

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

REGION 7 - DENVER, COLORADO

ANNUAL OPERATING PLAN
NIOBRARA, LOWER PLATTE,
AND KANSAS RIVER BASINS
1969 OPERATIONS 1970 OUTLOOK

FEBRUARY 1970

COVER Artist's sketch of Trenton Dam and Swanson Lake

UNITED STATES DEPARTMENT OF THE INTERIOR Walter J. Hickel, Secretary

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Region 7 - Denver, Colorado

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TABLE OF CONTENTS

Page

Synopsis	0
CHAPTER I - INTRODUCTION	
Purpose of Report	
Operational Responsibilities	
Water Supply	
Reservoir Operations	
Major Features	
Irrigation Districts	
Municipal Water and Industrial Water	
Fish Hatchery	
Other Functions	
CHAPTER II - NIOBRARA AND LOWER PLATTE RIVER BASINS	
Mirage Flats in Nebraska	
Ainsworth Unit, Sandhills Division in Nebraska	
Middle Loup Division in Nebraska	
Sargent Unit	
Farwell Unit	
CHAPTER III - REPUBLICAN RIVER BASIN 6)
Armel Unit, Upper Republican Division in Colorado 6)
Frenchman Unit, Frenchman-Cambridge Division in	
Nebraska	,
Meeker-Driftwood, Red Willow, and Cambridge Units,	
Frenchman-Cambridge Division in Nebraska	
Trenton Dam and Swanson Lake	
Red Willow Dam and Hugh Butler Lake	
Medicine Creek Dam and Harry Strunk Lake	
Almena Unit, Kanaska Division in Kansas 9	1
Franklin and Superior-Courtland Units, Bostwick	
Division in Nebraska	
Courtland Unit, Bostwock Division in Kansas 10)
CHAPTER IV - SMOKY HILL RIVER BASIN	
Solomon Division	
Kirwin Unit	
Webster Unit	
Glen Elder Unit	
Cedar Bluff Unit, Smoky Hill Division	

	LIST OF TABLES	
		age
1.	,	3
2.	Irrigation Data	L4
3.		L6
	LIST OF EXHIBITS	
	All Following Page	.6
1.	Operation Hydrographs - Box Butte Reservoir	
2.	Operation Hydrographs - Merritt Reservoir	
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	,	
12.		
13.		
14.	,	
15.	Operation Hydrographs - Cedar Bluff Reservoir	
Мар	- Irrigation and Flood Control Facilities	

Note: Appendix to the Annual Operating Plan, Niobrara, Lower Platte, and Kansas River Basins, contains additional tables and exhibits and may be received upon request to: Regional Director, Bureau of Reclamation, Region 7, Building 20, Denver Federal Center, Denver, Colorado 80225

GENERAL

This is the seventeenth Annual Operating Plan for the federally owned storage dams serving an irrigation function in the Niobrara, Lower Platte, and Kansas River Basins. These features are located in Colorado, Nebraska, and Kansas as shown on the location map in the back of this report. The storage dams in the Niobrara and Lower Platte River Basins are operated by irrigation or reclamation districts, and the storage dams in the Kansas River Basin are operated by the Bureau of Reclamation or Corps of Engineers. The canals, pumping plants, and diversion dams are also operated by irrigation or reclamation districts. There are 15 storage dams and reservoirs, 10 diversion dams, and 22 canal systems in operation.

In addition to irrigation, these features serve flood control, municipal and industrial water, recreation, fish and wildlife, stream pollution abatement, and other purposes.

1969 OPERATIONS

Precipitation. The precipitation during 1969 ranged from 79% to 134% of normal in the operating area. The annual total was above normal at all storage dams except Box Butte, Merritt, and Bonny.

Flood Control. Major floods were controlled by Bonny Dam and Reservoir and Glen Elder Dam and Waconda Lake. Minor floods were controlled by storage impoundments in Swanson and Harry Strunk Lakes and Enders, Harlan County, Kirwin, Webster, and Cedar Bluff Reservoirs.

Major floods occurred in other parts of Kansas River Projects from snow-melt in the spring of 1969; namely, on the Lower Republican River, which was controlled by Milford Dam and Reservoir, and the Big Blue and Little Blue Rivers, which were controlled by Tuttle Creek Dam and Reservoir. Milford and Tuttle Creek Dams are operated by the Corps of Engineers, and since they are not serving an irrigation function, are not in the scope of this report.

The flood damages prevented during 1969 by the operation of multipurpose storage dams within the scope of this report amounted to \$632,000.

Storage Dams. The conservation pools of Merritt, Sherman, Bonny, Harlan County, Lovewell, and Kirwin Reservoirs, and Swanson, Hugh Butler, and Harry Strunk Lakes were filled in 1969. The conservation capacities of Box Butte, Enders, Norton, Webster, and Cedar Bluff Reservoirs and Waconda Lake were not full at any time in 1969.

The active storage capacities of Box Butte and Enders Reservoirs were nearly depleted by the end of the 1969 irrigation season. The pool levels in these reservoirs were the lowest since their initial operation in the early 1950's.

Water Services. The water supply was adequate to meet the irrigation requirements of 209,541 acres irrigated in 1969, which is 79% of the acreage that had service available. The diversion of irrigation water to canal systems averaged 2.26 acre-feet per acre, while the farm delivery averaged 1.32.

The irrigation operations for each of the irrigation districts are shown in the following table:

Irrigation District	Acres Irrig.	Diversion (acft.)	Diversion (acft./ac.)	Farm Del. (acft./ac.)
Mirage Flats	10,795	19,916	1.84	1.04
Ainsworth	22,666	50,793	2.24	1.60
Sargent	13,144	24,286	1.85	0.87
Farwell Farwell	34,726	73,313	2.12	1.04
Frenchman Valley	8,845	21,469	2.43	1.56
H & RW	10,945	31,804	2.91	1.63
Frenchman-Cambridge	36,940	77,805	2.11	1.34
Almena	5,262	9,327	1.77	1.32
Bostwick in Nebraska	18,538	36,859	1.99	0.86
Kansas-Bostwick	25,433	54,798	2.15	0.94
Kirwin	9,554	19,626	2.05	1.49
Webster	6,951	14,731	2.12	1.18
Cedar Bluff	5,742	11,016	1.92	1.14
Total	209,541	445,743		

Diversions of 28,499 acre-feet were made to Hale Ditch and Middle Loup Public Power and Irrigation District Canals to irrigate 11,560 acres of non-project land. There were also diversions of 775 acre-feet for the cities of Norton and Beloit, 687 acre-feet for industrial purposes, and 2,624 acre-feet for the fish hatchery below Cedar Bluff Dam.

Fish & Wildlife and Recreation Uses. The recommendations of the Fish and Wildlife Service were generally satisfied with the exception of those for Lovewell Reservoir where a low reservoir level was necessary during the fall and winter months to facilitate maintenance operations.

There were 2,692,383 visitors in 1969 to the facilities covered in this report. Recreation uses included fishing, hunting, boating, skiing, camping, picnicking, and sightseeing.

1970 OUTLOOK

The conservation pools of Merritt, Sherman, Swanson, Hugh Butler, Harry Strunk, Harlan County, Lovewell and Kirwin are expected to fill with reasonable minimum inflow conditions. Enders conservation pool is expected to fill with the most probable inflow conditions. The carryover storage and reservoir inflows that can reasonably be expected for Merritt, Sherman, Bonny, Swanson, Hugh Butler, Harry Strunk, Harlan County, Lovewell, Kirwin, Waconda, and Cedar Bluff and natural flows in streams will be adequate for irrigation, municipal and industrial demands. If reasonable minimum inflow conditions are experienced in 1970, the carryover storage and inflows of Box Butte, Enders, Norton and Webster Reservoirs will be inadequate to meet the full irrigation requirements of Mirage Flats, Frenchman Valley, H & RW, Almena and Webster Irrigation District lands. All major construction will be completed by the spring of 1970 when Glen Elder Dam will be in full operation.

The operations of the above facilities will also enhance the visitation in 1970 for fishing, hunting, and other recreational purposes. Generally, the recommendations of the Fish and Wildlife Service can be satisfied and still fully meet the primary functions of flood control and irrigation.

CHAPTER I - INTRODUCTION

PURPOSE OF THE REPORT

In addition to describing the responsibilities of the Bureau of Reclamation, Corps of Engineers, and irrigation or reclamation districts, this Annual Operating Plan advises water users, cooperating agencies, and other interested groups or persons of the actual operations during 1969 and serves as guidelines for the 1970 operations.

OPERATIONAL RESPONSIBILITIES

The Bureau of Reclamation is responsible for irrigation operations at all Federal reservoirs in the Kansas River Projects area. Where the Bureau of Reclamation is the constructing agency, it is responsible for the employment of operation and maintenance personnel, safety of the structure, and reservoir operations for all other conservation functions, such as recreation, fish and wildlife, municipal and industrial uses, sanitation, and quality control not specifically associated with regulation of the flood control storage.

The Corps of Engineers is responsible for regulation of the flood control storage at all Federal reservoirs in the Kansas River Basin, and of the conservation functions other than irrigation at the dams where it is the construction agency.

By contractual arrangements with the Bureau of Reclamation, 12 irrigation or reclamation districts are responsible for the operation of irrigation facilities constructed or rehabilitated by the Bureau of Reclamation in the Niobrara, Lower Platte, and Kansas River Basins with the exceptions of the reservoirs in the Kansas River Basin.

The States of Nebraska, Colorado, and Kansas are responsible for administration and enforcement of the laws of their respective States pertaining to the water rights and priorities of all parties concerned with the use of water.

The Republican River Compact was authorized on August 4, 1942, by Public Law No. 696, which was enacted by the 77th Congress. The Compact was ratified by the States of Colorado, Kansas, and Nebraska. This Annual Operating Plan is in accordance with the objectives of the Compact, which are: to provide for the most efficient and multiple-purpose use of the waters of the Republican River Basin; to provide for an equitable division of such waters; to remove all causes, present and future, which might lead to controversies; to promote interstate comity; to recognize that the most efficient utilization of the waters within the Basin is for consumptive use; and, to promote joint action by the States and the United States in the efficient use of water and the control of destructive floods.

TABLES AND EXHIBITS

Principal records and graphs for the facilities in this report are attached as tables and exhibits.

WATER SUPPLY

For forecasting purposes, values of annual inflows that will be statistically equalled 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.

RESERVOIR OPERATIONS

At the end of the irrigation season, the carryover storage in each reservoir and the reasonable minimum inflow are evaluated to determine if water in excess of that required to fill the conservation pool may be anticipated. If excess inflow is apparent, controlled releases will be made to accomplish maximum downstream benefits. However, this plan is not used for Bonny Reservoir, as winter releases are undesirable.

MAJOR FEATURES

The Mirage Flats Project was constructed under the Water Conservation and Utilization Act and includes an irrigation storage reservoir, diversion dam, and canal system. The other features in the scope of this report are a part of the Missouri River Basin Project and include multipurpose reservoirs, diversion dams, pump stations, and canal systems. Fifteen storage facilities are now in operation as follows:

Constructed by the Bureau of Reclamation:

- (a) Operated by irrigation or reclamation districts Box Butte and Merritt Dams in the Niobrara River Basin and Sherman Dam in the Lower Platte River Basin.
- (b) Operated by the Bureau of Reclamation Bonny, Trenton, Enders, Red Willow, Medicine Creek, Norton, Lovewell, Kirwin, Webster, Glen Elder, and Cedar Bluff in the Kansas River Basin.

Constructed and operated by the Corps of Engineers:

(a) Harlan County in the Kansas River Basin.

There are 22 canal systems, 10 diversion dams and 10 pump stations that are operated by irrigation and reclamation districts. Capacity allocations

and locations of the 15 reservoirs and locations of diversion dams, irrigation canals and pump stations presently serving flood control, irrigation and other project functions in the scope of this report are shown on the general map in the back of this report.

IRRIGATION DISTRICTS

Fourteen irrigation districts and one reclamation district in the Niobrara, Lower Platte, and Kansas River Basins have contracted with the Bureau of Reclamation for a water supply and construction of irrigation facilities.

The normal irrigation season for Mirage Flats is April through September. The contracted irrigation season for Frenchman Valley, H & RW, Frenchman-Cambridge, and Cedar Bluff Irrigation Districts is from May 1 to October 15, and for all other districts, May 1 to September 30.

MUNICIPAL AND INDUSTRIAL WATER

Three municipalities and two oil companies have executed water service contracts for full or supplemental water supplies.

FISH HATCHERY

A United States Bureau of Sport Fisheries and Wildlife warm-water fish hatchery is in operation below Cedar Bluff Reservoir.

OTHER FUNCTIONS

A "Statement of Operational Objectives" for Harlan County Reservoir was adopted by representatives of the Federal, State, and local interests in June 1952. The statement sets forth the general operational objectives and the specific reservoir uses considered desirable, such as that fish and wildlife interests will be best served by high pool levels with minimum fluctuations and regulation of outflow in excess of minimum requirements insofar as feasible. The statement recognizes that to assure realization of the greatest public benefits, operation plans should be sufficiently comprehensive to permit the maximum integration of the secondary uses consistent with the primary purposes of flood control and irrigation.

Insofar as practicable, the above objectives are considered in operation of all reservoirs in the Kansas River Basin and also for Merritt Reservoir in the Niobrara River Basin. The regulated outflow to avoid unregulated spills will be of some advantage to farmers, ranchers, industries, cities, and other interests below all reservoirs.

CHAPTER II - NIOBRARA AND LOWER PLATTE RIVER BASINS

Mirage Flats Project in Nebraska. The 1969 inflow into Box Butte Reservoir was one of the two lowest years of record since 1946. The reservoir releases nearly evacuated the active conservation pool by mid-September when the irrigation season ended. This was the lowest pool level since the project was placed in full operation in the early 1950's. The carryover storage in December 1969 was 6,600 acrefeet less than in December 1968. The precipitation for 1969 in the Box Butte area was considerably below normal.

The 1970 Operation Study indicates that a shortage of the water supply will occur unless the inflow is greater than the most probable forecast. Under reasonable minimum inflow conditions, a severe shortage will occur commencing in July.

The Mirage Flats water users irrigated 10,795 acres in 1969 and estimated about the same for 1970. This represents 92.6% of the project acreage. The 19,916 acre-feet diverted in 1969 was the highest since 1960. The water supply was supplemented by the use of private irrigation wells. The supplemental water from wells was not measured and is therefore not included in the records for this project.

The Mirage Flats Irrigation District operates the Box Butte Dam and Dunlap Diversion Dam to avoid severe reductions in flow in the Niobrara River as suggested by the Nebraska Game and Parks Commission. They also keep the Commission informed of canal operations and chemical treatment plans.

Ainsworth Unit, Sandhills Division in Nebraska. The 1969 precipitation in the Snake River drainage area was below normal and the inflow into Merritt Reservoir was less than the reasonable minimum forecast. As a result of above normal precipitation over the irrigated area during the latter part of the irrigation season, the releases to Ainsworth Canal from the reservoir were below normal. The normal operation of Merritt Reservoir maintains the pool level 5 feet below the top of the conservation capacity by May 1 of each year.

In 1969, the Ainsworth Irrigation District delivered water to 22,666 acres, which is 67% of the District lands served. The District estimates that 26,000 acres will be irrigated in 1970.

The Ainsworth Irrigation District operates Merritt Dam to avoid severe reductions in flow to the Snake River and Ainsworth Canal as suggested by the Nebraska Game and Parks Commission. The District also advises the Commission of canal operation and chemical treatment plans.

Middle Loup Division in Nebraska:

Sargent Unit. The precipitation in the Sargent Unit area in the Middle Loup River Valley was generally below normal; consequently, the diversions into the Sargent Canal in 1969 were above normal. Diversions into Sargent Canal in excess of the appropriated natural flow water right can be made if the excess is not greater than the releases of storage from Sherman Reservoir or the amount of natural flow available in the Middle Loup River at the Arcadia Diversion Dam under the natural flow water right appropriation for the Farwell Unit. In 1969, diversions in excess of the appropriated water right were made for 21 days.

There were 13,144 acres irrigated in 1969, which was 98% of the irrigable land in the Sargent Irrigation District. It is estimated that 12,500 acres will be irrigated in 1970.

Farwell Unit. The precipitation in the Middle Loup Valley was below normal in 1969, and the diversions from the Middle Loup River into Sherman Feeder Canal of the Farwell system and into the Middle Loup Public Power and Irrigation District Canals were considerably above normal.

Normally, early spring diversions into Sherman Feeder Canal are made as necessary to fill the conservation pool of Sherman Reservoir by May 1 of each year. In 1969, however, spring diversions were deferred until late May while spring maintenance work on Sherman Dam and Sherman Feeder Canal was in progress.

Following the irrigation season, late fall diversions are made when necessary to fill Sherman Reservoir to 5 or 6 feet below the top of the conservation pool.

As a flood control operation, when flows in the Middle Loup River at Arcadia, Nebraska, exceed 6,000 c.f.s., 850 c.f.s. will be diverted into Sherman Feeder Canal. There were no flood control benefits accrued in 1969.

In 1969, 73,313 acre-feet were released from Sherman Reservoir to serve 34,726 acres in the Farwell Irrigation District. This acreage is 72% of the irrigable land in the District. It is estimated that 35,000 acres will be irrigated in 1970.

The Fish and Wildlife Service recommends that the irrigation pool be filled by March 1 and maintained, or to permit a gradual rise in water level until May 15. To avoid operation of Sherman Feeder Canal during winter months, diversions into Sherman Reservoir are started about April 1 of each year with a gradual rise until the conservation pool is filled about May 1. The Irrigation District advises the Nebraska Game and Parks Commission of canal operations and chemical treatment plans.

CHAPTER III - REPUBLICAN RIVER BASIN

Armel Unit, Upper Republican Division in Colorado. Bonny Reservoir storage is transferred to Swanson Lake where regulated releases are made to the Republican River to meet the industrial requirements of Midwest Oil Corporation and Livingston Oil Company for their water flood operations in the Sleepy Hollow Oil Field south of Bartley, Nebraska. Midwest used 618 acre-feet in 1969, and Livingston used 20 acre-feet.

Winter releases from Bonny Reservoir during freezing conditions are undesirable because of the exposed Hale Ditch outlet pipe, which is an integral part of the Bonny Dam outlet works. Releases in extremely cold weather are normally not necessary if the pool level is at least 3 feet below the top of the conservation pool in the fall. To reduce the chances of a large fall drawdown, the reservoir pool level is lowered to 2 feet below the top of the conservation capacity after May 15 and maintained there or below throughout the spring and summer months, except for flood control operation. During dry years, the normal reservoir losses will lower the pool another 2 to 3 feet by September. During other years, it will be necessary to make special releases during September and early October to draw the pool level down another foot.

The natural flows of the South Fork of the Republican River and Landsman Creek above Bonny Reservoir will be released to Hale Ditch when requested by the Colorado State Engineer. In 1969, there were 3,251 acre-feet released from Bonny Reservoir into Hale Ditch to irrigate 700 acres of non-project land and as a water supply for the Colorado Department of Game, Fish and Parks fish hatchery operations. This includes 163 acre-feet of Bonny Reservoir storage purchased by the State of Colorado and 20 acre-feet by a Hale Ditch Irrigator.

Heavy rains fell on the upper reaches of the South Fork of the Republican River Basin between August 18 and August 24, 1969. During the storm period, 11,700 acre-feet were stored in Bonny Reservoir and prevented \$200,000 in flood damages that would have occurred if the runoff had been uncontrolled. As a result of this storm, the inflow for 1969 was considerably above normal.

The normal spring operation of Bonny Dam is planned in cooperation with the Colorado Department of Game, Fish and Parks to enhance the natural spawning of northern and walleye pike. This reservoir is the primary source of eggs for these two species in the State. In the fall of 1969, in cooperation with the State of Colorado, the pool level was lowered an additional 3 feet (6 feet below the top of the conservation capacity) to facilitate the State's construction of spawning beds within the limits of the conservation pool.

In 1970, it is expected that the water supply for the industrial contracts will be met in full and storage water will be available for purchase under temporary one-year contracts as in past years.

Frenchman Unit, Frenchman-Cambridge Division in Nebraska. The transportation of water from Enders Reservoir through 52 miles of the Frenchman Creek to the Culbertson Diversion Dam created an erosion problem that made it necessary to initiate a construction program in 1964 to restore private access, protect the private and public improvements, stabilize various reaches of channel banks, and remove excess sediment from the canal at the headworks settling basin. This program, to be completed in fiscal year 1972, has been effective in reducing the sediment load carried by the stream at the Culbertson Diversion Dam.

Even though the precipitation was above normal at Enders Dam, it was generally below normal over the upper reaches of the Frenchman Creek drainage basin. As a result, the inflow into Enders Reservoir was about equal to the reasonable minimum forecast. This was the second year of below normal inflows. Although the water supply was barely adequate to meet the irrigation requirements of Frenchman Valley and H & RW Irrigation Districts, the pool level was about 28 feet below the top of the conservation capacity at the end of the irrigation season. This pool level was the lowest since the initial filling of the conservation capacity in 1952. If most probable or greater inflows occur in 1970, the conservation capacity will be filled.

Minor flood damages of \$1,000 were prevented by the operation of Enders Dam and Reservoir in the spring of 1969.

The diversions into the Culbertson Canal were above normal to irrigate 8,845 acres of Frenchman Valley Irrigation District lands and 10,945 acres in the H & RW Irrigation District. These acreages represented over 90% of the district lands with service available. The irrigated acreages in these districts were slightly less in 1969 than the previous year because of the Government feed grain program.

The Bureau of Reclamation cooperates with the Nebraska Game and Parks Commission in the operation of Enders Dam when possible. The water surface in the reservoir gradually rises usually until late June each year when large releases are started for irrigation purposes. The seepage from Enders Reservoir maintains a desirable minimum flow to preserve fisheries and improve fishing below the dam. The manager of the Frenchman Valley and H & RW Irrigation Districts advises the Commission of canal operations and chemical treatment plans.

Meeker-Driftwood, Red Willow, and Cambridge Units, Frenchman-Cambridge Division in Nebraska. The Bureau of Reclamation, as suggested by the Nebraska Game and Parks Commission, regulates Trenton Dam and Swanson Lake, Red Willow Dam and Hugh Butler Lake, and Medicine Creek Dam and

Harry Strunk Lake in the spring of each year when possible to enhance optimum spawning of northern and walleye pike. Desirable minimum flows for fishing purposes below these dams are maintained by seepage. The Frenchman-Cambridge Irrigation District advises the Game and Parks Commission of canal operations and chemical applications.

The development period of Block II of Frenchman-Cambridge Irrigation District ended December 31, 1969. The irrigation of 36,940 acres in 1969 indicates development of 85% of the district irrigable acreage. The development period for Block III will end in 1974.

Trenton Dam and Swanson Lake. The inflow into Swanson Lake and the precipitation at Trenton Dam in 1969 were about normal. The operations of Trenton Dam and Swanson Lake prevented \$1,000 of flood damages during 1969.

The diversions were above normal to irrigate 13,591 acres under the Meeker-Driftwood Canal System in 1969, and the Frenchman-Cambridge Irrigation District estimates that it will deliver water to 15,100 acres in 1970.

Under the Bartley Canal System, the diversions were slightly below normal to irrigate 5,425 acres in 1969, and the District estimates that 5,950 acres will receive water in 1970.

The Water Use Study, initiated in 1964 by the Bureau of Reclamation, in an area served by the Meeker-Driftwood Canal System, was completed this year. The Frenchman-Cambridge Irrigation District and the appropriate landowners and tenants cooperated throughout the entire study period.

Red Willow Dam and Hugh Butler Lake. In 1969, the precipitation was considerably above normal and the inflow was nearly equal to the reasonable maximum forecast. There were, however, no flood damages prevented in 1969 as there were no flood creating storms.

The diversions into Red Willow Canal were about normal to irrigate 3,546 acres. The District estimates that 3,600 acres will be irrigated in 1970.

Medicine Creek Dam and Harry Strunk Lake. The 1969 precipitation and the inflow into Harry Strunk Lake were considerably above normal. The operation of Medicine Creek Dam and Harry Strunk Lake prevented \$6,000 in flood damages.

Even though the precipitation over the irrigated area was much above normal, the diversions into Cambridge Canal System were above normal to irrigate 14,378 acres. The Frenchman-Cambridge Irrigation District estimates that 14,350 acres will receive water in 1970.

The District experienced considerable difficulty with the operation of Cambridge Diversion Dam in 1969. Excessive releases from Harry Strunk Lake were required during late July and August to maintain a head at the canal gates to divert design capacity into Cambridge Canal. This created a continuous by-pass of about 50 second-feet over the ogee section of the diversion dam. The District plans to modify the canal gate training wall and to raise the crest of the ogee section with sandbags prior to the start of the 1970 irrigation season.

Almena Unit, Kanaska Division in Kansas. In 1969, the precipitation at Norton Dam was above normal but generally below normal over the Prairie Dog Creek drainage area above Norton Reservoir. The inflow into the reservoir was slightly below normal.

The diversions were below normal as a result of above normal precipitation over the District area during the irrigation season. The Almena Irrigation District No. 5 delivered water to 5,262 acres that were irrigated in 1969. Even though the Almena System has only been operated since 1967, 98% of the District land was irrigated in 1969. The District has estimated that all the District acreage may receive water in 1970. The Norton Reservoir operation study indicates that a shortage will occur under reasonable minimum inflow conditions.

The City of Norton used 645 acre-feet of water in 1969. Its water service repayment contract provides for a maximum of 1,600 acre-feet annually. Under Kansas law, municipal use has a priority over irrigation use and about 600 acre-feet of storage in the bottom of the conservation capacity of Norton Reservoir is reserved for the City of Norton, Kansas.

The Kansas Forestry, Fish and Game Commission has requested the Bureau of Reclamation to operate the reservoir when possible for enhancement of fish spawning and the best possible fishing conditions. The normal plan of operation during the spring months provides for a nearly stable or gradual rising pool level. The seepage below Norton Dam provides Prairie Dog Creek with small continuous flows which enhances fishing conditions. The Almena Irrigation District has been requested to advise the Commission of canal operations and chemical applications.

Franklin and Superior-Courtland Units, Bostwick Division in Nebraska. The inflow into Harlan County Reservoir was about normal and the precipitation at Harlan County Dam was above normal. The operations of Harlan County Dam and Reservoir prevented \$14,000 of flood damages during 1969.

The diversions into the canal systems in the Bostwick Irrigation District in Nebraska in these units were below normal. There were 18,538 acres irrigated in 1969, which was 81% of the district land with service available. The District estimates that 21,000 acres will be

irrigated in 1970. The Nebraska Game and Parks Commission is advised by the District of its canal operations and chemical applications.

The Bostwick Irrigation District in Nebraska has experienced difficulties with the pumping station of Franklin South Side Pump Canal in recent years. They have been unable to obtain design capacity in the canal if the flows in the Republican River were not in excess of the irrigation demands of Franklin South Side Pump and Superior and Courtland Canals. During the period November 24 through December 1, 1969, the Bureau of Reclamation (in conjunction with the Irrigation District) made a special study to collect pertinent engineering data. No conclusions have been drawn; however, the Irrigation District will clean the forebay prior to the 1970 irrigation season, and additional studies will be made early this spring.

Courtland Unit, Bostwick Division in Kansas. The inflow into Lovewell Reservoir from White Rock Creek was much above normal; consequently, the requirements for diversions through Courtland Canal from Republican River flows and Harlan County storage were below normal.

Since the water supply in 1969 was above normal, the pool level of Lovewell Reservoir was maintained near the top of the conservation capacity until Labor Day to benefit the recreation interests. During September, the pool level was lowered to the sill of the spillway gates to facilitate the painting of the gates. The maintenance on the spillway gates will be completed this spring. The conservation capacity will be filled by late May or early June in 1970.

The Kansas-Bostwick Irrigation District No. 2 and the Bureau of Reclamation cooperate with the Kansas Forestry, Fish and Game Commission by maintaining a minimum inflow of 20 c.f.s. when possible into Lovewell Reservoir from Courtland Canal. The minimum flow to provide better fishing conditions in White Rock Creek below Lovewell Dam is maintained by seepage. The District has been requested to advise the Commission of their canal operations and chemical applications.

The diversions were about normal to irrigate 25,433 acres of Kansas-Bostwock Irrigation District lands. This is 65% of the irrigable lands with service available. The District estimates that 28,000 acres will receive water in 1970.

CHAPTER IV - SMOKY HILL RIVER BASIN

The Solomon Division. During planning, 13,300 acre-feet in Waconda Lake were allocated to flood control to provide for additional space in the conservation pools of Kirwin and Webster Reservoirs of 4,200 and 9,100 acre-feet, respectively. Pending formal approval between the Corps of Engineers and Bureau of Reclamation of an exchange of space between Waconda Lake and the other two reservoirs based on asbuilt capacities, the operating levels of Kirwin and Webster during the interim period will be as follows:

		Top of Conse	rvation Poo	1 Capacity	
	-	Previous		Current	
Reservoi	ir Elev.	Content(ac	ft.)Elev.	Content(acft.)	Difference
Kirwin	1728.40	95,180	1729.25	99,435	+4,255 acft.
Webster	1889.60	67,100	1892.15	76,235	+9,135 acft.
					13,390 acft.

Kirwin Unit. The 1969 precipitation was above normal in the drainage area above Kirwin Reservoir and the inflow was greater than the most probable forecast. The operation of Kirwin Dam and Reservoir prevented \$2,000 in flood damages in 1969.

As requested by the Kansas Forestry, Fish and Game Commission, the operation of Kirwin Dam during the spring months enhances the spawning of fish in the reservoir area.

The releases into Kirwin Canal were about normal for 1969. Water was delivered to 9,554 acres, which is 84% of lands with service available. The Kirwin Irrigation District estimates that 9,875 acres will receive water in 1970.

Webster Unit. The precipitation over the South Fork of the Solomon River drainage area above Webster Reservoir was generally above normal in 1969. The carryover storage in Webster Reservoir was below normal in the spring of 1969 and the threat of a serious shortage of irrigation water was relieved by above normal inflows into the reservoir and above normal precipitation over the irrigated area. The water supply for 1970 is considered good although minor shortages may occur late in the season if dry conditions prevail. The operation of Webster Dam and Reservoir prevented \$1,000 in flood damages in 1969.

The Kansas Forestry, Fish and Game Commission operates a portable fish hatchery at the Webster Dam spillway stilling basin during March, April, and May each year. Unless absolutely necessary for flood releases, the spillway gates are not operated during this period. The operation of Webster Dam during the spring months enhances the spawning of fish in the reservoir area.

The diversions into Osborne Canal were about normal for 1969. Water was delivered to 6,951 acres or 82% of the district area. The Webster Irrigation District estimates that about 7,000 acres will be irrigated in 1970.

Glen Elder Unit. All major construction in relation to Glen Elder Dam and Waconda Lake is expected to be completed by the spring of 1970 when the dam will be in full operation. The inflow in 1969 was well above normal. During March and April, heavy inflow created by snowmelt runoff and by rainfall during the summer was controlled by the operation of Glen Elder Dam and Waconda Lake. There were \$606,000 of flood damages prevented by these operations. Releases were made as necessary for the City of Beloit, pollution abatement, and regulation of the pool level to facilitate the Glen Elder construction program.

The City of Beloit required special releases of 130 acre-feet during August and September of 1969. Special releases have also been made during January of 1970. All releases to date for the City of Beloit have been for water quality control at the city intake rather than for a water supply. The requests of the City of Beloit will be met in full in 1970.

Surplus storage from Waconda Lake will be made available for purchase in 1970 if requested by natural flow appropriators in the Solomon River Valley downstream from Glen Elder Dam.

Cedar Bluff Unit, Smoky Hill Division. In 1969, the precipitation at Cedar Bluff Dam and the inflow into the reservoir were above normal. There were no storage releases required for the City of Russell, Kansas. There were 2,624 acre-feet diverted into the Cedar Bluff National Fish Hatchery, of which 1,174 acre-feet were passed through the facilities and returned to the Smoky Hill River. The return flows from the Fish Hatchery and the seepage from Cedar Bluff Dam preserve fisheries and enhance fishing in the Smoky Hill River. The operation of this dam and reservoir prevented \$1,000 in flood damages in 1969.

The releases to Cedar Bluff Canal for 1969 were slightly below normal. Water was delivered to 5,742 acres, which is 87% of the Cedar Bluff Irrigation District area. The Cedar Bluff Irrigation District estimates that 5,900 acres will receive water in 1970.

CAPACITY ALLOCATIONS 1/ LIVE FLOOD SURCHARGE RESERVOIR DEAD CONSERVATION CONTROL CAPACITY Box Butte - Elevation Ft. 3969.0 4007.0 4016.0 Total Acre-feet 640 31,060 47,800 ___ 640 Net Acre-feet 30,420 16,740 Merritt - Elevation Ft. 2875.0 2946.0 2949.8 74,486 Total Acre-feet 1,614 86,134 Net Acre-feet 1.614 72,872 11,648 Sherman - Elevation Ft. 2118.5 2161.3 2169.7 Total Acre-feet 66,246 3,839 92,670 62,407 Net Acre-feet 3,839 26,424 Bonny - Elevation Ft. 3635.5 3672.0 3710.0 3736.2 Total Acre-feet 1,418 41,340 170,160 348,390 Net Acre-feet 1,418 39,922 128,820 178,230 Swanson Lake - Elevation Ft. 2710.0 2752.0 2773.0 2785.0 Total Acre-feet 4,101 120,160 253,950 361,620 Net Acre-feet 4,101 116,059 107,670 133,790 Enders - Elevation Ft. 3080.0 3112.3 3127.0 3129.5 44,480 Total Acre-feet 8,467 74,520 80,730 Net Acre-feet 8,467 36,013 30,040 6,210 Hugh Butler - Elevation Ft. 2552.0 2581.8 2604.9 2628.0 Lake Total Acre-feet 6,313 37,776 86,627 163,415 Net Acre-feet 31,463 6,313 48,851 76,788 Harry Strunk - Elevation Ft. 2335.0 2366.1 2386.2 2408.9 Lake Total Acre-feet 4,911 37,141 89,313 195,997 Net Acre-feet 4,911 32,230 52,172 106,684 Norton - Elevation Ft. 2275.0 2304.3 2331.4 2341.0 Total Acre-feet 2,718 35,935 134,738 193,023 2,718 Net Acre-feet 98,803 33,217 58,285 Harlan County - Elevation Ft. 1885.0 1946.0 1973.5 1975.5 Total Acre-feet 929 342,560 840,561 887,373 Net Acre-feet 929 341,631 498,001 46,812 Lovewell - Elevation Ft. 1562.1 1582.6 1595.3 1610.3 Total Acre-feet 5,054 41,690 92,150 186,290 Net Acre-feet 5,054 36,636 50,460 94,140 Kirwin - Elevation Ft. 1693.0 1729.3 1757.3 1773.0 Total Acre-feet 6,385 99,435 314,550 513,020 Net Acre-feet 6,385 219,370 93,050 198,470 Webster - Elevation Ft. 1855.5 1892.2 1923.7 1938.0 Total Acre-feet 2,184 76,235 260,740 401,650 Net Acre-feet 2,184 74,051 193,640 140,910 Waconda Lake - Elevation Ft. 1407.8 1455.6 1488.3 1492.9 Total Acre-feet 1,208 238,251 973,554 1,146,261 Net Acre-feet 1,208 237,043 735,303 172,707 Cedar Bluff - Elevation Ft. 2090.0 2144.0 2166.0 2192.0 Total Acre-feet 8,261 185,090 376,950 730,180 Net Acre-feet 8,261 176,829 191,860 353,230 Total Storage (A.F.) 58,042 1,459,361 5,437,285 3,670,264 Total Net Acre-feet 58,042 1,401,020 2,384,223 1,598,131

^{1/} Includes space for sediment storage.

	1	ACREAGE DAT	A		WA	TER DATA (A	cre-Feet)	
	Service	Actually	Planned	1969	1970	1970	1970	Delivered
	Avail-	Irrig.	Irrig.	Diver-	Dry	Norm.	Wet	To
Canal System	able 1/	1969 2/	1970	sions	Yr.	Yr.	Yr.	Farms
			NON-PRO	JECT				
Hale Ditch	700	700	700	3,068	5,200	3,800	2,600	
Warren Act		65		196	345 * I= 43 B			
Middle Loup P.P.I.D.	11,800	10,795	11,800	25,235	41,890	26,670	17,700	
TOTAL NON-PROJECT	12,500	11,560	12,500	28,499	47,090	30,470	20,300	
		MIRAGE		RIGATION DI	STRICT			
Mirage Flats	11,662	10,795	10,800	19,916	34,200	26,000	21,600	11,180
				GATION DIS				
Ainsworth	33,960	22,666	26,000	50,793	98,900	72,700	46,300	36,273
				LAMATION DI				
					Irrigation	District)		
Sargent	13,349	13,144	10,500	24,286	37,400	23,800	15,800	11,449
Farwell	47,925	34,726	35,000	73,313	95,700	64,500	43,400	35,978
TOTAL	61,274	47,870	45,500	97,599	133,100	88,300	59,200	47,427
	2			IRRIGATION				
Culbertson	9,600	8,845	8,200	21,469	23,600	16,300	10,300	13,817
				ATION DIST				
Culbertson Extension	11,490	10,945	11,000	31,804	31,800	22,000	13,800	17,893
			N-CAMBRIDG		ON DISTRICT			
Meeker-Driftwood	16,440	13,591	15,100	34,001	40,700	28,800	17,000	21,862
Red Willow	4,150	3,546	3,600	7,683	9,300	6,400	3,800	4,321
Bartley	7,000	5,425	5,950	9,828	15,300	10,600	6,200	6,776
Cambridge	15,600	14,378	14,350	26,293	36,300	24,300	14,200	16,755
TOTAL	43,190	36,940	39,000	77,805	101,600	70,100	41,200	49,714
47	5 050			ATION DIST	The state of the s		-	
Almena	5,350	5,262	5,350	9,327	16,000	10,000	6,000	6,948
	/-				IN NEBRASKA			
Franklin	11,267	8,868	10,075	21,554	33,800	22,500	11,300	8,317
Naponee	1,533	1,389	1,725	2,222	5,800	3,800	2,000	1,571
Franklin Pump	2,125	1,956	2,000	1,806	6,800	4,400	2,200	1,235
Superior	6,021	4,793	5,500	10,262	16,400	11,800	5,800	3,945
Courtland	1,841	1,532	1,700	1,015	4,300	3,300	1,600	876
TOTAL	22,787	18,538	21,000	36,859	67,100	45,800	22,900	15,944

TABLE 2 IRRIGATION DATA

	A	CREAGE DAT	A		WA	TER DATA (A	cre-Feet)	
	Service Avail-	Actually Irrig.	Planned Irrig.	1969 Diver-	1970 Dry	1970 Norm.	1970 Wet	Delivered
Canal System	able 1/	1969 2/	1970	sions	Yr.	Yr.	Yr.	Farms
Courtland		KANSAS	-BOSTWICK]	RRIGATION	DISTRICT			
Above Lovewell Res.	12,400	8,515	9,500	20,762	24,600	17,700	8,600	7,941
Below Lovewell Res.		16,918	18,500	34,036	47,700	34,500	16,700	16,369
TOTAL	39,388	25,433	28,000	54,798	72,300	52,200	25,300	23,860
			THE RESERVE OF THE PARTY OF THE	ATION DIST	The same of the sa			
Kirwin	11,435	9,554	9,875	19,626	26,500	17,800	11,000	14,230
0.1	0 500		EBSTER IRRI					
Osborne	8,500	6,951	7,000	14,731	21,800	15,000	9,200	8,207
				NAME AND ADDRESS OF THE OWNER, WHEN PERSONS ASSESSED.	DISTRICT			
Cedar Bluff	6,600 <u>3</u> /	5,742	5,900	11,016	18,200	12,800	8,200	6,522
TOTAL FOR DISTRICTS	265,236	209,541 MUI	217,625 NICIPALITIE	445,743 S AND INDU	645,100 JSTRIAL	449,000	275,000	252,015
City of Norton				645				
City of Beloit				130				
City of Russell				. 0				
Midwest Oil Corporation	on			618				
Livingston Oil Company	У			20				
Cedar Bluff National	Fish Hatch	ery		2,624				
TOTAL				4,037				

^{1/} Acres estimated for official program documents as of June 30, 1970.

^{2/} Determined by crop census.

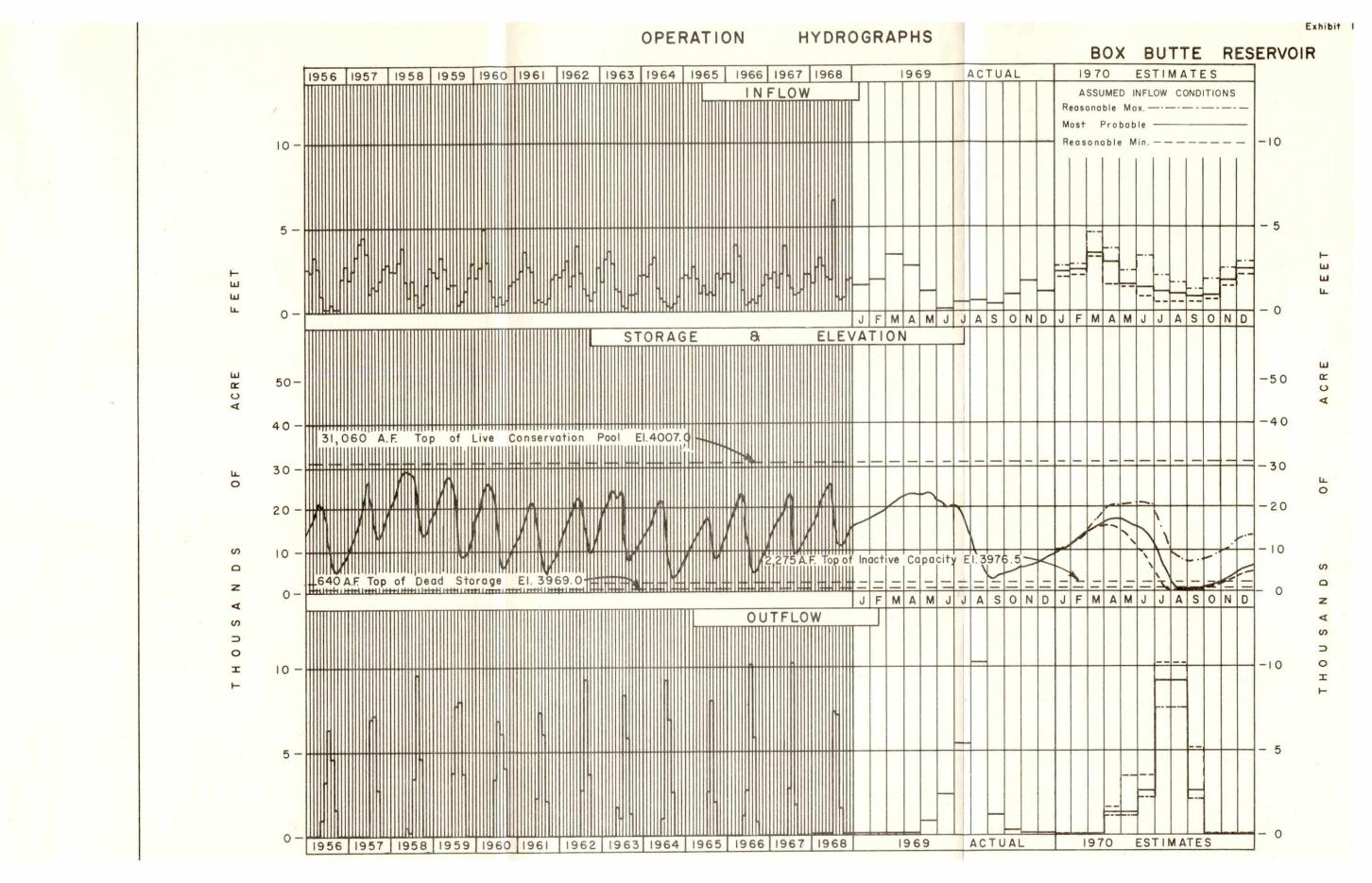
^{3/} 6,823 acres assessed on tax rolls.

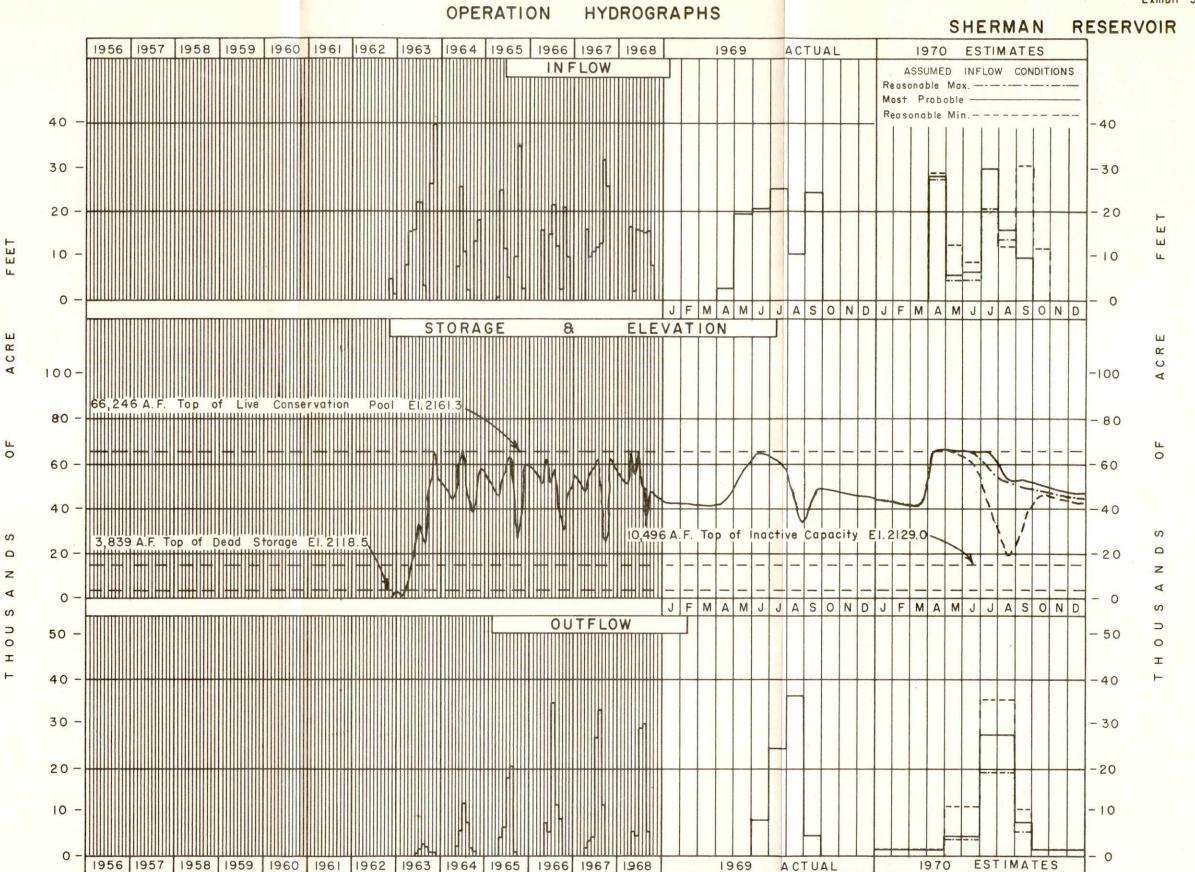
TABLE 3
OTHER USES AT FEDERALLY CONSTRUCTED STORAGE AND DIVERSION DAMS
NIOBRARA, LOWER PLATTE AND KANSAS RIVER BASINS
During 1969
Annual Totals

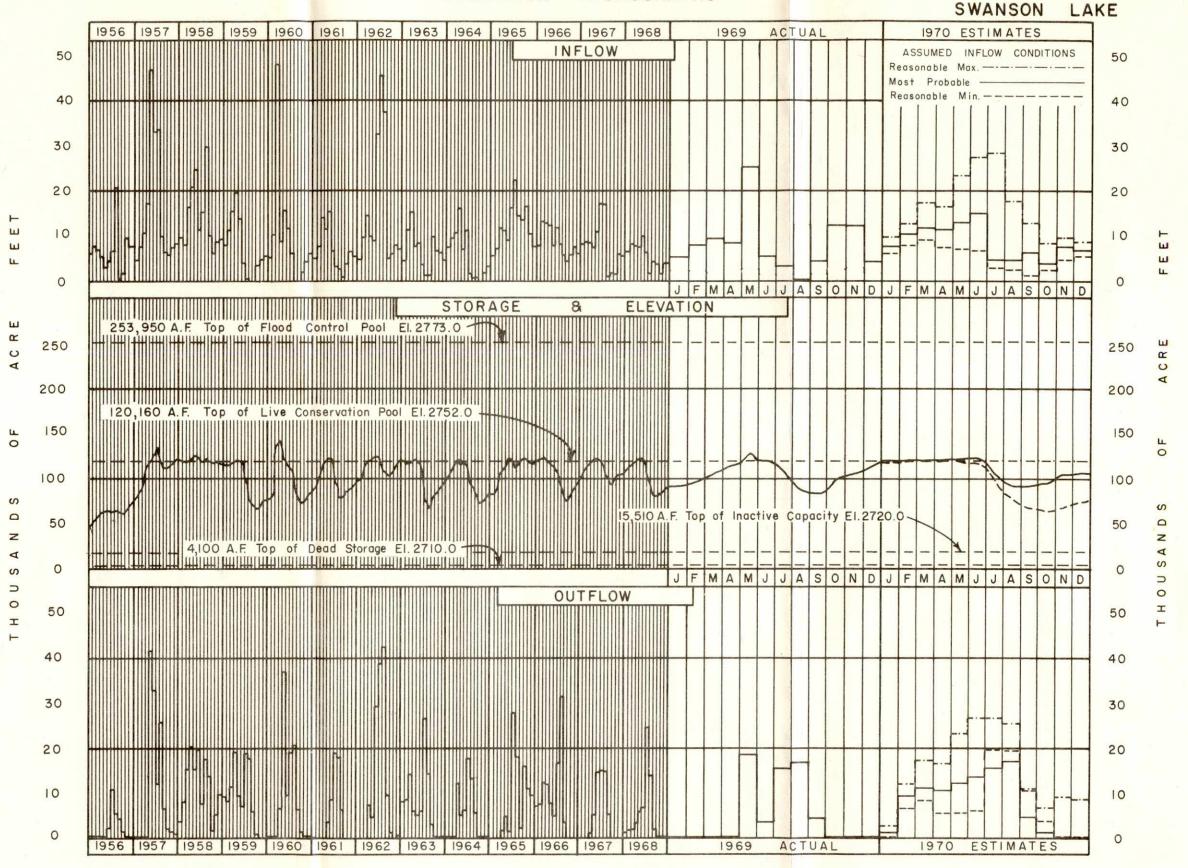
		Cars	Water	Sport	Se	eason Take
Features	Visitors	in Area	Craft	Fish Caught	Duck	s Gees
Colorado						
Bonny Reservoir	244,755	69,930	5,640	50,000	900	0
Kansas						
Norton Reservoir	235,626	54,290	4,091	125,000	350	25
Almena Diversion Dam	2,185	728	0	350	25	0
Lovewell Reservoir	179,078	42,637	3,500	17,000	75	20
Kirwin Reservoir	154,970	51,139	7,925	75,000	250	475
Webster Reservoir	63,185	19,751	520	20,000	175	150
Woodston Diversion Dam	2,075	700	0	300	0	0
Waconda Lake	54,000	13,500	520	30,000	3,000	30
Cedar Bluff Reservoir	244,855	62,689	2,900	45,000	450	25
Nebraska						
Box Butte	26,400	7,100	1,200	8,250	Not	Reported
Merritt Reservoir	38,175	10,400	2,805	20,000		Reported
Milburn Diversion Dam	4,675	850	0	2,000		Reported
Arcadia Diversion Dam	12,975	4;190	0	6,500		Reported
Sherman Reservoir	112,800	48,550	15,860	47,500		Reported
Swanson Lake	132,873	33,935	4,250	138,360	600	35
Enders Reservoir	18,207	4,926	931	10,632	300	10
Hugh Butler Lake	180,837	45,157	8,500	99,099	175	0
Harry Strunk Lake	51,412	14,545	1,985	44,210	100	0
Harlan County Reservoir	933,303	298,929		150,000		Reported
TOTAL REPORTED	2,692,383	783,946	60,627	889,201	6,400	770

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

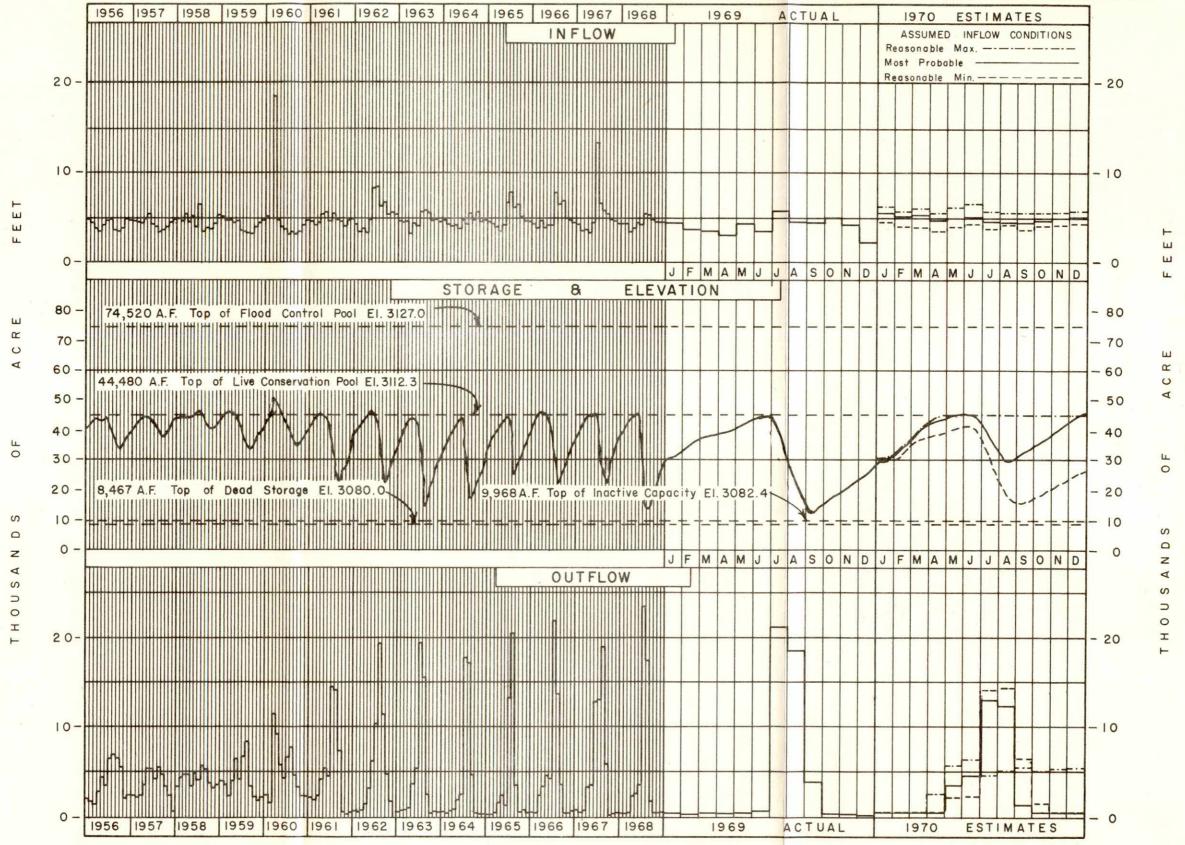
Water Craft = Boating days which includes rentals, inboards, outboards, rowboats and sailboats.







ENDERS RESERVOIR



HARLAN COUNTY RESERVOIR

