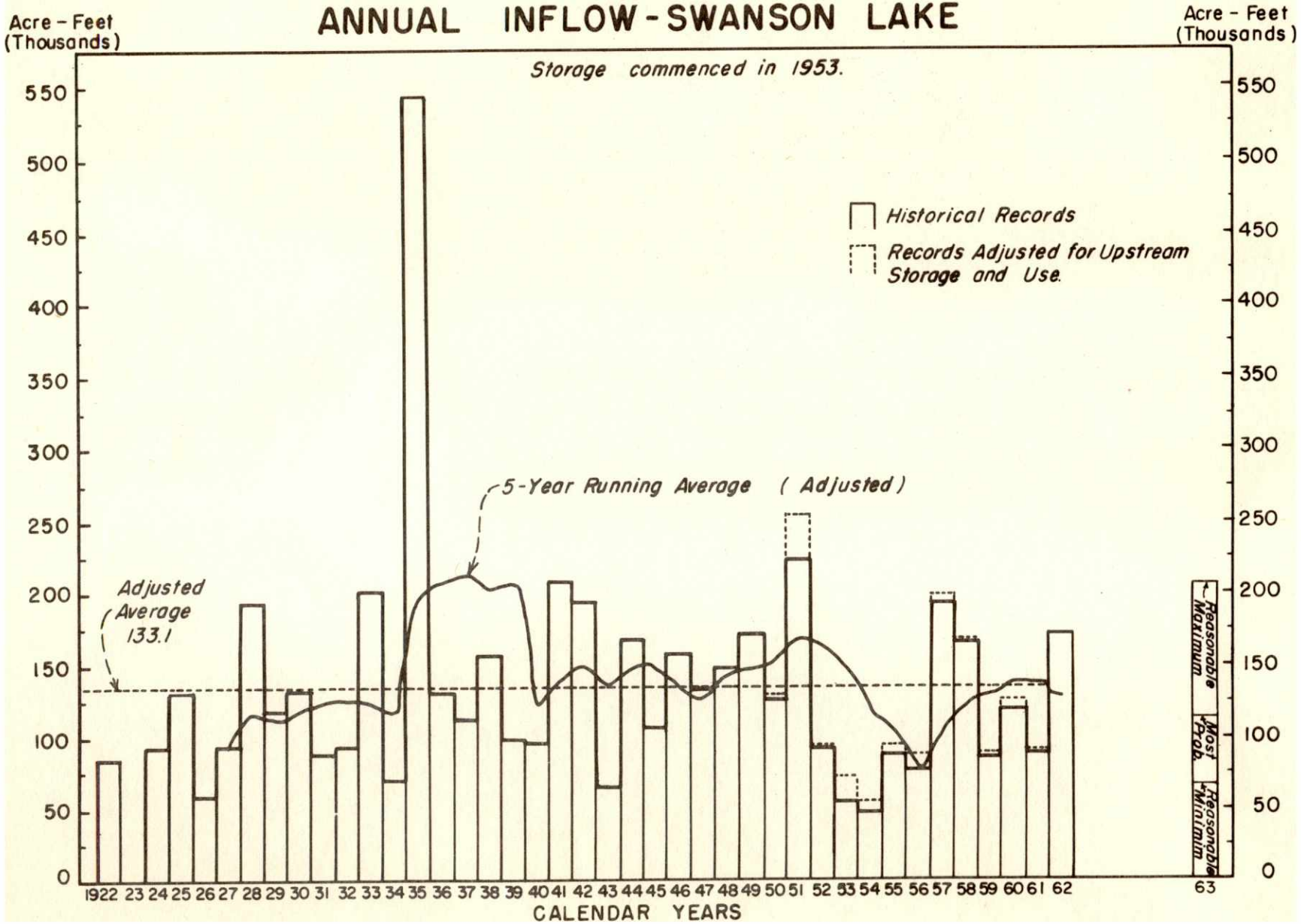
CANAL DIVERSIONS AND ACRES IRRIGATED

Webster Irrigation District

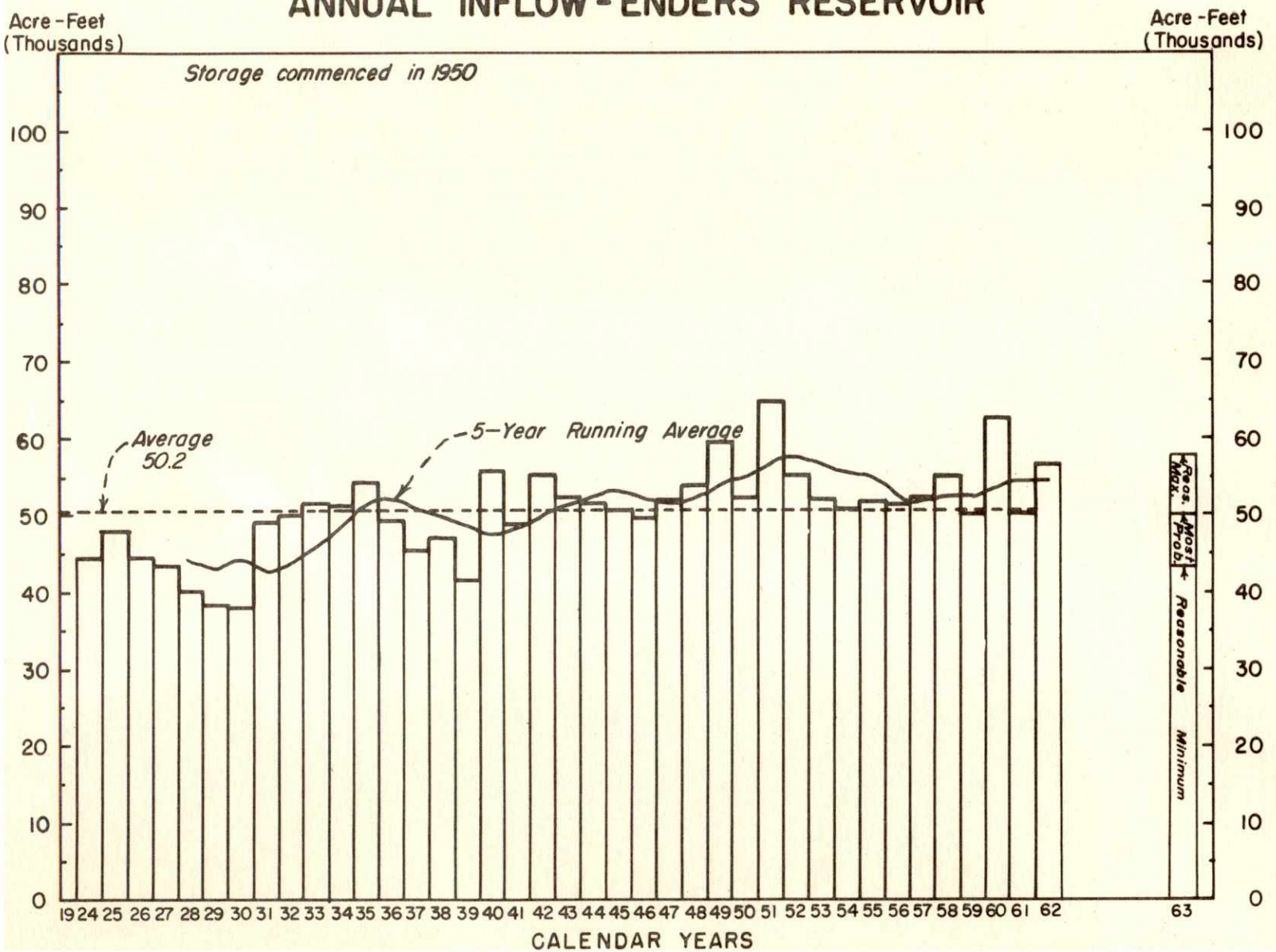



ANNUAL INFLOW - BONNY RESERVOIR
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1950
5-Year Running Average
Average
32.3
Reasonable Maximum
Most Prob.
Reasonable Minimum
0
10
20
30
40
50
60
70
80
90
100
150
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
CALENDAR YEARS

ANNUAL INFLOW - SWANSON LAKE



ANNUAL INFLOW - ENDERS RESERVOIR



ANNUAL INFLOW – HUGH BUTLER LAKE

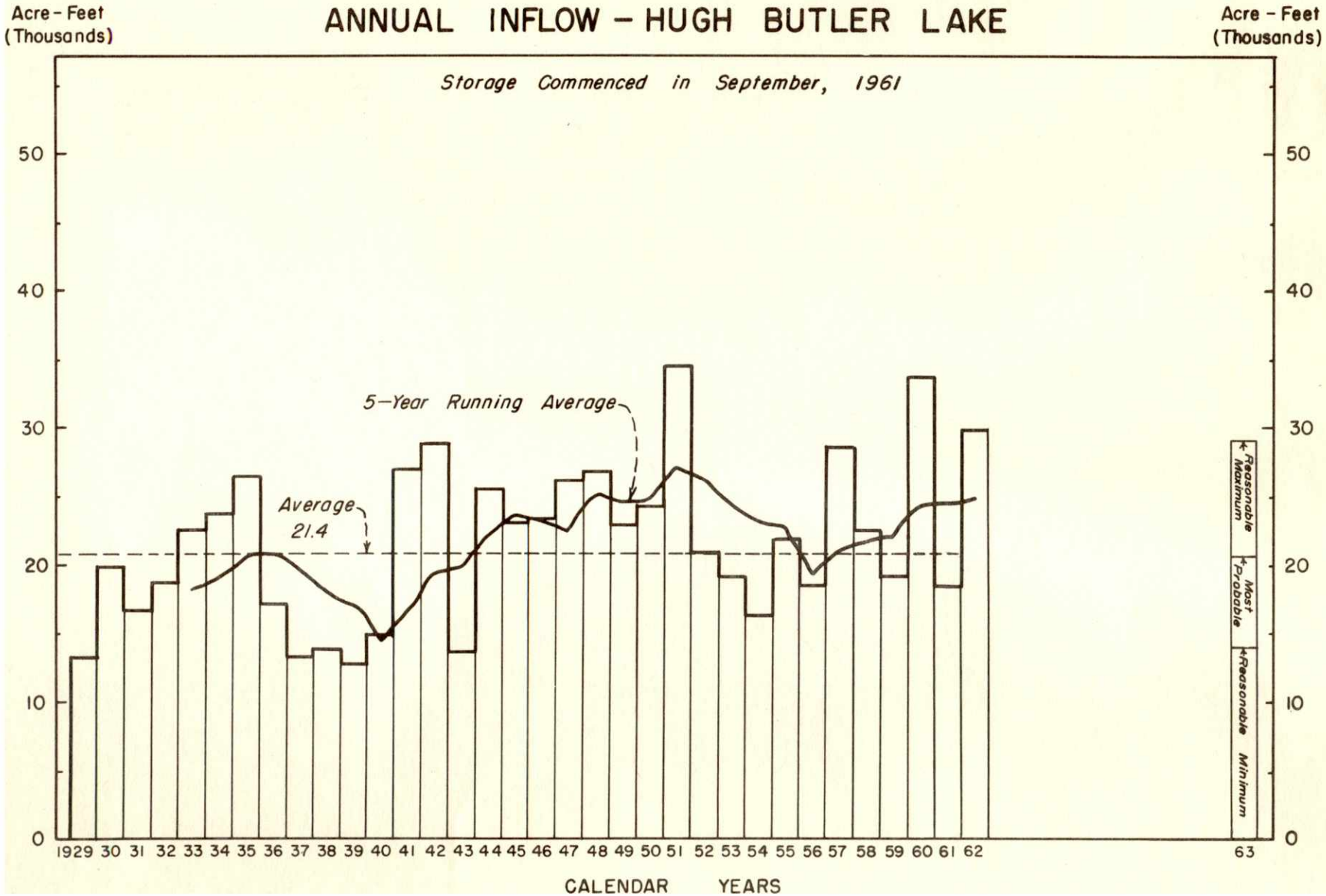
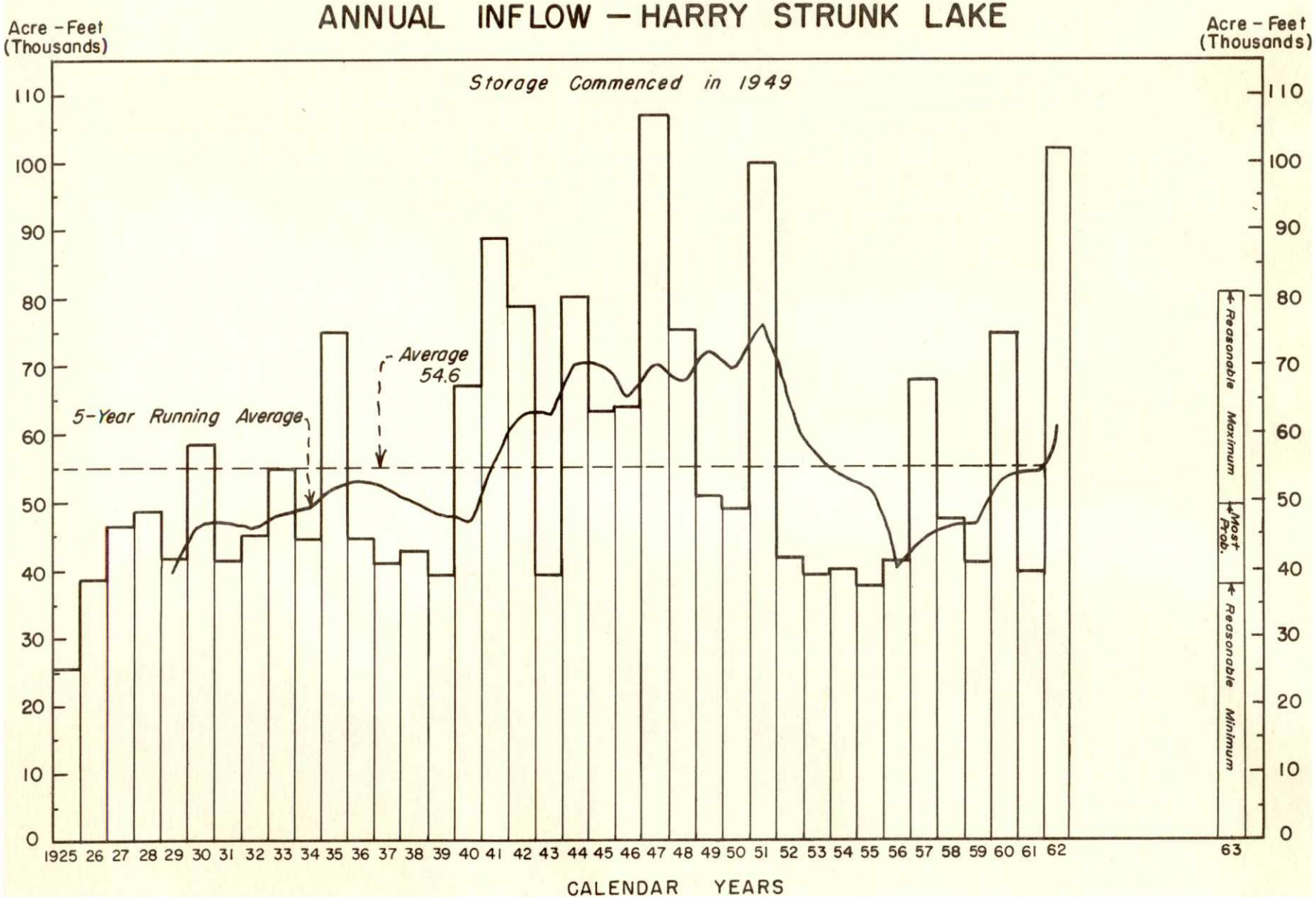
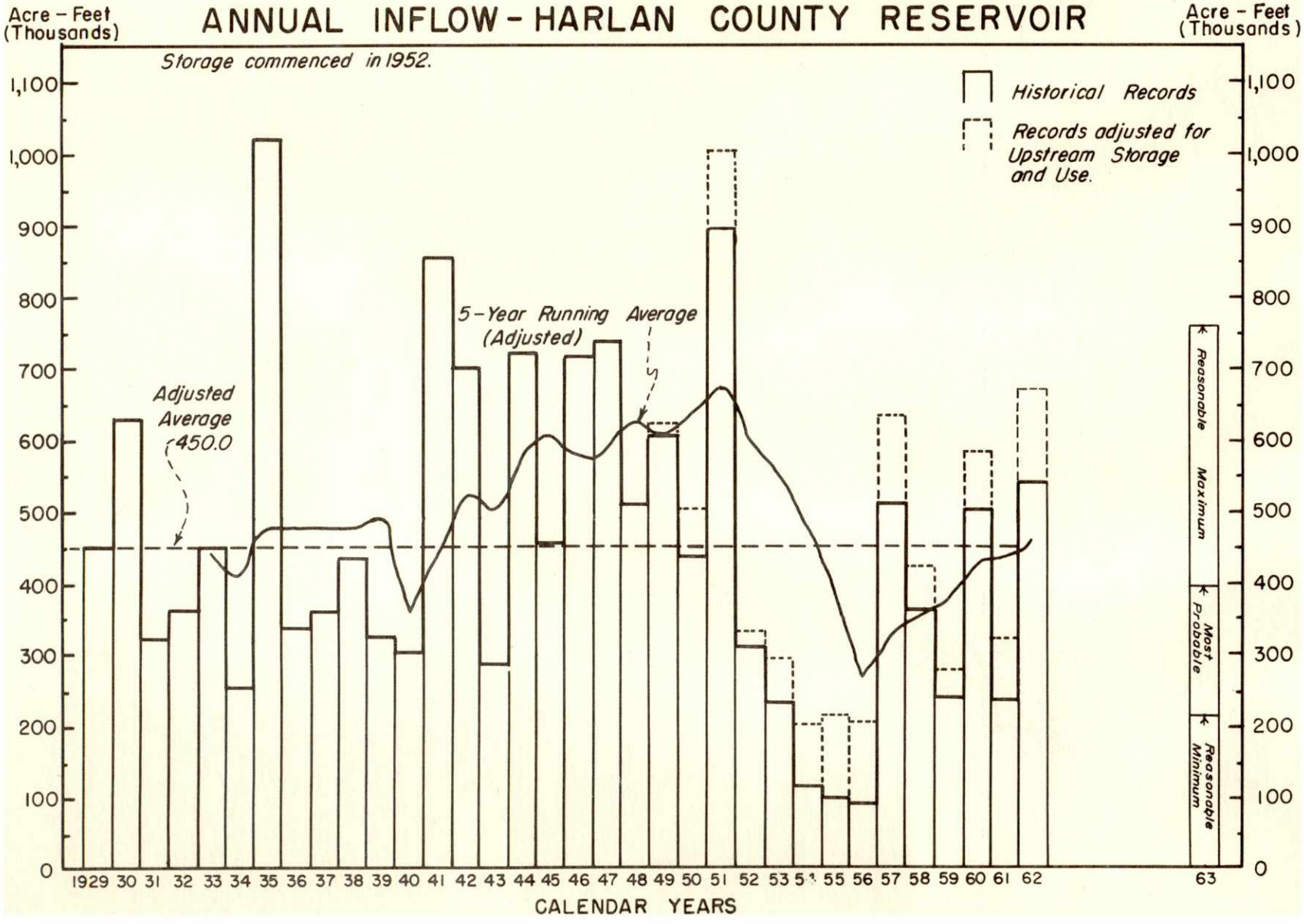


Exhibit 22

ANNUAL INFLOW — HARRY STRUNK LAKE




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 450.0
Reasonable Maximum
Most Probable
Reasonable Minimum
0
100
200
300
400
500
600
700
800
900
1,000
1,100
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 63
CALENDAR YEARS

ANNUAL INFLOW - LOVEWELL RESERVOIR

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

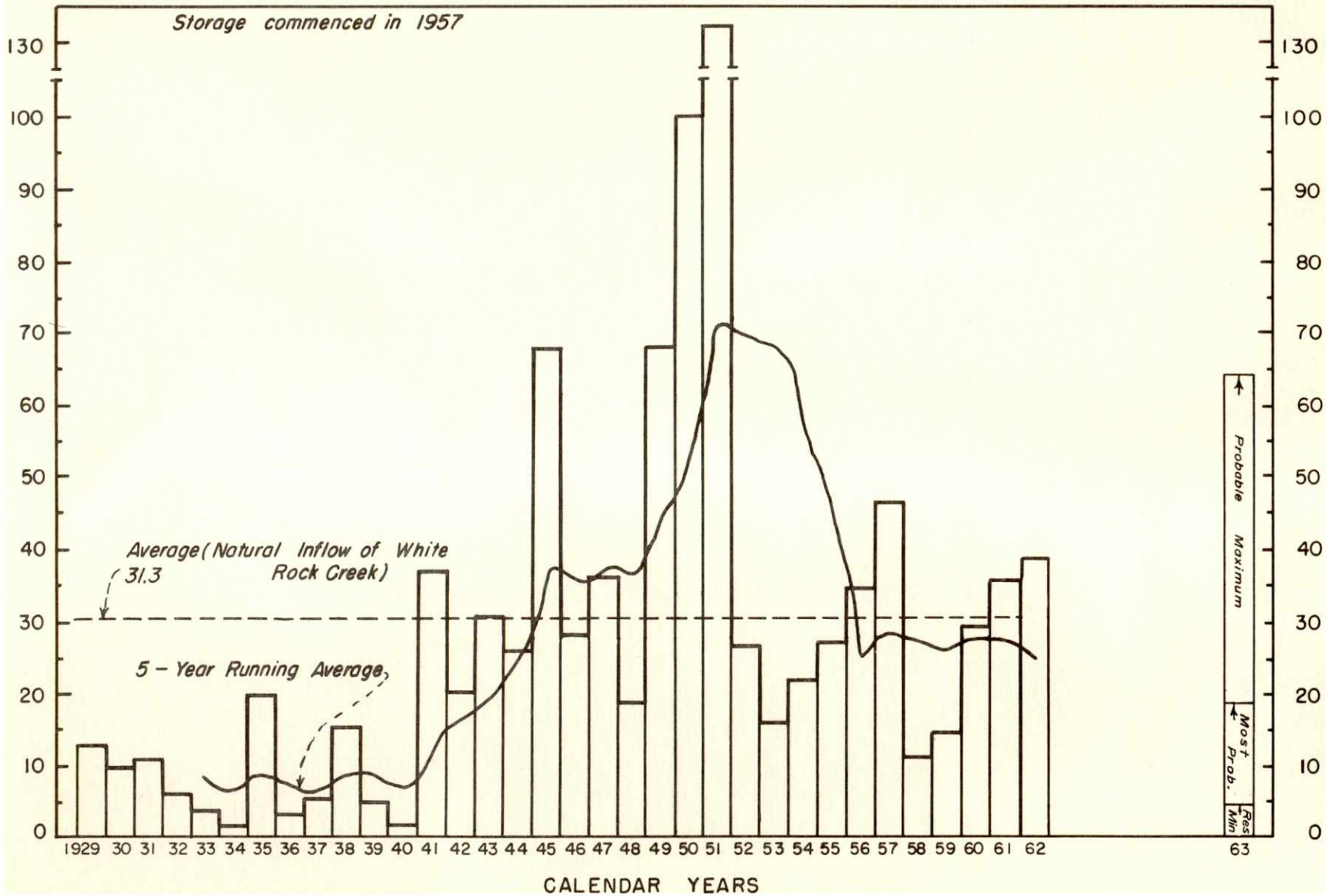
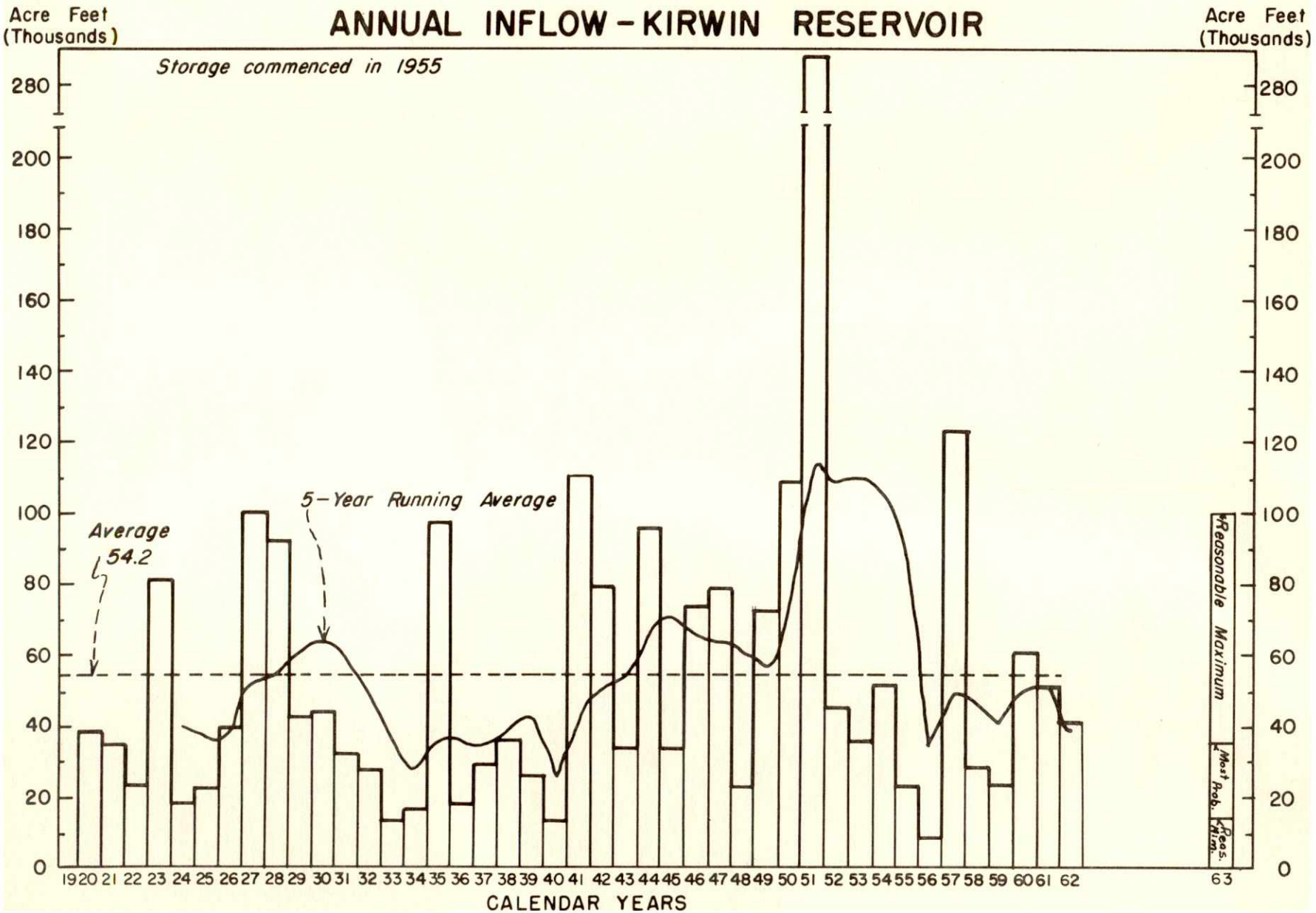
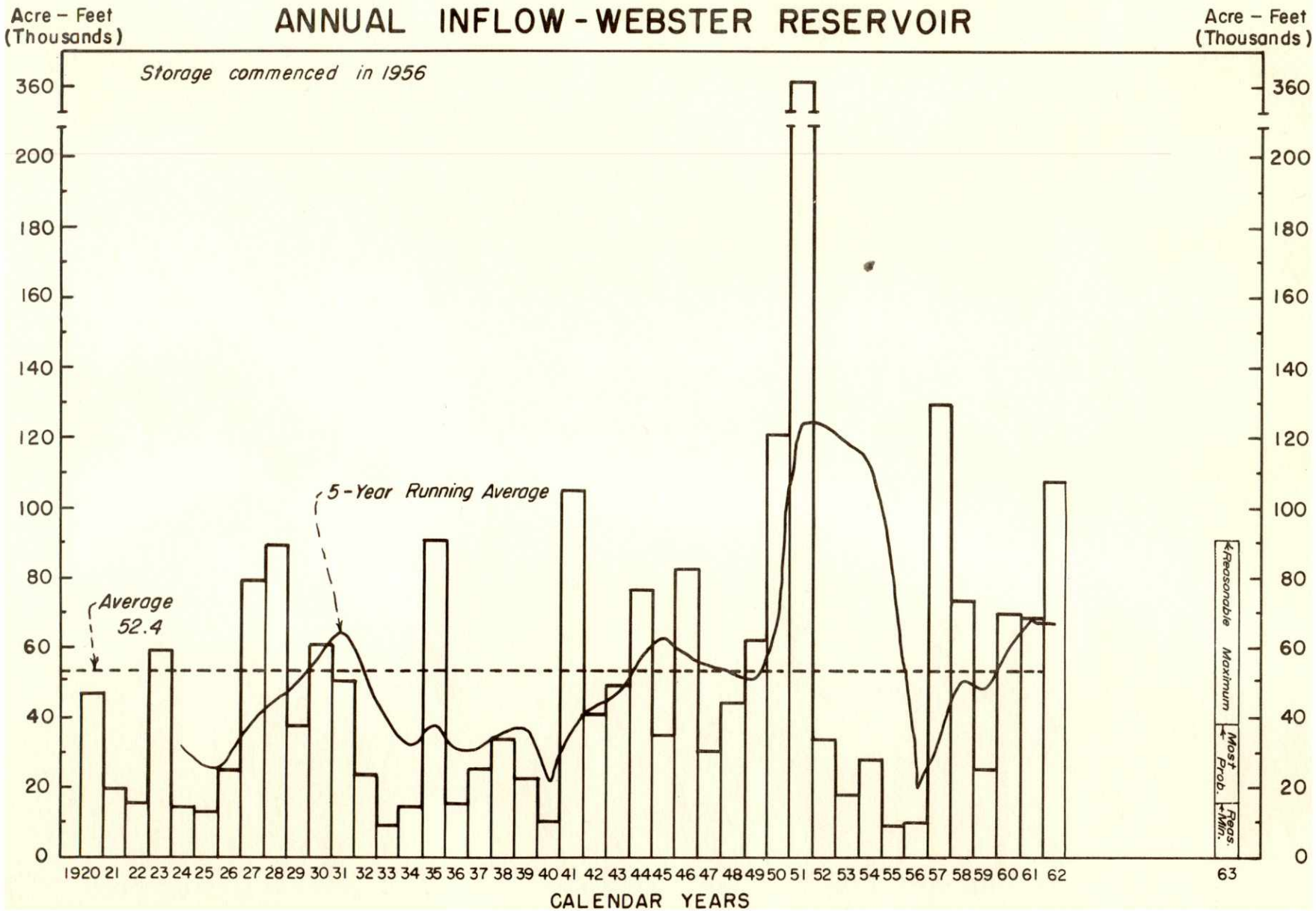
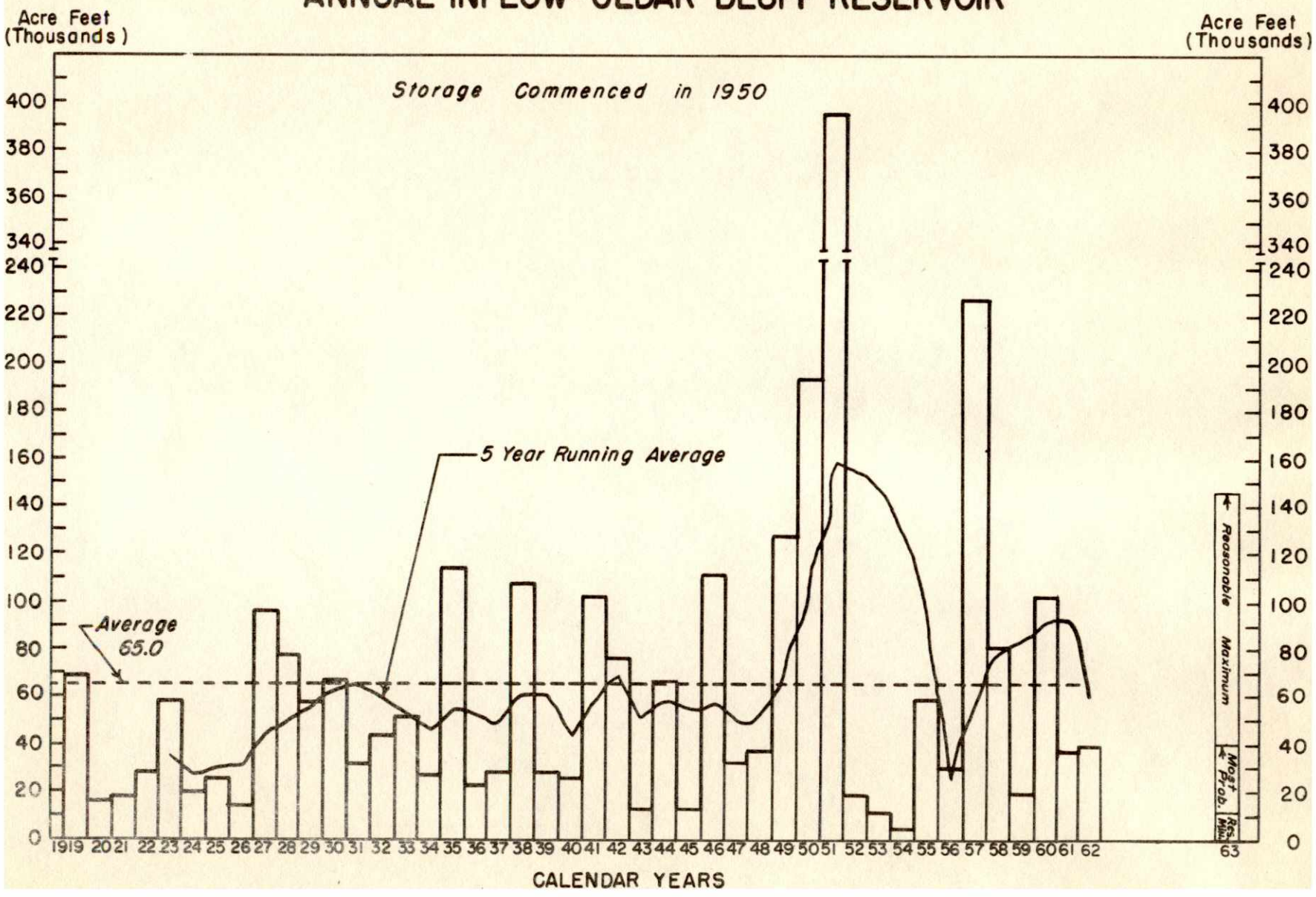


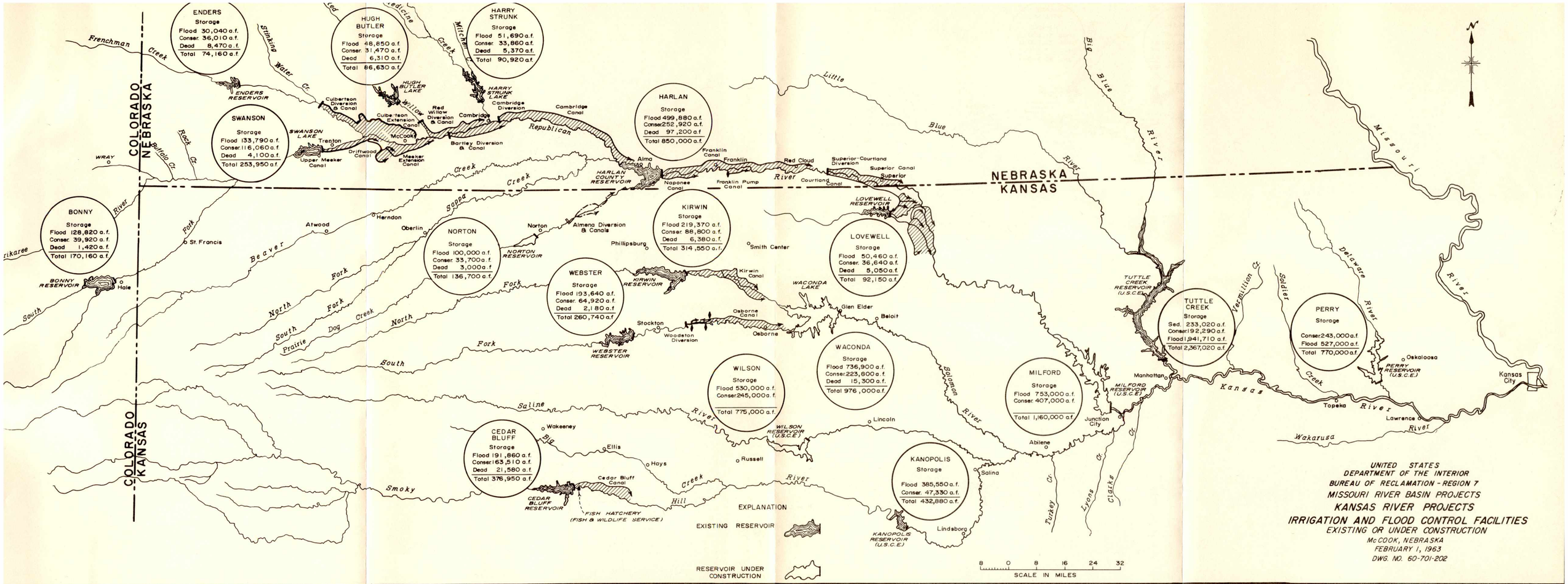
Exhibit 25


ANNUAL INFLOW - KIRWIN RESERVOIR
Acre Feet (Thousands)
Acre Feet (Thousands)
Storage commenced in 1955
5-Year Running Average
Average 54.2
Reasonable Maximum
Most Prob.
Reas. Min.
280
200
180
160
140
120
100
80
60
40
20
0
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 63
CALENDAR YEARS


ANNUAL INFLOW - WEBSTER RESERVOIR
Acre – Feet (Thousands)
Acre – Feet (Thousands)
Storage commenced in 1956
5-Year Running Average
Average 52.4
Reasonable Maximum
Most Prob.
Reas. Min.
0
20
40
60
80
100
120
140
160
180
200
360
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
63
CALENDAR YEARS

ANNUAL INFLOW - CEDAR BLUFF RESERVOIR




ENDERS
Storage
Flood 30,040 a.f.
Conser. 36,010 a.f.
Dead 8,470 a.f.
Total 74,160 a.f.
HUGH BUTLER
Storage
Flood 48,850 a.f.
Conser. 31,470 a.f.
Dead 6,310 a.f.
Total 86,630 a.f.
HARRY STRUNK
Storage
Flood 51,690 a.f.
Conser. 33,860 a.f.
Dead 5,370 a.f.
Total 90,920 a.f.
HARLAN
Storage
Flood 499,680 a.f.
Conser. 252,920 a.f.
Dead 97,200 a.f.
Total 850,000 a.f.
SWANSON
Storage
Flood 133,790 a.f.
Conser. 116,060 a.f.
Dead 4,100 a.f.
Total 253,950 a.f.
BONNY
Storage
Flood 128,820 a.f.
Conser. 39,920 a.f.
Dead 1,420 a.f.
Total 170,160 a.f.
NORTON
Storage
Flood 100,000 a.f.
Conser. 33,700 a.f.
Dead 3,000 a.f.
Total 136,700 a.f.
KIRWIN
Storage
Flood 219,370 a.f.
Conser. 88,800 a.f.
Dead 6,380 a.f.
Total 314,550 a.f.
WEBSTER
Storage
Flood 193,640 a.f.
Conser. 64,920 a.f.
Dead 2,180 a.f.
Total 260,740 a.f.
LOVEWELL
Storage
Flood 50,460 a.f.
Conser. 36,640 a.f.
Dead 5,050 a.f.
Total 92,150 a.f.
WILSON
Storage
Flood 530,000 a.f.
Conser. 245,000 a.f.
Total 775,000 a.f.
WACONDA
Storage
Flood 736,900 a.f.
Conser. 223,800 a.f.
Dead 15,300 a.f.
Total 976,000 a.f.
CEDAR BLUFF
Storage
Flood 191,860 a.f.
Conser. 163,510 a.f.
Dead 21,580 a.f.
Total 376,950 a.f.
KANOPOLIS
Storage
Flood 385,550 a.f.
Conser. 47,330 a.f.
Total 432,880 a.f.
MILFORD
Storage
Flood 753,000 a.f.
Conser. 407,000 a.f.
Total 1,160,000 a.f.
TUTTLE CREEK
Storage
Sed. 233,020 a.f.
Conser. 192,290 a.f.
Flood 1,941,710 a.f.
Total 2,367,020 a.f.
PERRY
Storage
Conser. 243,000 a.f.
Flood 527,000 a.f.
Total 770,000 a.f.
COLORADO
NEBRASKA
COLORADO
KANSAS
NEBRASKA
KANSAS
Frenchman Creek
Stinking Water Cr.
Medicine Creek
Mitchell Creek
Little Blue River
Blue River
Missouri River
Republican River
Rock Cr.
Buffalo Cr.
Sappa Creek
Beaver Creek
North Fork
South Fork
Prairie Dog Creek
South Fork
Saline River
Big Creek
Smoky Hill River
Solomon River
Kansas River
Wakarusa River
Delaware River
Soldier Creek
Vermillion Cr.
Turkey Cr.
Lyons Cr.
Clarke Cr.
ENDERS RESERVOIR
HUGH BUTLER LAKE
HARRY STRUNK LAKE
SWANSON LAKE
HARLAN COUNTY RESERVOIR
BONNY RESERVOIR
NORTON RESERVOIR
KIRWIN RESERVOIR
WEBSTER RESERVOIR
WILSON RESERVOIR (U.S.C.E.)
CEDAR BLUFF RESERVOIR
FISH HATCHERY (FISH & WILDLIFE SERVICE)
KANOPOLIS RESERVOIR (U.S.C.E.)
LOVEWELL RESERVOIR
TUTTLE CREEK RESERVOIR (U.S.C.E.)
MILFORD RESERVOIR (U.S.C.E.)
PERRY RESERVOIR (U.S.C.E.)
WACONDA LAKE
Culbertson Diversion & Canal
Culbertson Extension Canal
Red Willow Diversion & Canal
Cambridge Diversion
Cambridge Canal
Bartley Diversion & Canal
Driftwood Canal
Upper Meeker Canal
Meeker Extension Canal
Almena Diversion & Canals
Kirwin Canal
Osborne Canal
Woodston Diversion
Franklin Canal
Franklin Pump Canal
Naponee Canal
Superior-Courtland Diversion
Superior Canal
Courtland Canal
Cedar Bluff Canal
Wray
Rockford
Herndon
Atwood
Oberlin
Norton
St. Francis
Phillipsburg
Smith Center
Hale
Stockton
Osborne
Glen Elder
Beloit
Lincoln
Wakeeney
Ellis
Hays
Russell
Abilene
Salina
Lindsborg
Junction City
Manhattan
Topeka
Lawrence
Oskaloosa
Kansas City
Alma
Franklin
Red Cloud
Superior
McCook
Trenton
EXPLANATION
EXISTING RESERVOIR
RESERVOIR UNDER CONSTRUCTION
8 0 8 16 24 32
SCALE IN MILES
N
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION - REGION 7
MISSOURI RIVER BASIN PROJECTS
KANSAS RIVER PROJECTS
IRRIGATION AND FLOOD CONTROL FACILITIES
EXISTING OR UNDER CONSTRUCTION
McCOOK, NEBRASKA
FEBRUARY 1, 1963
DWG. NO. 60-701-202