GEORGE D. HOLTON

CREEL CENSUS AND EXPENDITURE STUDY, NORTH FORK SUN RIVER, MONTANA, 1951

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UNITED STATES DEPARTMENT OF THE INTERIOR
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Fish and Wildlife Service, John L. Farley, Director

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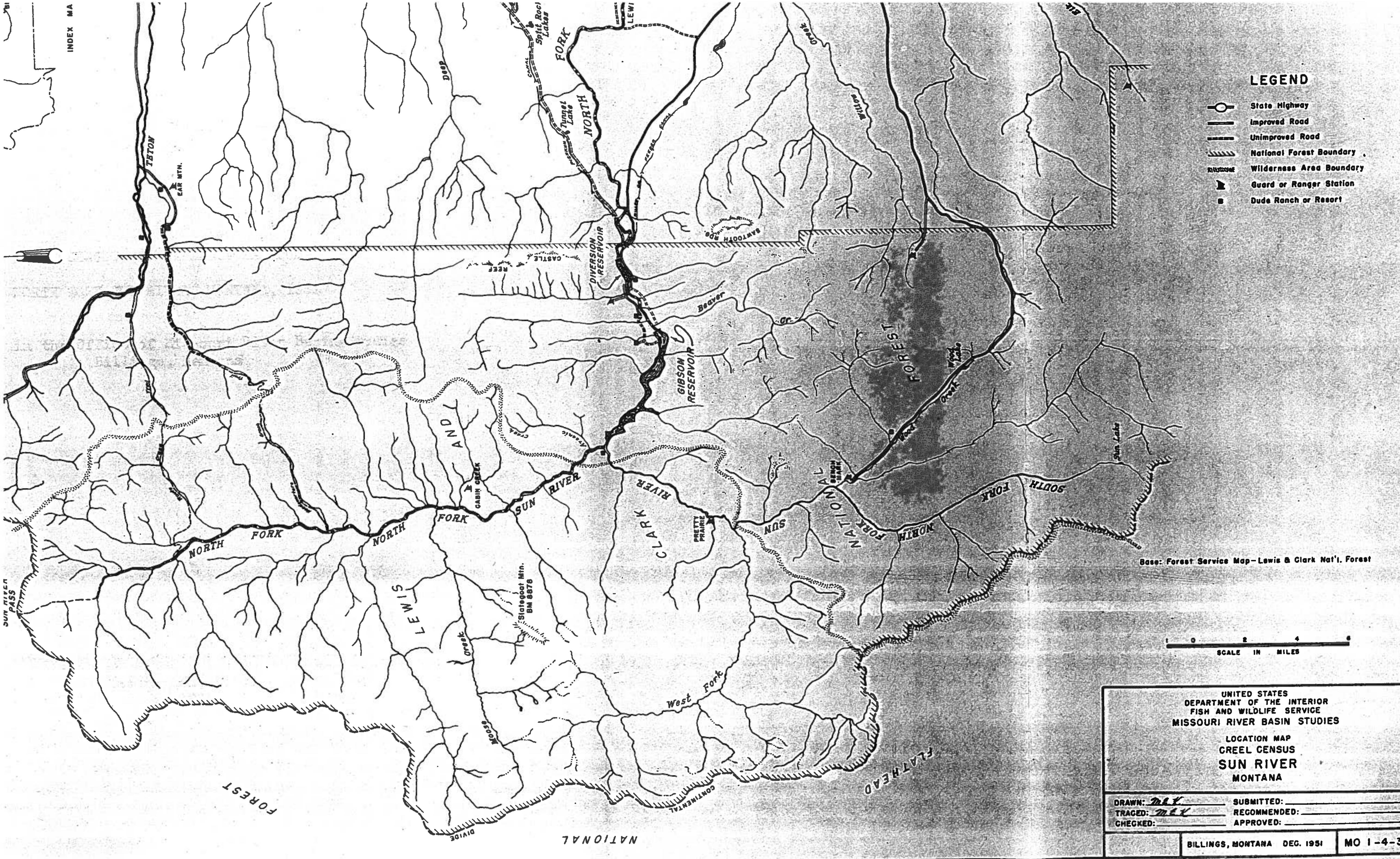

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
MISSOURI RIVER BASIN STUDIES

LOCATION MAP
CREEL CENSUS
SUN RIVER
MONTANA

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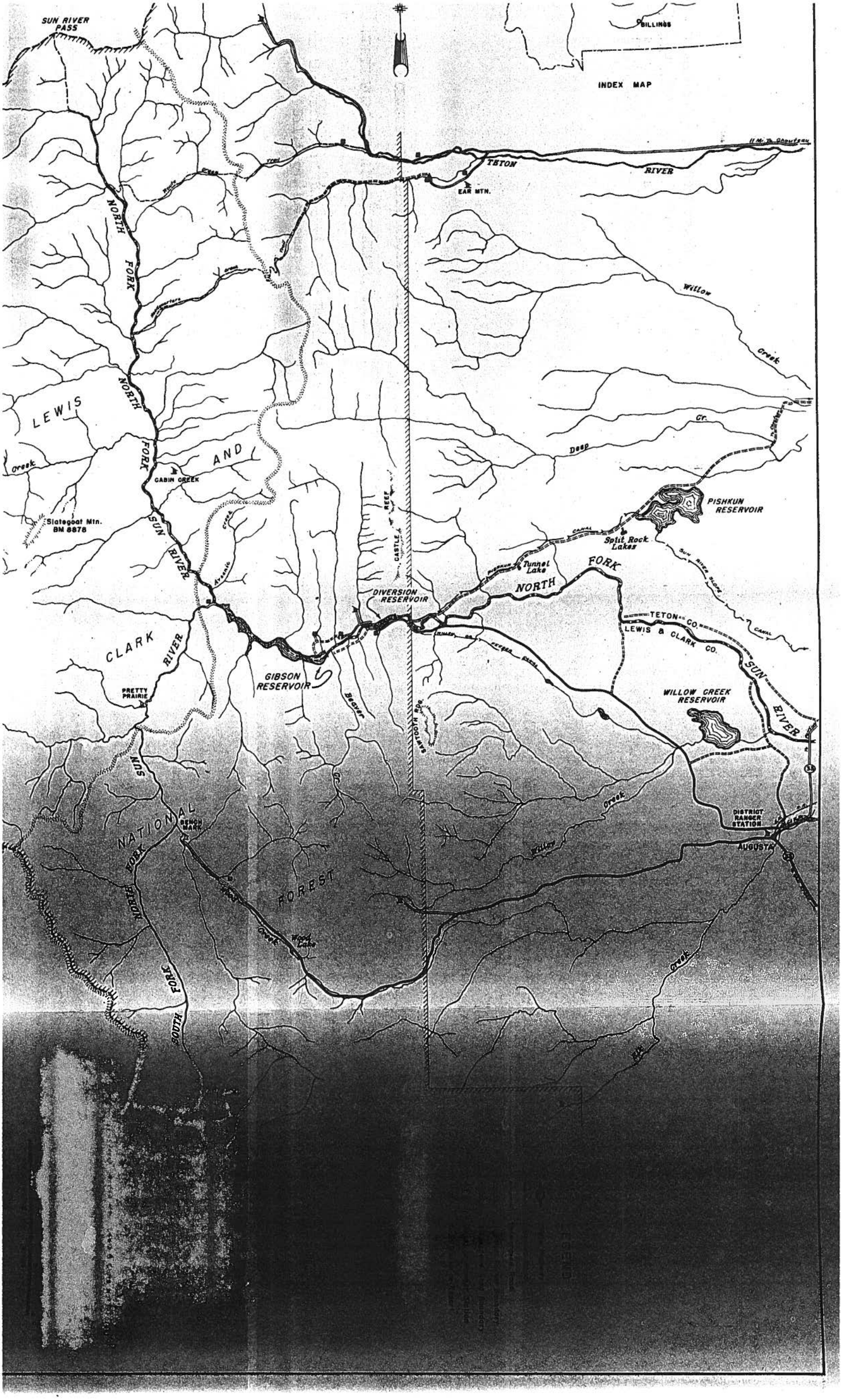
BILLINGS, MONTANA DEC. 1951 MO 1-4-3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WILLOW CREEK RESERVOIR
SUN RIVER
DISTRICT RANGER STATION
AUGUSTA
Willow Creek
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SUN RIVER NATIONAL FOREST
SOUTH FORK TETON

CREEL CENSUS AND EXPENDITURE STUDY, NORTH FORK SUN RIVER, MONTANA, 1951

A creel census was conducted on the North Fork Sun River and several associated bodies of water in Montana during 1951. This study was part of a general program inaugurated by the Office of Missouri River Basin Studies, Fish and Wildlife Service, to provide information concerning fishing pressure, yield, and comparative worth of various types of fisheries in the Missouri River Basin.

The present paper is concerned with fisherman-expenditures, fisherman-use, and yield of the fisheries involved, although some data on other aspects of the fishery were obtained.

The cooperation of the U. S. Bureau of Reclamation, the U. S. Geological Survey, the U. S. Forest Service, the Montana Fish and Game Department, and the Greenfields Irrigation District in various phases of the work is appreciated.

DESCRIPTION

Waters included in this study were (1) the North and South Forks of the North Fork Sun River (which unite at the head of Gibson Reservoir), (2) the North Fork Sun River between Gibson Dam and Diversion Reservoir, and between Diversion Dam and the confluence of the river with the outlet canal from Willow Creek Reservoir, (3) Gibson Reservoir, (4) Diversion Reservoir, (5) Pishkun Canal, (6) Tunnel Lake, (7) Pishkun Reservoir, (8) Split Rock Lakes, (9) Willow Creek Reservoir, (10) Beaver Creek, and (11) Wood Lake (see map).

Gibson, Diversion, Pishkun, and Willow Creek Reservoirs and Pishkun Canal were constructed by the U. S. Bureau of Reclamation between 1906 and 1911, and are now jointly owned by the Bureau of Reclamation and the Greenfields Irrigation District, a local water-users association.

The North Fork Sun River is on the eastern slope of the Rocky Mountains in Lewis and Clark County and Teton County, Mont. The two main tributaries of the North Fork Sun River, the North and South Forks, flow through mountain valleys which more or less parallel the Continental Divide (fig. 1). From the junction of these main tributaries at the head of Gibson Reservoir, the North Fork Sun River flows easterly for 7 miles through the reservoir, thence 4 miles through a steep, narrow canyon, and then out onto the plains for about 25 miles, where it joins with the South Fork Sun River to form the Sun River, just below the town of Augusta.

Fig. 1.--A typical section of the North Fork of the North Fork Sun River.

The North and South Forks of the North Fork Sun River are medium-altitude streams (about 4,730 feet m.s.l. at their confluence); each has an abundance of pools and riffles and a width of about 60 feet in the lower reaches. Records indicate a marked similarity in the flow of the two streams. In 1951 the combined flow at their confluence reached the maximum in May, when the average flow for the month was 4,253 second-feet. The minimum monthly flow of 304 second-feet occurred in March. These two streams drain an area of about 1,000 square miles. The principal tributaries are Moose Creek on the North Fork and the West Fork on the South Fork, but there are many other named and unnamed tributaries in the drainage. Beaver dams are found on many of the smaller creeks. Although the river below the junction of the two forks has been considerably modified by water-development projects, the tributary streams that originate the North Fork Sun River are essentially in a natural state. The upper slopes of the headwater valleys are characterized by stands of lodgepole pine, Douglas-fir, and spruce. Both streams lie within the Lewis and Clark National Forest. A part of the South Fork and all of the North Fork are within the Bob Marshall Wilderness Area. This headwater area can be reached by boat through Gibson Reservoir, or by hiking or horseback. The North Fork may be reached also by trails entering the area from the headwaters of the Teton River at the Ear Mountain Ranger Station, and

the South Fork may be reached by way of a graded road which terminates at the Bench Mark Ranger Station. Pack trails follow many of the larger tributary streams. The K-L Ranch, with facilities at the confluence of the North and South Forks and on nearby Arsenic Creek, is open to guests throughout the summer.

Gibson Reservoir, on the North Fork Sun River just below the confluence of the two principal tributary streams, is a storage reservoir. It is about 7 miles long and has a maximum width of approximately 1 mile. It has a surface area of 1,360 acres at maximum capacity. The maximum depth is about 180 feet; normally about four-fifths of the reservoir is over 30 feet deep. The reservoir is subject to considerable fluctuation of water level. For example, during the past 6 years, the maximum annual fluctuation was 116 feet (1949) and the minimum was 29 feet (1951). In 1951 the water level dropped 28 feet in August, after having risen more or less consistently.

Gibson Reservoir lies within the Lewis and Clark National Forest, at elevation 4,729 feet. It is surrounded by rocky ridges, partly covered with coniferous growth. It can be reached at the dam by a steep, narrow, rocky road, and is accessible by foot or horseback from a pack trail which skirts the north shore. Boats may be used on the reservoir providing they are at least 14 feet in length and have a beam of 48 inches.

That part of the North Fork Sun River which lies between Gibson Dam and Diversion Reservoir is 3 miles long and about 80 feet wide. Here the river flows through a narrow canyon and is characterized by large, deep pools and turbulent riffles. The flow is regulated by discharge from Gibson Dam. During 1951 the flow varied from 234 second-feet in February to 4,060 second-feet in May; during the study period the flow gradually decreased from the 4,060 second-feet in May to 407 second-feet in September. Several streams, the largest of which is Beaver Creek (about 15 feet wide), enter this reach of the river. All streams entering from the north were closed to fishing, and all on the south side were open to fishing. Of those entering from the south, Beaver Creek was the most extensively used by fishermen. A forest road extends up Beaver Creek a distance of about 2 miles. Large areas of the canyon and adjacent gulches are barren of forest cover because of the rocky terrain and past fires.

Diversion Reservoir, 3 miles downstream from Gibson Reservoir, is a long, narrow, 100-acre impoundment. Water in this reservoir is maintained at a relatively stable level. Diversion Reservoir is in the same canyon as the river between it and Gibson Reservoir and therefore has a similar setting. It is accessible by a road along the south shore.

The 22 miles of the North Fork Sun River (fig. 2), from Diversion

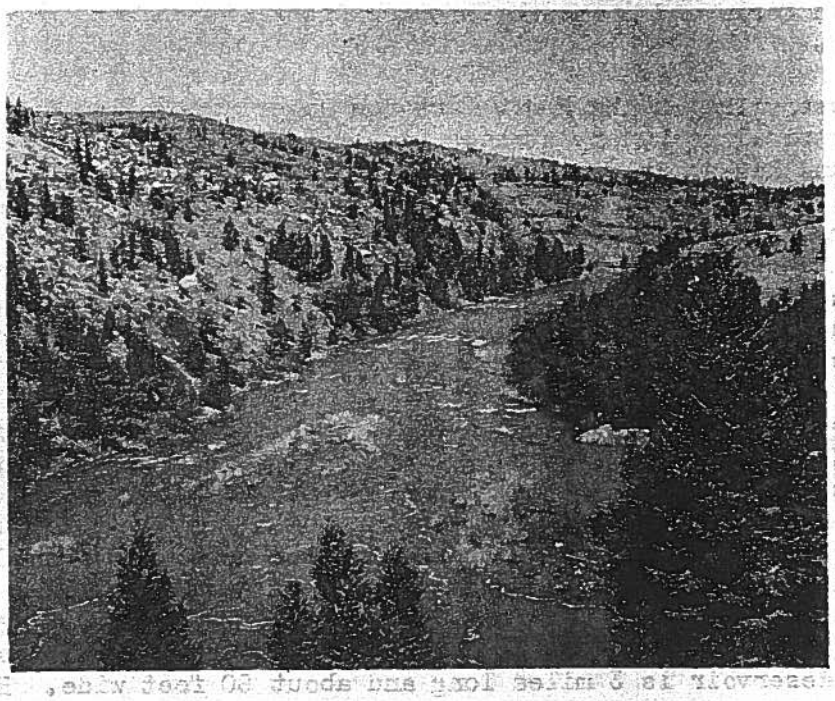

Fig. 2.--North Fork Sun River below Diversion Dam.

Dam to its confluence with the Willow Creek Reservoir outlet canal, was included in the census area. The average width of this reach of stream is about 120 feet, and the gradient is about 18 feet per mile.

Although some of the substantial seepage from Pishkun Canal enters this section of stream through the few small tributaries, the flow is largely controlled by releases from Diversion Reservoir. During water year 1951, the extremes in flow just below Diversion Dam were 234 second-feet in February and 3,526 second-feet in May. Flows of between 3,526 and 1,517 second-feet were maintained during May, June, and July but were dropped to less than 500 second-feet in August, September, October, January, February, and March. Alternate riffles and pools are characteristic of this section of the river. From Diversion Reservoir the river flows through a narrow band of wooded foothills, thence through rolling prairie-type terrain. A fringe of cottonwoods and willows grows along most of the lower river. The upper 3 or 4 miles is accessible by a graded road, while the rest is accessible in all but the most adverse weather by a network of trails.

Pishkun Canal, which carries water from Diversion Reservoir to Pishkun Reservoir, is 12 miles long and has a capacity of 1,200 second-feet. Since the intake to Pishkun Canal is not screened, fish enter the canal from Diversion Reservoir and large numbers are lost when the canal is drained each fall (Fish and Wildlife Service, 1952b). The canal extends through the foothills and into the prairie. A maintenance road parallels the canal throughout its length.

Pishkun Reservoir is an offstream impoundment on the plains about 12 miles northeast of Diversion Reservoir. It has a surface area of 1,550 acres at maximum elevation. The water level in Pishkun remains fairly stable during most of the year, although a rise occurs each year beginning about May. The water level rose about 10 feet in May 1951 and remained fairly stable until July, when it dropped about 5 feet. Maximum and minimum annual fluctuations during the past 7 years were 16 feet (1949) and 9 feet (1946), respectively. Pishkun Reservoir is surrounded by grasslands. It is accessible by ranch roads from Augusta, the maintenance road along Pishkun Canal, and a graded road from Choteau.

Fig. 3.--View of Willow Creek Reservoir showing Willow Creek Dam in foreground.

Willow Creek Reservoir is a 1,400-acre impoundment (fig. 3) on the plains near Augusta, about 15 miles southeast of Gibson Reservoir and about 1 mile off the graded road between Augusta and Diversion Reservoir. Water stored in this reservoir is released, as needed, to satisfy downstream water rights of 300 second-feet for irrigation. Water enters the reservoir from Willow Creek and Willow Creek Feeder Canal, which stems from Pishkun Canal a short distance below Diversion Dam. Willow Creek Feeder Canal has a maximum capacity of 500 second-feet and is 7.5 miles long.

Tunnel Lake, adjacent to Pishkun Canal, about 6 miles from Pishkun Reservoir, is a former pothole. It now has a surface area of about 30 acres and a maximum depth of about 20 feet. Natural runoff into Tunnel Lake is now intercepted by Pishkun Canal, but this is more than replaced by seepage from the canal. The water level rose about 4 feet between May and September in 1951.

The chain of ponds known as Split Rock Lakes also is near Pishkun Canal, about 2 miles above Pishkun Reservoir. Of the many ponds, which are from 3 to 30 acres in size, only 3 or 4 of the largest are fished to any extent. Before the construction of Pishkun Canal, the Split Rock Lakes were shallow potholes with an undependable water supply; seepage from the canal now supplements the normal inflow and assures relatively stable water levels.

There are a few other small lakes in the watershed which provide fishing. Wood Lake, 2 20-acre lake near Bench Mark, is the most important of these. Actually, Wood Lake is on a tributary of the South Fork of the North Fork Sun River. A short creel census was made at Wood Lake during the course of the study. Other lakes in the watershed were censused but, because of limited use, data were included with that for adjacent streams.

Augusta, at the lower extremity of the study area, is the closest town to the study area (see map). Augusta has a population of about 500 people and is a trading point for the local ranchers. Choteau, 26 miles to the north of Pishkun Reservoir, has a population of 1,615, and Great Falls, 60 miles directly east of the study area, has a population of 39,214 (1950 census).

The general area is accessible by State Highway 33 which links Augusta with Helena (75 miles to the south) and Choteau to the north, and by State Highway 20 which connects Augusta with Great Falls. A branch line of the Great Northern Railway terminates at Augusta.

Stock raising is the principal local industry. Some lands are dry-farmed or irrigated. Catering to tourists and sportsmen is an important business in the area, and several resorts and dude ranches are located in the vicinity of the study area. In 1951, there were at least seven dude ranchers who either provided accommodations for guests or packing facilities, or both. Two of these ranchers were located on the main river; one ranch (K-L) was just outside the Wilderness Area at the confluence of the North and South Forks. Others were at Ear Mountain and Bench Mark near the headwaters of the North and South Forks (see map).

Precipitation amounted to 2.95 inches at Augusta and 2.59 inches at Gibson Dam for the period of study, May through September. At the junction of the North and South Forks some rain or snow fell on about 30 percent of the days of this period and about three-fourths of the days were cloudy. Weather conditions were more favorable at the lower elevations. The prevailing winds were westerly and often reached gale strength, especially in the canyon area.

Water temperatures recorded during the study ranged from 34° F. to 58° F. During the early part of the season temperatures below Diversion Dam were slightly higher than those above Gibson Reservoir, but throughout most of the remainder of the season temperatures taken immediately below Diversion Dam and at the junction of the two upper forks were not materially different. Daily temperature recordings were not made in the lower reaches of the North Fork Sun River, but readings taken at occasional intervals indicate that the average water temperature in that area was a few degrees higher than in the upper reaches. The maximum recorded difference in temperatures between the upper and lower reaches was 8° F. Except in the shallow Split Rock Lakes, water temperatures of the reservoirs were similar to those of the streams.

The water in Gibson, Diversion, and Pishkun Reservoirs is in the medium-hard group (73 to 191 p.p.m. $CaCO_3$). As might be expected, the waters of Gibson Reservoir were slightly softer than those of the lower two reservoirs; otherwise, there was little apparent difference in the chemical nature of the waters of the three impoundments.

Rainbow and cutthroat trout were taken in all waters included in the study except the Split Rock Lakes; brook trout were taken in all areas except Pishkun Reservoir and Split Rock Lakes. Grayling were recorded from Pishkun Reservoir and the river below Diversion Dam; single specimens were reported from Gibson Reservoir, the Middle River, and Pishkun Canal 1/.

1/ Although single specimens of grayling were reported from Gibson Reservoir, the Middle River, and Pishkun Canal, there is some doubt about this species occurring in these areas. All these areas are above Diversion Dam, and there is no record of any grayling plants above this point. If the species were native to these areas, it would seem that several specimens would have been checked in creels.

Whitefish were caught in Diversion Reservoir and in sections of the river below Gibson Dam. A few brown trout were caught in Tunnel Lake. Pike (fig. 4), yellow perch, and a single largemouth black bass were recorded from the Split Rock Lakes. Suckers were recorded from all the reservoirs and the upper and lower river. Sculpins were found in most of the waters.

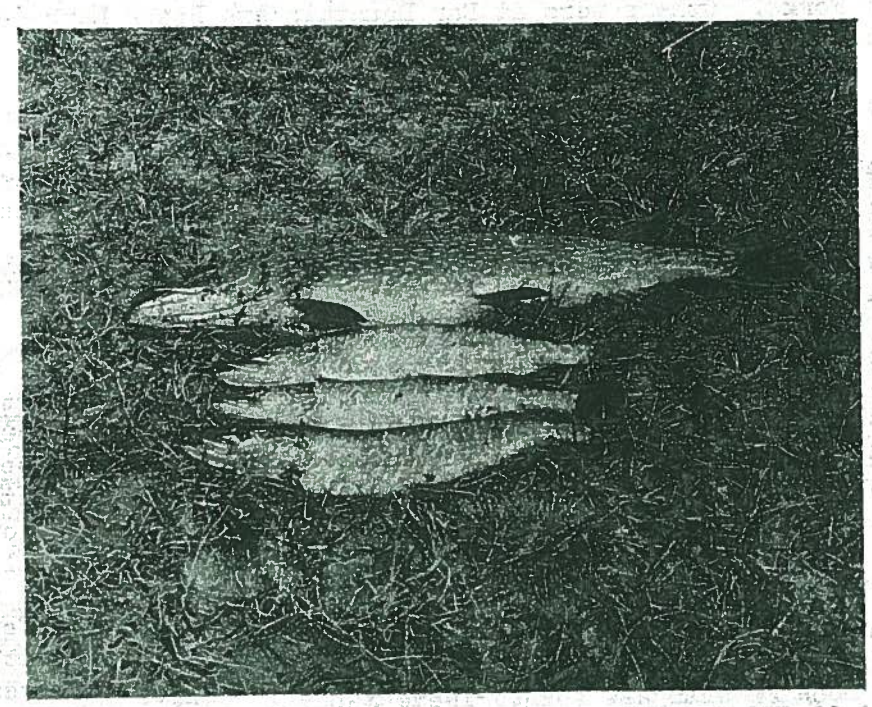

Fig. 4.--Four pike taken from Split Rock Lakes on opening day of the fishing season by a party of three men. The largest fish weighed 11-3/4 pounds, and the three others weighed 2 pounds each.

Cutthroat trout, whitefish, and grayling are the only game fishes native to the area; however, all of the reservoirs and lakes included in the study and most of the larger streams have been stocked in the past with various game species now present. Introductions of trout apparently were first made about 1895. It is believed that, before stocking, no trout were present above the natural falls on which Diversion Dam was built, although evidence of this is not entirely conclusive.

The regular fishing season opened on May 20, 1951, and closed on November 15, except at Pishkun Reservoir, which was opened to fishing from July 15 through the following February 29. Winter fishing was permitted in all of the North Fork Sun River below Diversion Dam and in Willow Creek Reservoir during the months of December, January, and February. Daily and possession limits were as follows: Trout and whitefish, 15 fish, not to exceed 10 pounds and one fish; grayling, 5 fish, no weight limit; pike, 15 fish, not to exceed 15 pounds and one fish; and bass, 15 pounds and one fish, no limit on number. Minimum size limits permitted the taking of not more than 5 trout or whitefish under 7 inches in length and no pike under 18 inches in length. There was no creel or size limit on yellow perch or suckers. During the winter season the creel limit on the river was 15 fish, of which not more than 3 could be trout.

METHODS

Creel-census activities started with the opening of the fishing season on May 20 and continued until September 30, a period of 133 days. A 4-day check was made during October in an attempt to provide a basis for estimating the amount of fishing during the period October 1 to November 15.

To facilitate the study, 18 check areas 2/ were designated. Characteristics of the body of water or limitations of access were the primary considerations in making the designations. Data recorded at each check area were kept separate, and estimates of total fishing pressure and yield were made independently for each.

Because of limited access, it was necessary for virtually all parties fishing above Diversion Dam, except those using the upper extremities of the two forks of the river, to pass through a checking station established near Diversion Dam. This station was operated continuously during daylight hours, except for two weekdays each week. An auxiliary checking station was maintained during much of the season at the head of Gibson Reservoir. Interviews for the South Fork, North Fork, North Fork-South Fork area, Gibson Reservoir, Middle River, Beaver Creek, and Diversion Reservoir check areas were made at one or the other of these checking stations. The "North Fork" and "South Fork" check areas were used to designate fishing on the respective streams (exclusive of a half-mile stretch of each immediately above their junction) which could be checked at either of the two checking stations. The "North Fork-South Fork" check area was used to designate fishing that occurred at or near the junction of the two forks (within one-half mile) where, because of overlapping use of the two streams, it was impossible to separate the data.

2/ See table 1 for listing of check areas.

Access roads leading to the upper portions of the South and North Forks of the North Fork terminate at the Bench Mark Ranger Station on the former and near the Ear Mountain Ranger Station on the latter. "Bench Mark" and "Teton" were used to designate fishing in the two forks by fishermen who passed through these two points. Through the cooperation of resort owners, packers, Forest Service personnel, and others, it was possible to maintain a record of such use by making weekly trips to these areas.

A 2-week (June 24 to July 7) intensive census of Wood Lake was made by means of a checking station.

Accounting for fishermen using the 22 miles of the main river below Diversion Dam presented a special problem, since there were several trails leading to the river from the main road and it was not feasible to use checking stations except for the extreme upper one-half mile. A census was made of the upper 6 miles (Lower River A) and lower 5 miles (Lower River B) of this reach of stream by means of periodic patrols; but the intervening 11-mile section (Lower River C) was checked only occasionally because of limited pressure and difficulty in traversing the rough road along the river. Fishermen using Pishkun Reservoir, Pishkun Canal, Tunnel Lake, and Split Rock Lakes were generally checked as they passed through checking stations at Pishkun Reservoir or below Diversion Dam, but periodic patrols also were made of these areas. Willow Creek Reservoir was censused by patrolling. Checks were made of the above areas on an alternate-week basis.

Information concerning the number of fishermen in the party, hours spent fishing, type of fishing, residence and sex of fishermen, the catch by species, and the cost of the fishing trip was recorded. Weights and lengths of a nonselective sample of fish in creels also were obtained. Estimates of the total weight of the catch were based on the average weights thus obtained. The data were recorded on punch cards, which facilitated fast and accurate compilation.

Creel-census data were collected on a party basis. All the fishermen in one boat or the occupants of one or more automobiles who fished together were treated as a party. By using this system, it was usually possible to secure the necessary information from one member of the party, thereby enabling the crews to accumulate considerably more data than would otherwise have been possible.

Creel data were compiled on a biweekly basis, and estimates of fishing and yield were based on the respective compilations. Judgment factors were used in arriving at estimates of fishing and yield for Lower River C.

Trip expenditures, which included the expenditure per day for food, lodging, bait, rentals, and miscellaneous items such as refreshments, film, ice, and similar items, were recorded on a party basis for each party contacted. Average trip expenditures and round-trip mileage per person per day were computed for four major units of the study: (1) above Gibson Reservoir, (2) Gibson Reservoir, (3) below Gibson Reservoir, and (4) Wood Lake. A rate of 7 cents per mile was used to determine transportation costs.

The fishing activity of the individual fisherman is expressed in terms of "fisherman-days" and "fisherman-hours (pole-hours)." As the term implies, a fisherman-day represents a day of fishing by an individual, irrespective of the number of hours involved. The term "fisherman-hours" represents the number of hours fished by a fisherman.

In a few instances complete data were not obtained on all aspects of the study; those interview records were omitted in calculating the particular aspects for which data were incomplete. Accordingly, the number of individuals in the various samples listed in tables is not always the same.

RESULTS OF CREEL CENSUS

Based on recorded data shown in tables 1, 2, 3, and 4, it is estimated that the fishing and yield in 1951 3/ of the North Fork Sun River (from its headwaters to its junction with the Willow Creek outlet canal), including that from Gibson and Diversion Reservoirs, was 7,201 fisherman-days (33,455 fisherman-hours), and 14,755 fish weighing 6,728 pounds (table 5). Estimates of fishing and yield, reduced to a surface-acre or mile-of-stream basis are shown in table 6.

Table 5 indicates that there was slightly more fishing pressure and yield on the approximate 80 miles of the North Fork Sun River than on the 1,460 acres of water in Gibson and Diversion Reservoirs. Table 5 also shows considerable variation in the fishing pressure between the various units of the river. It is believed that this situation can be attributed largely to accessibility.

The upper section of the river (above Gibson Reservoir) was accessible only by trail or by boat. Relatively few people fish in this extensive, scenic, wilderness area, although there were at least seven dude ranchers who made a business of packing people into this area and one outfit (K-L Ranch) provided lodging facilities within easy walking distance of the area.

3/ Estimates are for the period May 20 to September 30, 1951, only; however, on the basis of only two parties observed in the 4-day period, October 26-29, and interrogation of local residents and State Fish and Game Department employees at the game checking station, it is believed that fishing in the area under study was small between October 1 and November 15, the end of the regular open season. Although weather conditions were extremely bad throughout the 4-day check period and thus could account for the limited fishing at that time, the weather in the study area ordinarily can be expected to be on the extreme side after the end of September. Furthermore, the North Fork Sun River area is one of the major elk hunting areas in Montana, and most local people devote much of their spare time during the fall and early winter to hunting. In the past, winter fishing has been rather extensive, but no attempt was made to determine its extent during the winter of either 1950-51 or 1951-52.

and percent of recorded fish by species, North Fork Sun River and associated fisheries, Montana, 1951.

k Area	Rainbow Trout		Brown Trout		Cutthroat Trout		Brook Trout		Grayling		Whitefish		Pike		Yellow erch		Largemouth Bass		Suckers	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ake	59	32	0		63	34	63	34	0		0		0		0		0		0	
kum Canal	64	63	0		19	19	17	17	1/		1	1	0		0		0		0	
kum Reservoir	82	69	0		2	2	0		24	20	0		0		6	5	0		5	4
low Creek Reservoir	15	34	0		2	5	5	11	0		0		0		0		0		22	50
nel Lake	134	90	11	7	1	1	1	1	0		0		0		0		0		2	1
it Rock Lakes	0		0		0		0		0		0		74	96	2	3	1	1	0	
Total	295	60	11	2	24	5	23	5	24	5	1	2/	74	15	8	2	1	2/	29	6
son Reservoir	998	93	0		56	5	15	1	1/		0		0		0		0		2	2/
ersion Reservoir	1,661	77	0		62	3	408	19	0		28	1	0		0		0		1	2/
Subtotal	2,659	82	0		118	4	423	13	0		28	1	0		0		0		3	2/
th Fork	109	93	0		5	4	3	3	0		0		0		0		0		0	
ch	46	98	0		0		1	2	0		0		0		0		0		0	
th Fork	77	71	0		2	2	29	27	0		0		0		0		0		0	
on	102	100	0		0		0		0		0		0		0		0		0	
th Fork-South Fork	100	90	0		6	5	5	4	0		0		0		0		0		1	1
Subtotal	434	89	0		13	3	38	8	0		0		0		0		0		1	2/
dle River	1,652	77	0		120	6	358	16	1/		15	1	0		0		0		0	
ver Creek	101	46	0		12	5	109	49	0		0		0		0		0		0	
Subtotal	1,753	73	0		132	6	467	20	0		15	1	0		0		0		0	
er River A	1,009	57	0		26	1	49	3	6	2/	669	38	0		0		0		0	
er River B	58	59	0		1	1	4	4	1	1	24	24	0		0		0		11	11
er River C	99	55	0		2	1	3	1	1	1	75	42	0		0		0		0	
Subtotal	1,166	57	0		29	1	56	3	8	2/	768	38	0		0		0		11	1
Total	3,353	69	0		174	4	561	11	8	2/	783	16	0		0		0		12	1
otal	6,012	74	0		292	4	984	12	8	2/	811	10	0		0		0		15	2/

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