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Fourth Biennial Report
of the

State Water Conservation Commission

and the

Twenty-First Biennial Report
of the

State Engineer

of

North Dakota

From December 1, 1942 to November 1, 1944

Buy "Dakota Maid" Flour

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LETTER OF TRANSMITTAL

December 1, 1944

Honorable John Moses
Governor of North Dakota

Sir:

In compliance with provisions of law, we transmit herewith for your information and consideration the *Fourth Biennial Report* of the activities of the State Water Conservation Commission and the Twenty-First Biennial Report of the State Engineer from December 1, 1942, to November 1, 1944.

Respectfully submitted,

STATE WATER CONSERVATION COMMISSION

KENNETH W. SIMONS, Vice Chairman
SIVERT W. THOMPSON
EINAR H. DAHL
LEWIS T. ORLADY

John T. Tucker
Secretary and Chief Engineer
State Engineer—on leave U. S. Navy
J. J. Walsh, Acting Secretary

EXPERIENCE PROVES FORECAST

"Years will come of abundance and years will come of disaster, and between the two the people will be prosperous and unprosperous, and the thing to do is to look the question squarely in the face and provide for this and for all years."

"In the western portion all dependence on rain will ultimately bring disaster to the people. They are unwilling yet, a good many of them, to admit it, but * * * they will have to depend forever on artificial irrigation for all agriculture."

"The State of North Dakota has a curious position geographically in relation to agriculture. The eastern portion of the state has sufficient rainfall for agricultural purposes; the western part has insufficient rainfall, and the western portion is practically wholly dependent on irrigation."

(From talk before the North Dakota Constitutional Convention on Aug. 5, 1889, by Major Powell, Director of the U. S. Geological Survey.)

John Moses, Governor, has given enthusiastic support of irrigation in North Dakota.

ORGANIZATION AND PERSONNEL

The State Water Conservation Commission was created by the 1937 Legislature. The Governor was made ex-officio Chairman, and authorized to appoint the other members. Amendments to the law were made by the 1939 legislature.

The Commission is vested with full and complete power, authority and jurisdiction to investigate, plan, regulate, construct, establish, maintain, control and supervise all works, dams and projects, public and private, to control the low-water flow of streams of the state, to impound for municipal and rural water supplies; to conserve and develop waters within the natural water-shed area of the state; to provide sufficient water flow for the abatement of stream pollution; to develop the water areas of the state for recreation and wild life conservation; to promote the maintenance of existing drainage channels and construct needed channels; to provide more satisfactory sub-surface water supplies for the smaller towns; to improve the condition of water flow for the production of hydro-electric energy; to generate and transmit hydro-electric energy to consumers; to provide for storage, development, diversion, delivery and distribution of water for irrigation of agricultural land, and drainage of irrigated lands; to provide water for stock, mining or manufacturing; to define, declare and establish rules and regulations for the sale of waters and water rights; for the supervision, regulation and control of water within the state; and other broad powers.

Membership

	Term Began	Term Ends
Governor John Moses, Ex-officio Chairman	Apr. 3, 1939	Dec. 31, 1944
Governor Fred G. Aandahl, Ex-officio Chairman	Jan. 2, 1945	
Kenneth W. Simons, Vice-Chairman	Apr. 3, 1939	July 1, 1949
Sivert W. Thompson	Apr. 3, 1941	July 1, 1947
Einar H. Dahl	Apr. 3, 1941	July 1, 1947
Lewis T. Orlady	Mch. 30, 1943	July 1, 1945

John T. Tucker, Secretary and Chief Engineer, State Engineer—On leave with U. S. Navy

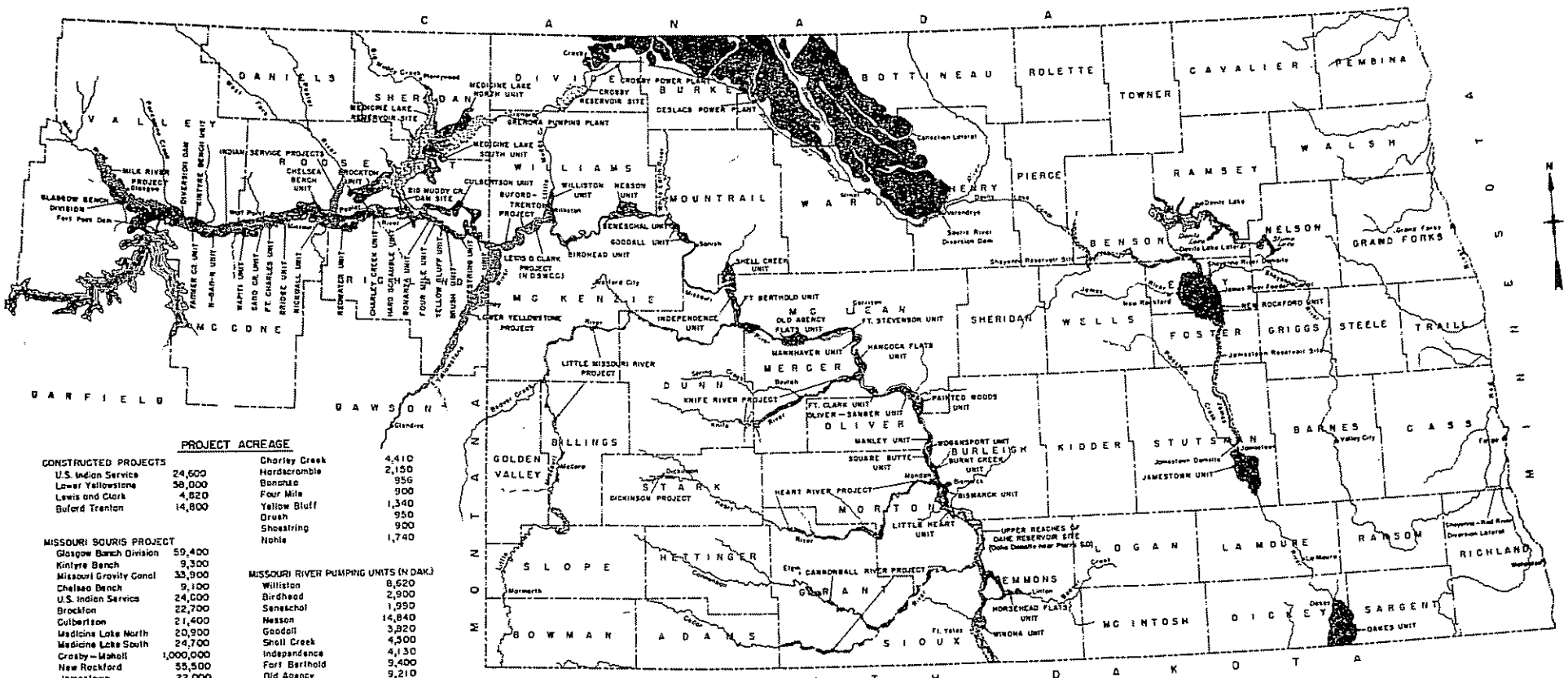
J. J. Walsh, Acting Secretary and Chief Engineer and Ex-officio State Engineer

THE STATE ENGINEER

The laws of North Dakota relating to the office of State Engineer were amended in 1941, relating to his appointment, duties, powers, qualifications and salary.

This provided for his appointment by the State Water Conservation Commission, of which he shall serve as Secretary and Chief Engineer. His salary and term of office is fixed by the Commission.

He is required to cooperate with the Board of University and School Lands, Dean of the School of Mines, and the State Geologist in determining coal-bearing lands; has general supervision of the waters of the state under the direction of the State Water Conservation Commission; appropriations; filing licenses; stream measurements and water supply records; cooperation with the U. S. Geological Survey on precipitation and stream-flow records; flood prevention; approval of designs, plans and specifications for the construction of dams; he is Chief Engineer of the State Water Conservation Commission on irrigation development, including design and construction of projects; cooperates with state, county and federal agencies engaged in similar work and other state engineering problems, and is a Member of the Mouse River Valley Authority which has control, regulation and distribution of the Mouse River waters within the state; supervision and control of the construction and maintenance of drainage channels, and such powers and duties imposed by law on the State Engineer.



PROJECT ACREAGE

CONSTRUCTED PROJECTS	
U.S. Indian Service	24,600
Lower Yellowstone	58,000
Lewis and Clark	4,620
Buford Trenton	14,800
MISSOURI SOURIS PROJECT	
Glasgow Bench Division	59,400
Kintyre Bench	9,300
Missouri Gravity Canal	33,900
Chelsea Bench	9,100
U.S. Indian Service	24,000
Brockton	22,700
Culbertson	21,400
Medicine Lake North	20,900
Medicine Lake South	24,700
Crosby-Mohall	1,000,000
New Rockford	55,500
Jamestown	22,000
Oakes	31,000
MISSOURI RIVER PUMPING UNITS (MONT)	
Former Creek	1,600
N-Bar-N	4,050
Wapiti	2,500
Sand Creek	1,350
Fort Charles	3,160
Bridge	1,230
Nickwall	1,870
Redwater	7,260
Charley Creek	4,410
Hardscramble	2,150
Bonanza	956
Four Mile	900
Yellow Bluff	1,340
Brush	950
Sheestring	900
Nohle	1,740
MISSOURI RIVER PUMPING UNITS (N DAK.)	
Williston	8,620
Birdhead	2,900
Seneschal	1,990
Nesson	14,840
Goodall	3,820
Shell Creek	4,500
Independence	4,130
Fort Berthold	9,400
Old Agency	9,210
Fort Stevenson	6,830
Mannhaven	1,550
Hancock Flats	5,030
Fort Clark	2,750
Oliver Sanger	6,080
Painted Woods	2,300
Manley	2,160
Wogansport	2,400
Square Butte	2,750
Burnt Creek	1,945
Bismarck	4,875
Little Heart	3,930
Horseshoe Flats	9,710
Winona	5,940
TRIBUTARY PROJECTS	
Knife River	15,380
Dickinson	780
Heart River	13,538
Cannonball River	22,068
Little Missouri River	30,000

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

EXISTING AND POTENTIAL

IRRIGATION DEVELOPMENT

NORTH DAKOTA-NORTHEASTERN MONTANA

DRAWN C.L.S. SUBMITTED Charles D. Stimson
TRACED C.L.S. RECOMMENDED:
CHECKED APPROVED

MISC. ND 23 | BISMARCK, N DAK. JANUARY '66

OBJECTIVES AND PROGRAM

During the past three or four seasons, the rainfall has been above normal, hence the need for irrigation has not been so apparent as yields have been satisfactory. However, the U. S. Weather Bureau records of rainfall in this area for about seventy years past show that on the average six out of eleven years have had insufficient rainfall to produce a paying crop; that the only other four-year period of continued good moisture supply was 1899 to 1904, and that a drouth preceded and followed this period. Hence it is safe to conclude that this area is now approaching a period of drouth years.

Two important government agencies have been cooperating with the State Water Conservation Commission in surveying the possibilities of irrigation in this state, and each has evolved a plan which is now before Congress.

The Army Engineer Corps were charged by Congress with devising a plan principally for flood protection of the lower Missouri river area, for providing for navigation on the river below Sioux City, and for generating of electric energy from water power. Their plan provides for a series of dams and reservoirs on the Missouri river for the control of its flood waters, the largest one suggested near Garrison, North Dakota. Their report suggests that water from this reservoir could be pumped from near Mercer over the divide and into the headwaters of the Sheyenne and James rivers, from which it could be diverted into Devils Lake and Stump Lake.

The U. S. Bureau of Reclamation engineers plan would divert waters through a canal from below Fort Peck Dam in Montana through the northeastern part of that state to a reservoir near Crosby, North Dakota, and eastward, where 1,100,000 acres of land could be irrigated, thence by canal to the headwaters of the Sheyenne river, and Devils Lake, and into the James River, irrigating 55,000 acres near New Rockford, 22,000 acres below Jamestown and 33,000 acres below Oakes, North Dakota. In addition, they would provide for irrigation by pumping from the Missouri river and its tributaries as follows: the Shell Creek project of 4,500 acres; the Independence 4,130 acres; the Fort Berthold 9,400 acres; the Old Agency Flats 6,510 acres; the Old Agency Flats No. 2, 2,700 acres; Fort Stevenson, 6,830 acres; Mannhaven, 1,550 acres; Hancock Flats, 5,030 acres; Fort Clark, 2,750 acres; Oliver-Sanger 6,880 acres; Painted Woods, 2,300 acres; Manley, 2,160 acres; Wogansport, 2,400 acres; Square Butte, 2,750 acres; Burnt Creek, 1,940 acres; Little Heart, 1,940 acres; Horsehead Flats, 9,000 acres; Winona, 5,100 acres and Bismarck, 4,880 acres; total 84,740 acres, all in North Dakota. It is also proposed to irrigate 32,000 acres in projects near

Includes an undetermined acreage irrigated only by shallow

Williston, the Birdhead, Nesson, Seneschal and Goodall units. And the irrigation of 51,800 acres along the western tributaries is planned, including the Knife, Heart and Cannonball rivers. This plan would irrigate a total of 1,264,170 acres in North Dakota.

Hydro-Electric Power

The plans for the Garrison dam would utilize the water-power thus provided to generate electricity, sufficient, it is held, to electrify practically the whole territory within a radius of one hundred fifty miles from the dam, at a very low rate. Almost every farm within this area would ultimately have the blessing of this wonderful power in the homes, the barns and shops, thus enabling farmers and their families to produce much more with considerable less physical effort, and to have the premises well lighted at the turn of a switch.

Use of Man Power

The construction of these projects will utilize the labor of thousands of men for several years, when they return from the armed forces and defense industries after the war, and enable many of them to establish permanent future homes for themselves either on farms or in the towns serving the needs of the farmer.

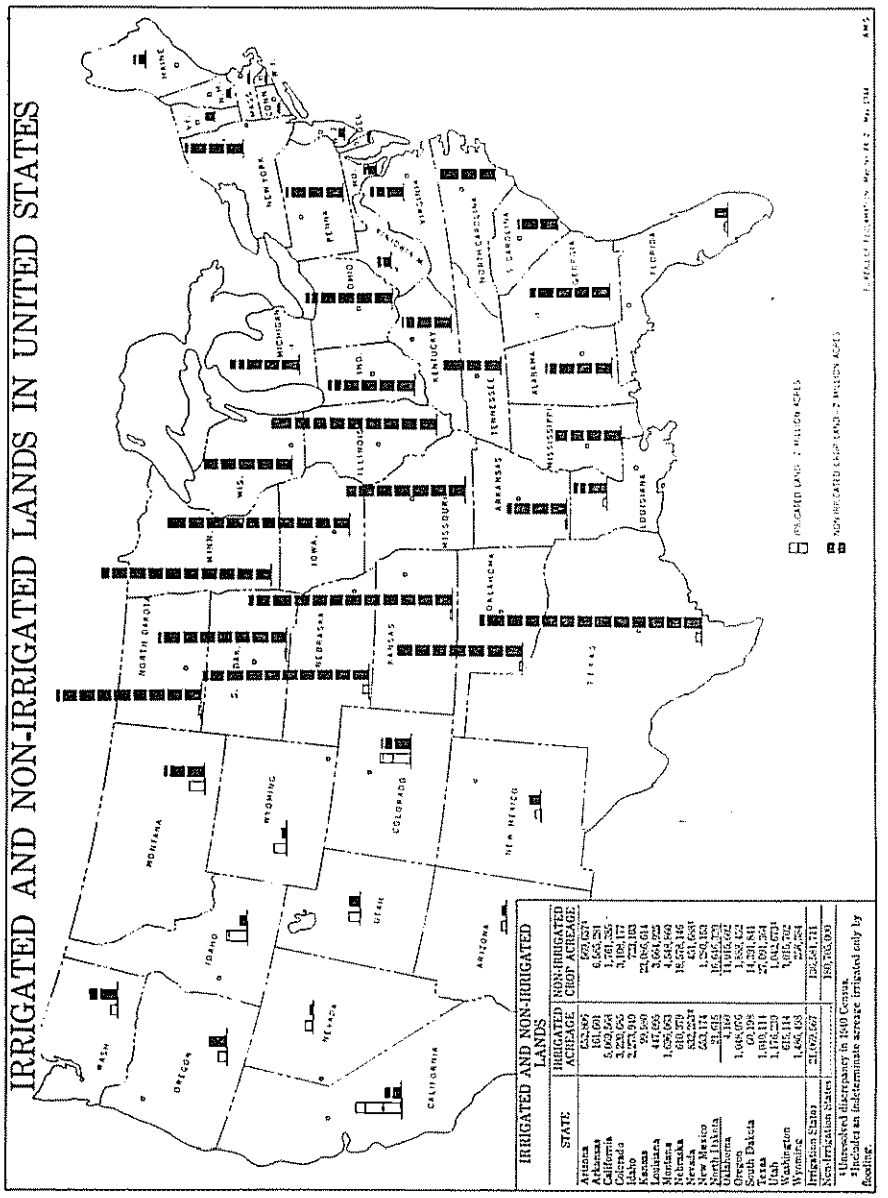
No other proposed project for the utilization of man-power after the war gives the promise which the development of irrigation does, in that it will after completion pay its own annual cost of operation and pay back to the government over a period of years the original investment, because of the doubling or better the income from the lands irrigated. This has been demonstrated by irrigation projects already in operation in North Dakota as reported later in these pages.

Soil Productivity

The experience of the recent years of more than normal rainfall have proved conclusively the wonderful productivity of the soil of Western North Dakota, and that all that it needs is ample water. A review of 1943 wheat yields for North Dakota as a whole shows an average yield of 18.2 bu. per acre, while the average for counties in the western half of the state was 19.2 bu.

Drainage

In the Red River Basin, during years of above normal rainfall, drainage has become a very pressing need, the U. S. Statistician survey having shown an estimated loss from crop flooding in 1943 and 1944 amounting to more than twenty three million dollars. A comparatively small start has been made in cleaning out and construction of drainage ditches to relieve this situation.



IRRIGATED AND NON-IRRIGATED LANDS		
STATE	IRRIGATED ACREAGE	NON-IRRIGATED CROP ACREAGE
Arizona	632,969	602,671
Arkansas	161,021	6,566,251
California	5,003,504	1,781,350
Colorado	3,220,055	3,109,177
Idaho	2,270,940	721,183
Kansas	20,000	23,000,614
Louisiana	417,056	7,564,024
Montana	1,656,063	4,549,593
Nebraska	610,379	18,578,146
Nevada	632,229	631,668
New Mexico	503,114	1,524,163
North Dakota	31,845	18,016,022
Oklahoma	11,145	13,666,622
Oregon	1,066,056	1,856,822
South Dakota	60,199	14,201,841
Texas	1,690,111	27,091,254
Utah	1,176,239	1,942,673
Washington	672,114	1,015,762
Wyoming	1,646,148	1,647,254
Irrigation States	21,672,567	136,541,711
Non-Irrigation States	.....	199,703,003

*Unresolved discrepancy in 1940 Census.
†Included as indeterminate acreage irrigated only by flooding.

IRRIGATION IN THE UNITED STATES AND NORTH DAKOTA

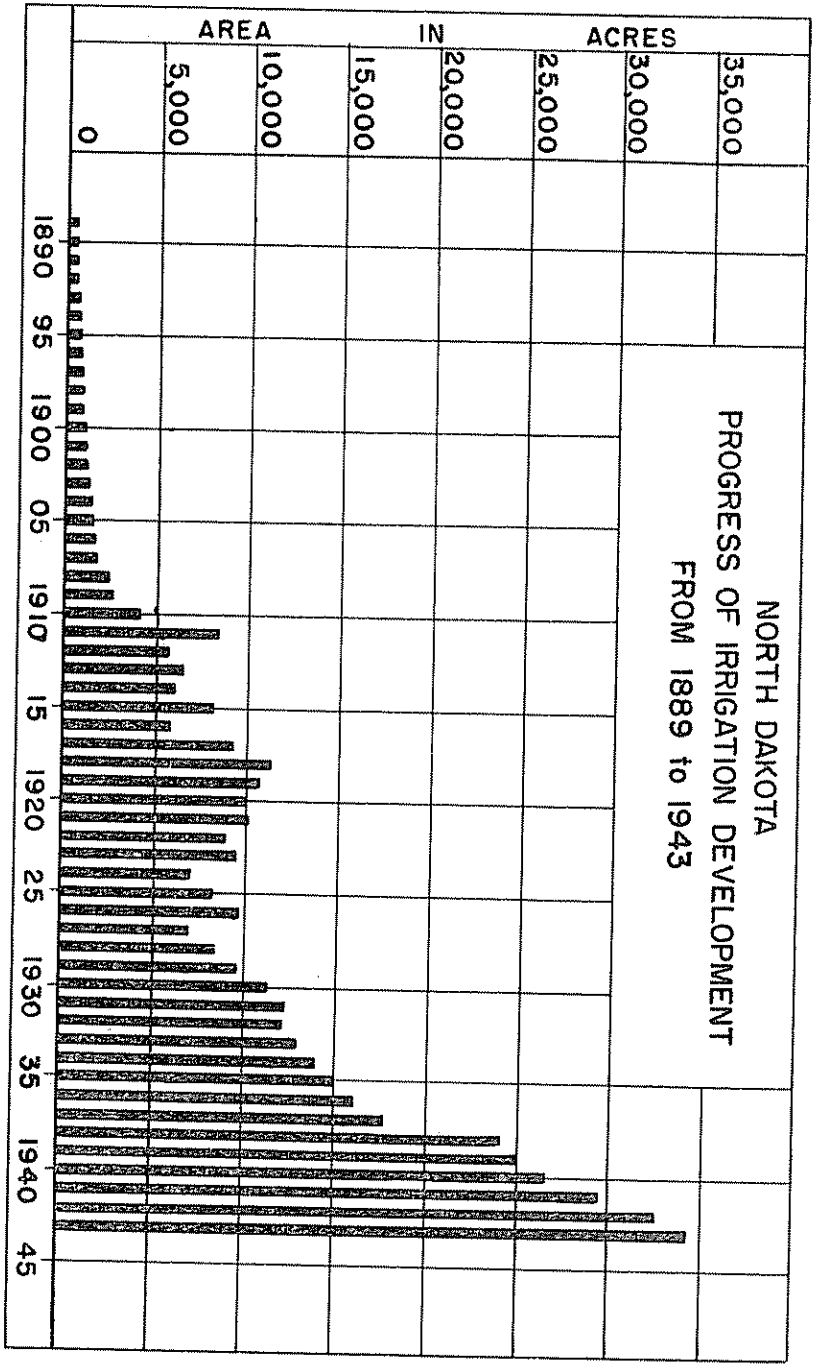
Irrigation has been used in some form as an aid to the production of food for man and beast as far back in history as there is any written record. And, even in prehistoric times, it has been divulged in the opening of the tombs of King Tut and other rulers of the Nile Valley, that crude irrigation methods were used in that day. Some great dams and irrigation works have been constructed in Russia and India and other countries in recent times.

In most of these areas it was simply impossible to raise needed food unless some form of irrigation was practiced, hence irrigation was forced on the people in order to survive. In the United States, this same rule has applied on most of the earlier irrigation works which were installed mostly on desert lands which would not produce needed foods without water being applied by artificial means. Experience proved that many desert valleys in the western areas have been made to blossom and produce beyond all expectation by the application of water. Land that had no sale value has been sold as high as one thousand dollars per acre after irrigation works were installed and citrus fruit orchards developed. Because this desert type of land was found mostly in the western part of the United States, the early irrigation development was made in that area largely. But actual experience has proved that irrigation can be made highly profitable in the semi-arid areas where the rainfall is insufficient in many seasons to produce a paying crop.

This has been the experience in North Dakota, where some drouth years and series of seasons have resulted in harrowing experiences for a majority of its citizens, and even compelled the expenditure of millions of dollars of federal money in order to provide subsistence and prevent famine. Between June, 1933, and December, 1935, Federal Emergency Relief expenditures in North Dakota amounted to more than twenty-four million dollars, in addition to large sums expended for relief by the State and subdivisions and municipalities and local Red Cross chapters.

During these extreme years there was one bright spot in the state, on the Lower Yellowstone irrigation district covering about 45,000 acres, of which about one-third is in McKenzie County, North Dakota. The reports show that in 1935, probably the worst drouth year recorded in that area, that the value of the crops produced on the irrigated land in this district AVERAGED more than $35 per acre, while the report states that dry lands adjoining average returns were about seventy cents per acre, not enough for man or beast for subsistence.

Even in years of ample rainfall to make dry land farming profitable, like in 1942 and 1943, the report of the Lower Yellowstone Irrigation District later in these pages show an average return per acre for 1942 of $50.89 and in 1943 of $59.65, demon-



strating conclusively that irrigation farming can be made much more profitable EVERY YEAR than dry land farming, and fully warrants the expenditure of money required for construction.

The Lewis & Clark and the Buford-Trenton irrigation districts in McKenzie and Williams counties, in North Dakota, are more recent irrigation developments which are still somewhat in the experimental stage and in the process of growth and development. However, the report given later in these pages show that the AVERAGE return per acre in 1943 was over $35. while on adjoining dry-land farming even on a year of ample rainfill the average return per acre was just about half this amount. It is believed that with further development that the average return per acre on these projects can be made to equal that on the Lower Yellowstone, which has the advantage of more years of experience as it has been in operation about forty years.

These irrigation projects are in the state of North Dakota, consequently are the most conclusive evidence of what may be expected from further irrigation development.

Irrigated and non irrigated lands in the United States are shown on the accompanying map prepared by the Bureau of Reclamation. California leads with the largest acreage under irrigation. Montana has nearly 1,700,000 acres under irrigation. North Dakota is next to the bottom of the list. The total area of lands irrigated in the United States is slightly over twenty-one million acres, involving a capital investment of over $1,052,049.201 at an average cost per acre of $34.36.

High Returns on Smaller Acreages

More than six hundred Water Rights have been granted in North Dakota, as shown by Supplement "A" of this report. In the early days of ranching the water was commonly used for spring flooding of meadows and alfalfa fields for raising winter feed for stock. With the gradual passing of many ranches into combination stock and grain farms, many owners discontinued the spring flooding practice and depended on the cultivated lands to raise needed feed, although the spring flooding had produced remarkable yields

In later years, water rights have been granted to more than three hundred smaller irrigation projects scattered over the state, largely for gardens and fruit growing but with some larger acreages for alfalfa or other crops. During the seasons of low rainfall these smaller pumping projects have been found to be of great value in producing necessary vegetables for the family table, and in many cases more fruit than is required for the family.

Even in the wettest years, the farmer who persists in the use of water during periods of dry weather which come every year

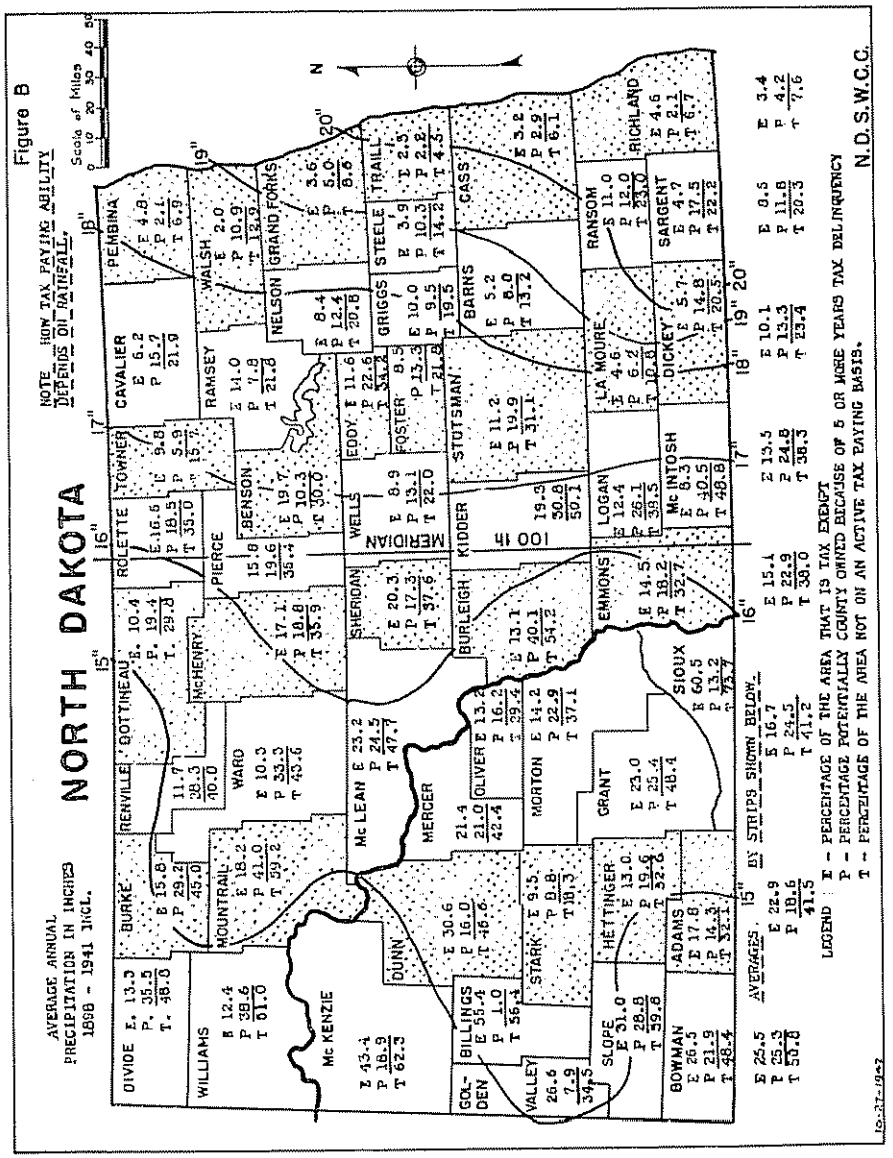
finds that his increased yields pay well for the time and expense required in the application of water at the crucial periods in the growth of the crop. Many yields are doubled as a result.

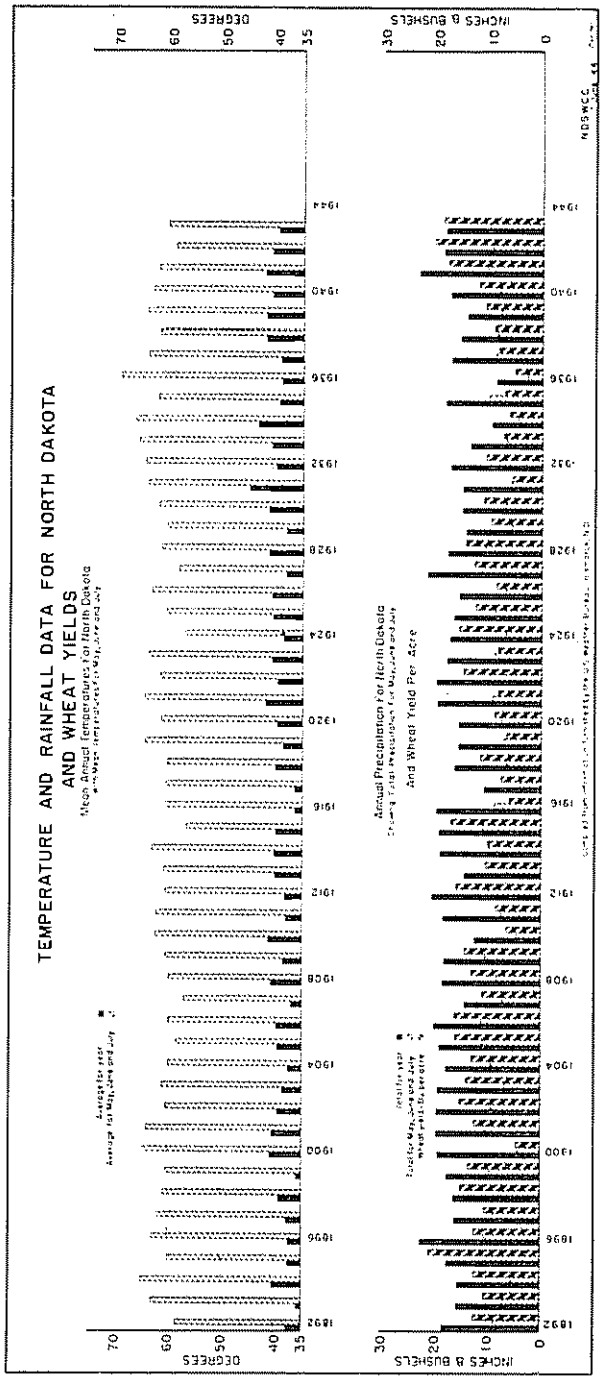
Some small market gardeners and fruit growers have produced high money returns on small acreages. For instance, the Benzi Market Gardens, south of Washburn, North Dakota, report returns of more than one thousand dollars from an acre of strawberries in 1944, and almost as much from vegetables on two acres adjoining, and state they are enlarging their gardens to eight acres for 1945. L. P. Wedge, located near Sunny, west of Mandan, reports about the same results from several years of experience during which he has enlarged his vegetable and fruit gardens to about fourteen acres under irrigation by pumping. W. T. Krebsbach, from north of Reeder, is an enthusiastic supporter of irrigation after several years of practical experience. Many other successful small projects are in operation.

The average annual precipitation in North Dakota from 1898 to 1941 inclusive, over a period of forty three years, is shown on map Figure B. The 20 inch average in the Red River Valley is gradually diminished westward to an average of less than fifteen inches rainfall at the Montana line.

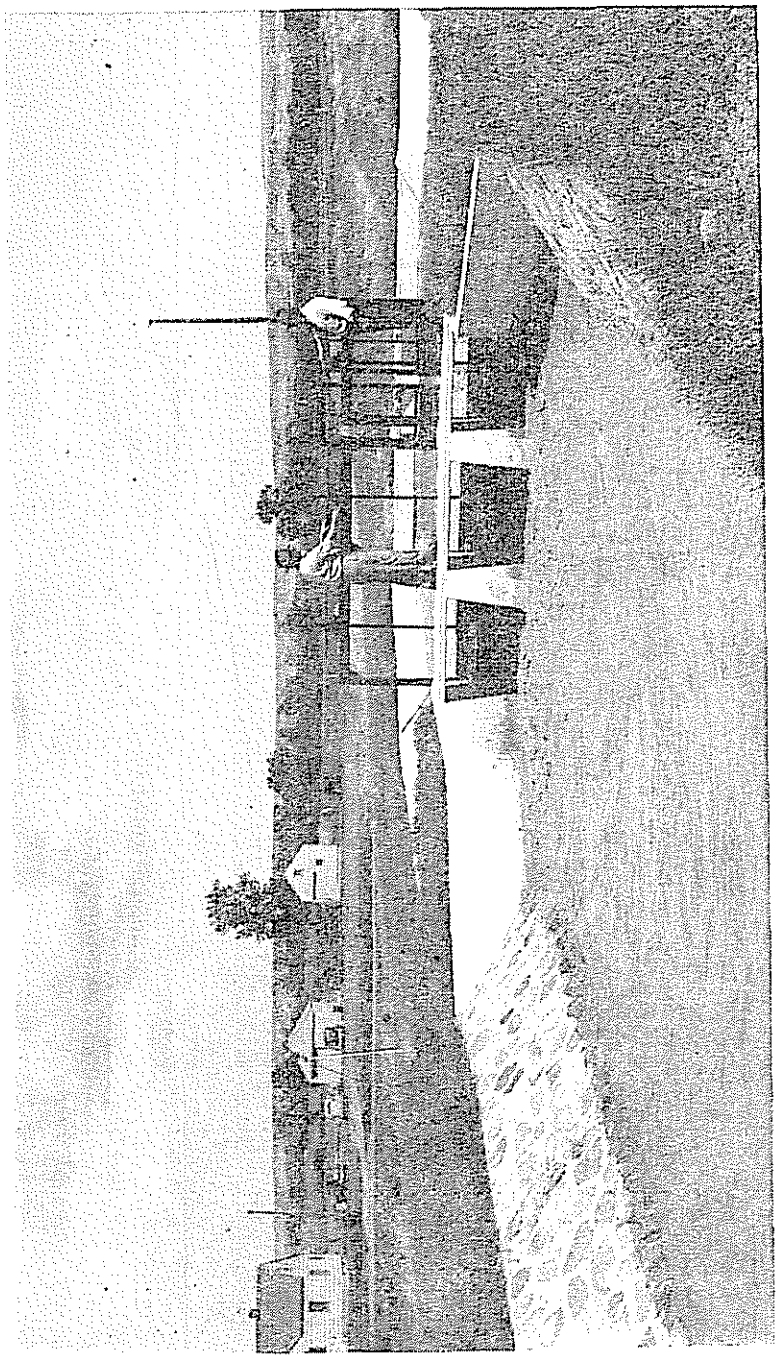
During the series of drouth years in the thirties and consequent tax delinquency, counties acquired large acreages by tax titles, as shown by "E" on the map, creating a serious tax problem for those who retained their lands. No figures are available, but much of the county land has been sold during the recent favorable crop years and is again on the tax list, greatly relieving the tax situation. "P" on the map indicated the potential percentage of tax delinquent lands if the drouth had continued another five years. "T" showed the percentage of land not on the tax paying basis in 1941. A study of this map clearly indicates the distribution of precipitation as it affects agriculture, stock raising and population trends, and the serious situation which may arise again in North Dakota as a result of a series of drouth years.

Irrigation tracts scattered as widely as possible over the state would provide vegetables and fruit for the family table and feed for stock within easy trucking distance on the most severe drouth years, and do much to stabilize farming and stockraising as well as all business.





This graph shows the average annual wheat yield per acre over a fifty one year period in North Dakota, from 1892 to 1943. The maximum average annual yield is over 20 bushels to the acre. The minimum is less than 4 bushels. The trend has been gradually downward until about 1940, since which the abnormal rainfall has brought greatly increased yields.



Intake gates on Lewis & Clark Irrigation District, in McKenzie County, N. D.

IRRIGATION DEVELOPMENT

The accompanying graph on a separate page pictures the gradual increase in acreage brought under irrigation since 1890. The progress has been steady except for a few years of heavy rainfall. There has been a steady growth in acreage brought under irrigation during the past six years, since the North Dakota State Water Conservation Commission was created. During this period irrigation increased from about 1,000 acres to 35,000 acres in 1943. In view of the increased precipitation during the past three years, this is a real accomplishment for the Commission. The cost of irrigating 21,165 acres in 1939 averaged $1.41 per acre, when projects costing up to $4.50 per acre are considered feasible and profitable.

Lewis & Clark Irrigation District

The engineers of the State Water Conservation Commission planned, designed and constructed the irrigation works on this project, which is located about six miles southwest of Williston, North Dakota, and covers approximately 5,000 acres of Missouri river bottom lands. The land development work has been done under a cooperative agreement with the Farm Security Administration, which has been in charge of the land leasing, farming and management, with Mr. Joseph C. Paulson as Supervisor.

He reports this land produced about $7,000. in 1939, before irrigated, which was increased to $130,000. from the proceeds of 1943 crops, an average of about $35. per acre. One farmer, with a field of 14 acres of certified Bliss Triumph potatoes had a gross return of $3,889.00, or about $275.00 per acre. 259 acres of alfalfa and corn produced 1,066 tons of alfalfa hay and corn fodder. Alfalfa meal is being processed for market, for which farmers are being paid $18.00 per ton for alfalfa.

On this tract, the land was cleared and developed ready for the farmer's use. Farmers with little capital and no equipment to level and prepare the land and construct farm ditches, were able to put this land into production the first year of occupation and secure surprising results. Under the old system where water was brought to the land and farmers required to do the development work on their farms before placing same under production, results were much delayed and some farmers found financing difficult during this land development period, but not so on the Lewis & Clark Irrigation District.

The Buford-Trenton Irrigation Project

The Farm Security Administration and the Bureau of Reclamation are bringing 14,800 acres under irrigation. It was expected to have about 5,000 acres under irrigation in 1944, with an estimated income around $175,000. and increase the acreage under irrigation about 3,000 each year until completed. It will be fully developed ready for production, as was done on the Lewis & Clark.

Harvesting 1943 Potatoes on Lewis and Clark Irrigation District, McKenzie County, N. D.

Missouri River Diversion Projects

As this report is written, two great plans for the diversion of the surplus waters of the Missouri River are before Congress for consideration and such action as the majority approves. It is currently reported that approval of a consolidated plan has been given by the Army Engineers and the Bureau of Reclamation, together with the President and leaders in Congress. The details of the consolidated plan have not been released, but it is believed will result in unified action which will mean ample funds will be provided and authorization given to these two government agencies to construct immense irrigation works in North Dakota and other states in the Missouri Basin, to provide for control of the flood waters of the Missouri and for generation of low cost hydro-electric power sufficient to supply great areas. The two proposals have been discussed briefly earlier in this report.

Central N. D. Areas Served

Either plan proposed would provide for irrigation in the Sheyenne and James river valleys and for diverting waters to raise the level of the waters of Devils Lake and Stump Lake, from which a steady flow of water in the Sheyenne river would care for sewage disposal and municipal water supply for cities along its course and the Red River from Fargo north.

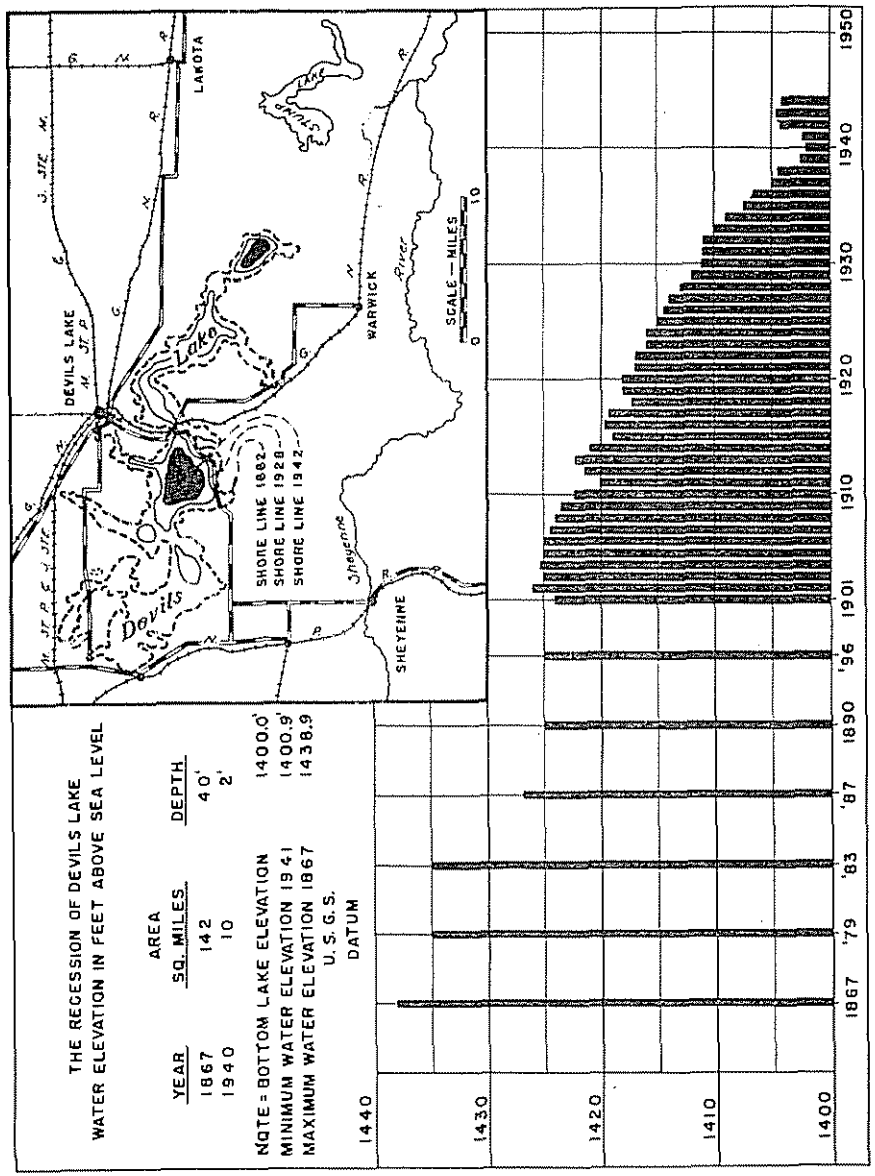
Both plans would also provide water for reservoirs on the Sheyenne above New Rockford and the James river above Jamestown, with irrigated projects covering 55,000 acres below New Rockford, 22,000 acres below Jamestown and 33,000 acres below Oakes.

Yellowstone Pumping Irrigation District

Originally this project was a part of the Sidney Pumping Project of Montana. However, due to insufficient funds made available to Montana by the Public Works Administration only that portion in Montana was constructed.

During 1941 the State Water Conservation Commission made detailed surveys and estimates for the construction of that part lying within North Dakota. Due to the increased costs, construction material, labor, etc. the Directors of the District felt it would be advisable to delay construction until after the war.

Recently the State Water Conservation Commission has resurveyed that portion of the lands paralleling the Yellowstone River that was destroyed by floods. This has resulted in reducing the original acreage by over 100 acres. Plans are being made to develop the feasibility of constructing an intake in North Dakota for the irrigation of lands within the Irrigation District.



Devils Lake

The water surface of Devils Lake has been gradually declining since the earliest year of record, 1867. At that time the lake covered an area of 142 square miles and reached an elevation of 1438.9 feet. The map shows the shore line in 1882. The area of the lake at that time was approximately 120 square miles and elevation of water surface was 1434 feet. The shore line shown in 1928 covered an area of approximately 35 square miles and lowered to elevation 1413.4 feet. The lowest elevation of record occurred during 1941 when the lake level reached 1400.9 feet and covered an area of approximately 4½ square miles. During the recent years of heavy precipitation, the lake has been gradually filling and during 1944, June 30, reached elevation 1404 feet.

Restoration of Devils Lake to elevation 1420 feet has been proposed by both the U. S. Army Engineers and the Bureau of Reclamation by diversion from the Missouri River.

AVERAGE WHEAT YIELDS

The average wheat yield in the 26 counties of North Dakota west of the 100th meridian is shown in the page graph accompanying this report. On the left is indicated bushels per acre. The years are indicated at the bottom, from 1900 to 1943 inclusive, ranging from a low of two bushels to the acre to the high record of 1943 of slightly more than 20 bushels.

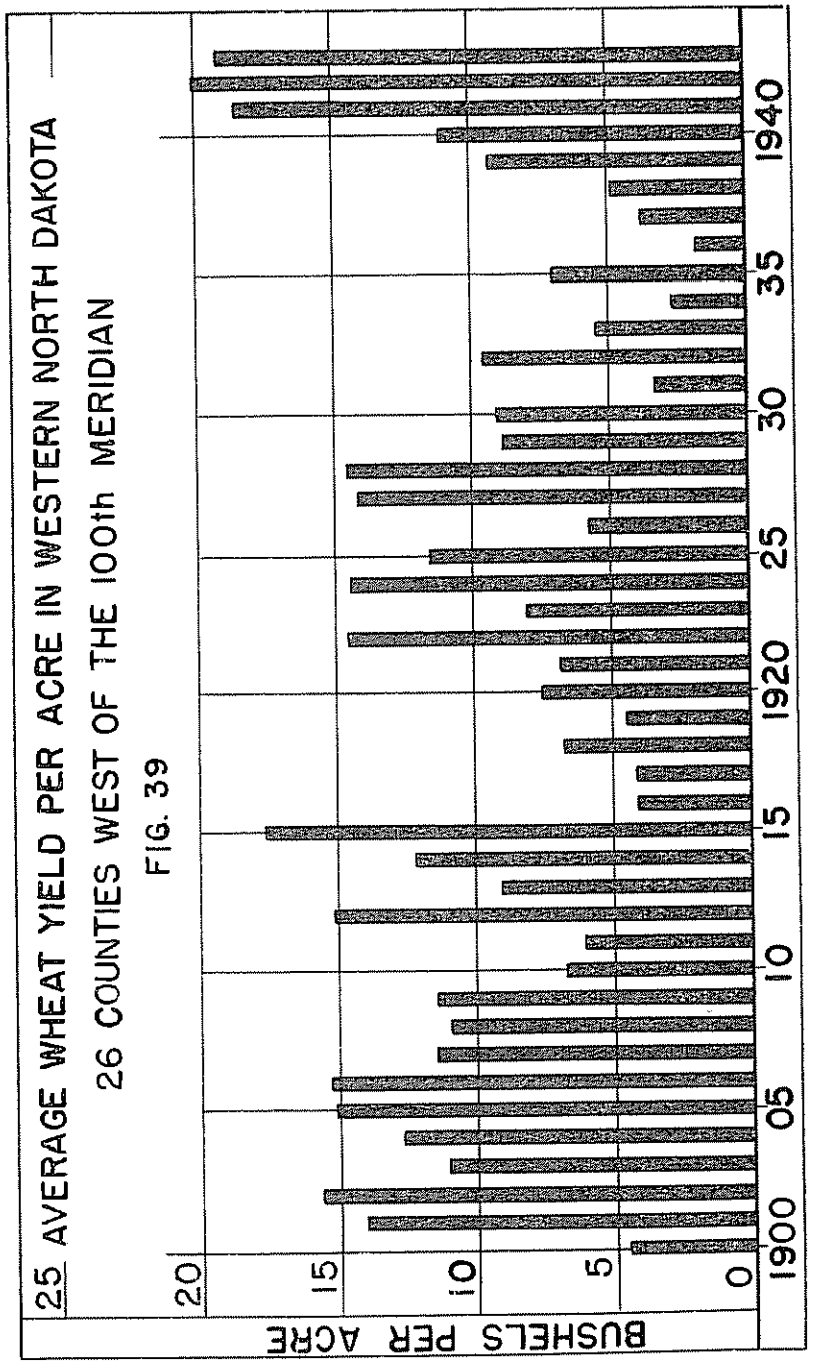
LOWER YELLOWSTONE IRRIGATION PROJECT

(In North Dakota and Montana)

This project with an acreage about equal to two townships of land has had about forty years experience and has probably arrived at about what may be expected to be the peak income average for irrigation in this area. Other younger irrigated districts have not developed as high an average income, although small irrigated acreages have produced a much larger money return.

It is noted that these two townships of land under irrigation have produced for the two years of 1942 and 1943, a gross income about as large as the average whole county of thirty or more townships has produced under dry farming on some of the best income years.

It is producing enough feed to maintain a livestock population valued at two and a half million dollars, with amazing returns from feeding operations.



LOWER YELLOWSTONE IRRIGATION DISTRICTS 1 and 2

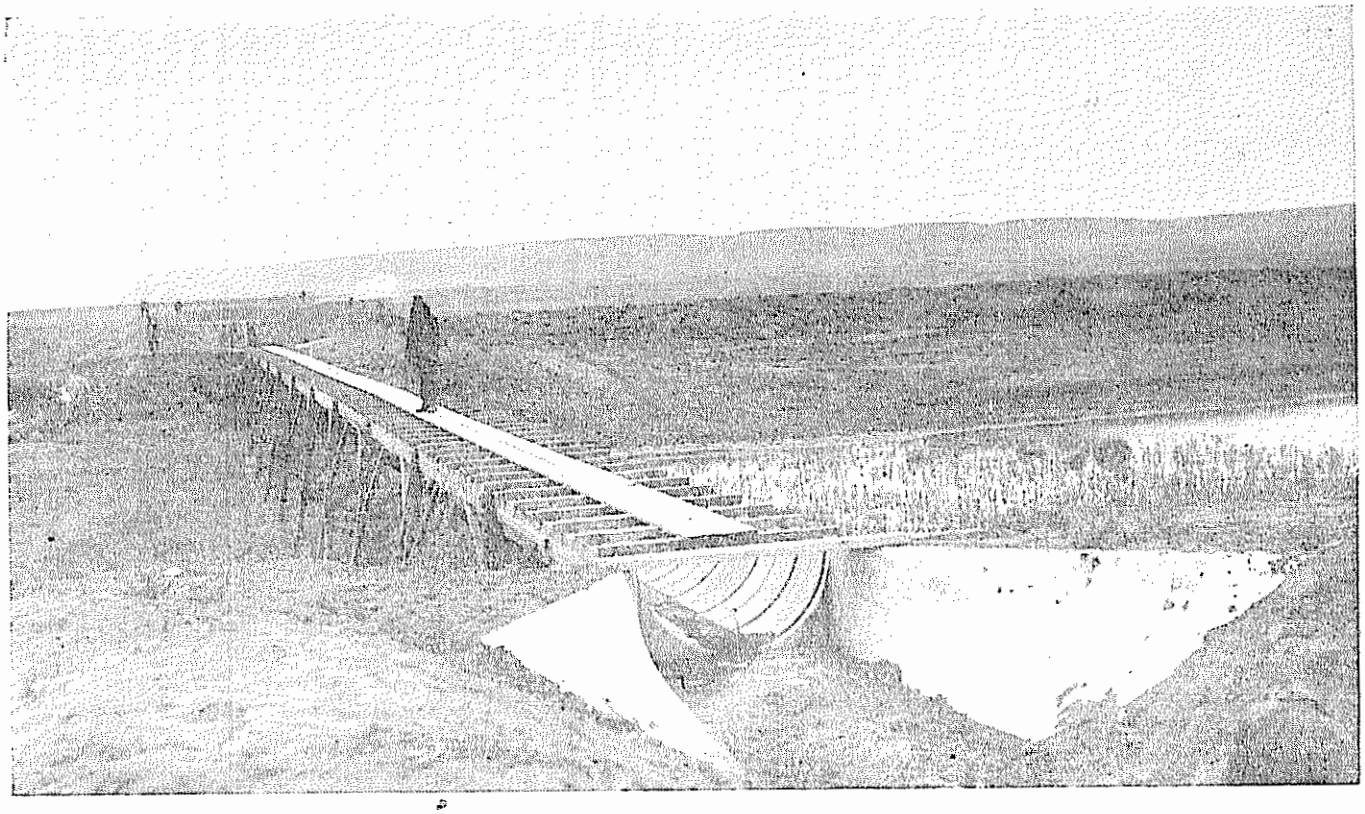
In North Dakota and Montana
45,026 Acres

Crop	1942 Av. Yield	1942 Acre Value	1942 Total	1943 Av. Yield	1943 Acre Value	1943 Total
CEREAL:						
Barley	38 0	$ 18 23		40 5	$ 32 46	
Corn	31 9	19 12		32 1	32 12	
Oats	58 0	20 87		55 3	29 31	
Wheat	31 9	31 87		31 4	36 68	
Speltz	36 1	16 59		61 2	30 59	
Totals			$ 282,451 00			$ 480,262 00
SEED:						
Alfalfa	1 4	14 20		2 7	55 65	
Clover	5 9	14 14				
Flax	9 9	21 04		10 6	28 14	
Millet	15 0	11 25				
Soybeans	7 8	7 03				
Totals			14,120 00			29,245 00
FORAGE:						
Alfalfa	2 2	16 84		2 1	22 89	
Other hay	1 3	3 15		1 3	7 83	
Corn Fodder	1 9	4 80		2 1	7 24	
Corn Silage	5 6	8 40		6 5	13 04	
Sugar beet tops	12 6	3 15		10 0	4 02	
Natural pasture		50			50	
Tame pasture		10 00			10.00	
Other pasture		2 00			2 00	
Totals			$ 243,808 00			$ 303,962 00
VEGETABLES:						
Beans, commerce	12 5	12 46		9 4	34 96	
Onions, dry	39 4	47 30		125 0	150 00	
Potatoes, white	209 7	125 83		72 2	72 20	
Gardens, truck		66 61			72 50	
Totals			76,174 00			181,158 00
Sugar beets	12 6	74 35	1,136,417 00	10 0	82 53	977,350 00
Additional revenues			538,554 00			770,345 00
TOTAL VALUE CROPS			$2,291,524 00			$2,742,322 00
AV. VALUE PER ACRE			50 89			59 65

LOWER YELLOWSTONE IRRIGATION DISTRICTS 1 and 2

In Montana and North Dakota
45,026 Acres
Livestock Inventories

	December 31, 1941			December 31, 1942			December 31, 1943		
	Number	Value	Total Value	Number	Value	Total Value	Number	Value	Total Value
Horses-Mules	1,401	$48.83	$68,410.00	1,269	$ 49.97	$ 63,415.00	1,007	$ 44.06	$ 44,371.00
Cattle, beef	1,888	47.89	90,410.00	3,922	65.87	258,340.00	2,986	67.60	201,863.00
Cattle, range feeders	5,670	56.11	318,139.00	3,910	73.52	287,464.00	5,762	73.54	423,755.00
Cattle, dairy	2,811	52.15	146,551.00	2,229	73.54	163,922.00	1,666	75.65	126,040.00
Purebred sires	55	118.38	6,465.00	55	145.09	7,980.00	66	197.42	13,030.00
Scrub sires	41	75.49	3,095.00	24	125.42	3,010.00	39	99.23	3,870.00
Sheep, farm flock	5,104	5.68	28,970.00	4,181	8.42	35,200.00	4,145	5.75	23,844.00
Sheep, range feeders	165,578	5.93	981,505.00	189,211	7.75	1,466,385.00	172,746	8.59	1,483,272.00
Hogs	4,715	2.25	1,420.00	728	2.50	1,821.00	10,959	16.53	181,144.00
Turkeys	631	2.25	1,420.00	728	2.50	1,821.00	385	4.28	1,647.00
Fowls	31,137	.54	16,718.00	36,323	.57	20,557.00	37,513	.82	30,928.00
Other fowl	.....	.....	318.00	.....	.....	455.00	.....	.....	509.00
Bees, hives	250	5.00	1,250.00	376	9.03	3,396.00	405	10.04	4,068.00
Totals	.....	.....	$1,715,840.00	.....	.....	$2,453,818.00	.....	.....	$2,538,341.00
Increased values	.....	.....	.....	.....	.....	737,978.00	.....	.....	84,523.00



Metal Flume—Buford-Trenton Irrigation District

VICTORY GARDENS

North Dakotans have contributed their share to the raising of needed health-giving foods and have again been blessed by nature and ample rainfall with bounteous returns, now overflowing the winter storage capacity. Many have utilized irrigation of the gardens during occasional dry and hot spells when a little water added by artificial means tides over the bad period and greatly increases the production. In the years of low rainfall which past records indicate are almost certain to follow the present years of excess moisture, it will be absolutely essential to have some means of watering the gardens in order to produce needed health-giving foods. Reports indicate that it is not uncommon to produce food to the value of four to five hundred dollars per acre on well-cultivated and irrigated and fertilized land. Several reports of small fruit sales show that more than a thousand dollars per acre have been received. This all indicates that the garden plot is the most profitable on the farm, and that one can well afford some form of irrigation to tide it over dry spells which occur each year, and in the past have developed into dry seasons when very little could be raised without irrigation.

PROPOSED IRRIGATION PUMPING PROJECTS

Through a cooperative agreement between the U. S. Bureau of Reclamation and the State Water Conservation Commission with funds provided by the North Dakota legislature and the Congress of the United States, on a 50-50 basis, investigations, plans and specifications have been made for an extensive development of the possibilities for irrigation in North Dakota, and a Bureau of Reclamation plan has been submitted to Congress asking for appropriation of funds for construction of irrigation projects in this state as listed below:

	Irrigable acres		Irrigable acres
Williston	8,620	Hancock Flats	5,030
Birdhead	2,900	Fort Clark	2,750
Seneschal	1,990	Oliver-Sanger	6,880
Nesson	14,840	Painted Woods	2,300
Goodall	3,820	Manley	2,160
Shell Creek	4,500	Wogansport	2,400
Independence	4,130	Square Butte	2,750
Fort Berthold	9,400	Burnt Creek	1,940
Old Agency Flats	6,510	Little Heart	3,930
Old Agency Flats No 2	2,700	Horsehead Flats	9,000
Fort Stevenson	6,830	Winona	5,100
Mannhaven	1,550	Bismarck	4,880
Totals	67,790		49,120

The above group of irrigation projects are all in the Missouri river valley and water would be supplied by pumping from this river. If the Congress adopts the plan of the U. S. Army engineers and the Garrison dam is constructed, the waters in the reservoir would cover approximately two-thirds of the area listed in the first column, but this loss might be at least partially offset by lands at higher levels which it would be practical to irrigate from the impounded waters of the Garrison reservoir.

Development of irrigation and flood control projects on the western tributary streams is also planned. This would include 51,800 acres along the Knife, Heart and Cannonball rivers, with one storage structure on the Knife, two on the Heart and two on the Cannonball rivers. Plans for the development of the Little Missouri river are not complete, and require further study.

RED RIVER BASIN

The eastern area of North Dakota would benefit by the proposed diversion of Missouri River surplus waters in that Devils Lake and Stump Lake waters would be raised to a point which would bring this area the popularity it formerly held as a pleasure resort and popular meeting place for the people of this state.

The ability to release waters from the Stump Lake outlet in steady flow into the Sheyenne River, would provide ample flow for municipal use and handle sewage disposal along its course. The proposed diversion would bring water through the outlet of the Sheyenne into the Red River above Fargo, thus giving an ample steady flow to supply the needs of that city and others farther north on the Red River.

Reservoirs Proposed

The Bald Hill reservoir, on the Sheyenne river north of Valley City, has been approved by the Army Engineers as a part of its flood control program, as have reservoirs on the south branch of Park River for flood control and water supply, and reservoirs for the same purposes on the Pembina and Tongue rivers, in the northeast corner of North Dakota.

Drainage Problems

In western North Dakota agricultural stability can be attained in a substantial way by irrigation. In the Red River valley, stability cannot be attained until adequate drainage canals and ditches are provided to carry off surplus water. Hence North Dakota has a water shortage problem in the western two thirds of the state and a water surplus problem in the eastern third of the state.

In the past the construction of drainage ditches was considered a local problem and provision was made for drainage districts to levy special assessments to meet the cost on the theory that the lands directly benefited should bear the entire expense. But

gradually the public is realizing that loss of crops caused either by drouth or floods indirectly affects the economic stability of the whole state.

Ben Kienholz, Agricultural Statistician of the U. S. Department of Agriculture, submitted a report to the State Water Conservation Commission giving a summary of his survey of the estimated damages and value of crops lost resulting from an excess rainfall in the Red River Basin in North Dakota, for 1943 and 1944. This report follows:

SUMMARIZED REPORT OF CROP DAMAGE IN THE RED RIVER VALLEY FOR 1943 AND 1944

by

Mr. Ben Kienholz

Agricultural Statistician, Bureau of Agricultural Economics
U. S. Department of Agriculture, Fargo, North Dakota

County	No. of Reports	Indicated total Acres of Crop land not used, or on which crops were damaged or destroyed due to excessive moisture in 1944	Estimated value per acre of crops lost or destroyed due to excess moisture	Total value of crops lost or destroyed in 1944	Total value of crops lost or destroyed in 1943 (Based on a similar survey made in fall of 1943)
Pembina	93	112,000	$16 76	$1,877,000	$ 809,000
Walsh	91	82,000	19 91	1,633,000	1,810,000
Grand Forks	86	41,000	12 94	531,000	684,000
Traill	82	50,000	14 47	724,000	543,000
Cass	128	246,000	13 68	3,365,000	2,541,000
Richland	122	272,000	11 70	3,182,000	4,465,000
Total for area surveyed both years				11,312,000	10,852,000
Sargent	58	82,000	10 24	840,000	(not surveyed)
Dickey	52	51,000	9 97	508,000	(not surveyed)
LaMoure	52	40,000	8 98	359,000	(not surveyed)
Ransom	27	50,000	10.91	546,000	(not surveyed)
Total Area	791	1,026,000	$13 22	$13,565,000	

The total area of the crop land damaged during 1944 as shown in the above table is 1,025,000 acres, with an average estimated value of $13 22 per acre, making an estimated crop loss for 1944 of $13,565,000. This is considerably in excess of the estimated damages shown in the report compiled from the survey covering the six counties bordering the Red and Boise de Sioux rivers for the year of 1943.

During recent years of heavy precipitation, the counties in the Red River drainage basin of North Dakota have sustained damage to crops estimated as much as in excess of twenty five million dollars.

Maintenance Drainage Channels

The last session of the North Dakota Legislature appropriated $50,000 to be expended under the direction of the engineers of the State Water Conservation Commission for the maintenance of drainage channels and for new construction.

After several public hearings in the Red River area and a survey of the estimated damage in the different counties by Ben Kienholz, Agricultural Statistician, an allocation of the fund to the different counties was made on the basis of the crop losses incurred for 1943 from flooded farm lands, with the provision that the counties or drainage districts or cooperative farmer groups affected should pay at least 60% of the cost of maintenance or construction and the State Water Conservation Commission 40%.

Allocation of Drainage Funds

Cass County	19%	8,930.00
Grand Forks County	4%	1,880.00
Pembina County	8%	3,760.00
Richland County	49%	23,030.00
Traill County	5%	2,350.00
Walsh County	15%	7,050.00
		47,000.00

The amount appropriated was found to be inadequate to do the job which it was intended to do, with the result that only a fair start has been made on the drains which are needed to carry off surplus waters and prevent a recurrence of this immense loss not only to the individual farmers affected, but to the local communities and the state as a whole.

An agreement was made with the U. S. Department of Agriculture Soil Conservation Service to use its engineers for the planning and supervision of the drainage construction work, and to use its heavy machinery and equipment needed and which because of war conditions was almost impossible to secure otherwise. They have in use on this work 8 dragline ditchers, 10 crawl-type tractors, 9 carrying scrapers, 2-12 ft. blade graders, 3 elevator graders and 9 trucks, and have established headquarters offices at Grafton and Wahpeton.

Difficulty and delay was experienced in getting organized to do this work and provide required dirt-moving equipment, get the financial organization plans completed for the different projects

and secure efficient labor required, with the result that approximately one-third of the work contemplated has been completed as this report is written. It is demonstrated more and more as progress is made that the needed drainage construction is a much bigger job than at first contemplated and that it may take several years to complete the work, also that each year will bring needed maintenance work after construction is completed.

RED RIVER DRAINAGE PROGRAM

Progress of Construction Sept. 30, 1944
Under Supervision Soil Conservation Service

County	Work under Construction Cubic Yards	Approved for Work Cubic Yards	Surveyed	Plans Complete
Richland	170,438	90,673	928,013	824,013
Cass		15,150	99,000	39,000
Pembina	46,240		978,000	65,000
Walsh	83,560		847,560	790,000
Grand Forks	100,030		119,500	
Totals	400,268	105,823	2,952,073	1,718,013

COOPERATING AGENCIES

State and national departments and agencies with which the work of the State Water Conservation Commission is coordinated have contributed their own statement of work accomplished, which in most cases had to be condensed to bring the total within the number of pages authorized for this report. On first glance it may appear to the reader that there is an over-lapping but on further study it will be found that each department or agency has performed its particular part of the work which when coordinated with the others covers all the phases of the planning, surveying, mapping, specifications, weather and stream-flow records required for estimates, and details which make up the complete and detailed plans. This Commission is deeply indebted to the different cooperating agencies for their very fine cooperation in every way.

BUREAU OF RECLAMATION PLAN

Cooperative investigations conducted by Bureau forces under a North Dakota contract with the State Water Conservation Commission dated May 7, 1943, began in June of that year. Seven survey parties stationed at Williston completed detailed surveys on the Williston, Birdhead, Nesson and Goodall units by October,

1943. Further detail work on the Missouri river above Garrison was halted pending decision by Congress as to the inclusion or rejection of the Garrison Reservoir in the Missouri River development program.

Reconnaisance surveys were made of 270,000 acres along the James and the Little Missouri Rivers and detailed surveys were completed for the Thunder Hawk and Cannonball Dams and Reservoirs on the Cannonball River. Work was commenced on a detailed survey of Heart Butte Dam and Reservoir and reconnaisance mapping of the Missouri-James river divide. Preparation of the Little Missouri Basin report was deferred because of the shortage of engineers to do the work.

The early months of 1944 were devoted to details of the Bureau's Missouri Basin report to Congress, including studies of the water supply and reservoir requirements. Power and navigation benefits were assessed. Since May, 1944, most of the staff has been preparing report data on pumping plants below the proposed Garrison Dam, on which field surveys are nearing completion and land classification is now under way.

On Sept. 1, 1944, after 15 months of cooperative work, field work had been completed as follows:

Land surveyed in detail	110,710	acres
Land classified in detail	80,382	"
Canal system estimates complete	22,504	"
Reconnaissance topographic survey	600,000	"
Reconnaissance soil classification	270,000	"
Reservoir surveys completed	7,000	"
Dam sites surveyed	2	"

Five survey parties and one land classification party are employed by the Bismarck office. Because of war conditions it has been difficult to maintain a force of engineers to advance the work as fast as desired, and no more than half the professional help desired has been employed.

The farm attitude toward irrigation and Federal specifications for land ownership is an important survey being made. Field interviews with farm owners on six of the Missouri River pumping units are complete, and 177 owners in the Crosby-Mohall area. On the Williston, Nesson, Birdhead, Seneschal, Goodall and Burnt Creek projects, where livestock feed is the principal need, practically no opposition to irrigation was found. It was found that land settlement will be less of a problem than expected. Crosby-Mohall farmers would approve formation of an irrigation district.

Office engineering and editorial work on the survey data collected could well require several years for completion under present conditions, depending on the action of Congress on legislation now being considered.

NORTH DAKOTA RURAL REHABILITATION CORPORATION

The funds of this corporation and the cooperation of its officials have been of very great aid to the Water Commission in the construction of the Lewis & Clark, the Sioux and Grantier projects in McKenzie county, as well as in constructing an enlarged intake on the Yellowstone Pumping Irrigation project. Without the financing through this corporation, very little could have been accomplished on the construction and practical demonstrations of the increased returns from irrigated lands as compared to dry land farming.

This corporation advanced a total of $175,000. used in the construction work, levelling and drainage works of these projects and on seven Cedar River and Cannonball river community garden projects, which were much needed because of the drouth conditions at the time.

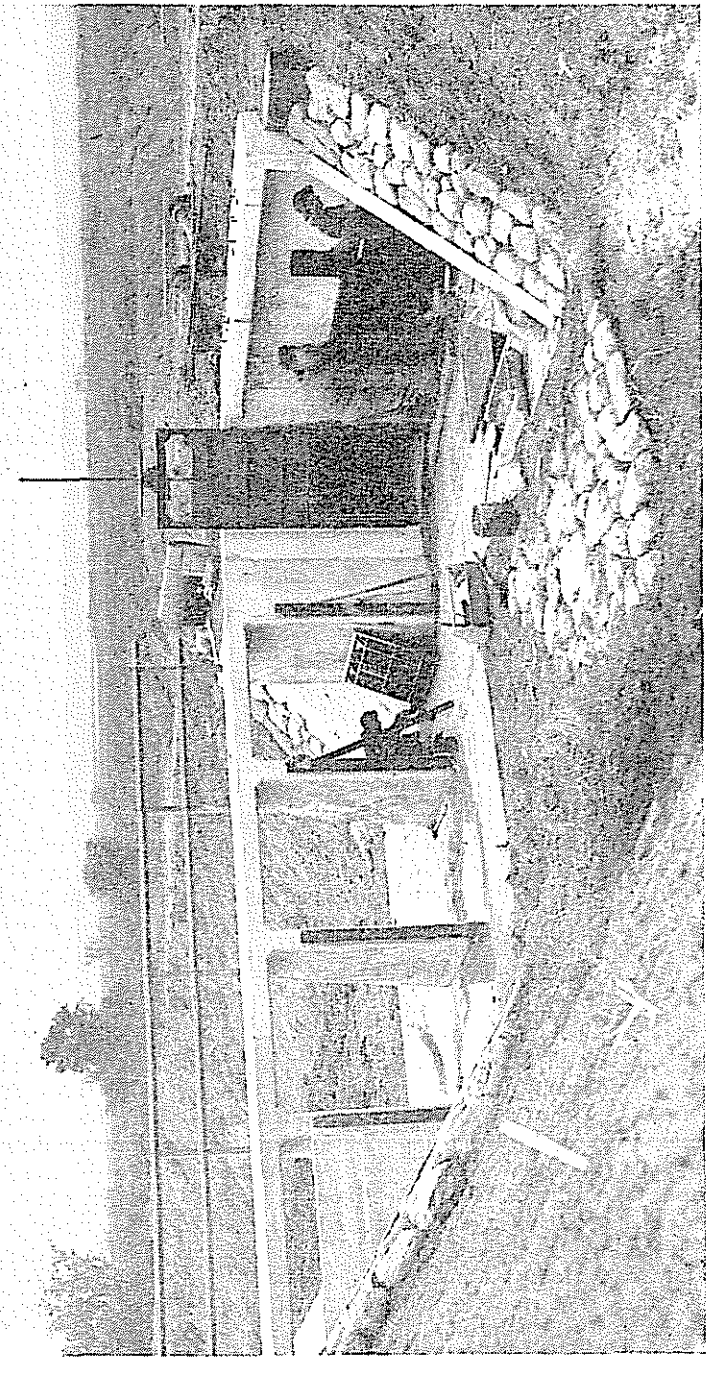
Lands to the value of $27,000. on the Lewis & Clark Irrigation District, which were purchased by the State Water Conservation Commission at the time of construction of the irrigation and drainage system, have been purchased by the Rural Rehabilitation Corporation, which now owns all of the lands in that District. It expects to pay off the balance of $35,000. due on the Lewis & Clark Irrigation District bonds, which will enable the Commission to reduce its outstanding bonds to $32,000. being carried for the Sioux, Grantier and Yellowstone Pumping projects.

The Lewis & Clark Irrigation District has been divided into fifty one irrigated tracts averaging a little over one hundred acres which were surveyed during 1944 by engineers of the State Water Conservation Commission for the Rural Rehabilitation Corporation. These plats have been filed for record for convenience in making transfers to individual owners who will purchase these irrigated tracts. In addition, the District owns additional upland tracts which are suitable for pasture lands.

NATIONAL RIVERS AND HARBORS CONGRESS

This organization acts in an advisory capacity to Congress. Its engineers have recommended Congressional appropriations on several of the projects in North Dakota on which action has not been rushed because of the labor shortage and inability to secure machinery and materials needed unless it contributes directly to the war effort.

The meeting of this Congress at New Orleans, La. on July 26-27, 1944, was attended by Vice-Chairman Kenneth W. Simons and two others from North Dakota, at which time there was considerable discussion regarding the plans for the utilization of the waters of the Missouri River Basin, with supporters of both plans before Congress.



FARM SECURITY ADMINISTRATION

Under the provisions of the Wheeler-Case Act as amended, the Secretary of Agriculture is authorized to conduct investigations and surveys of projects proposed under authority of the Act in cooperation with the Bureau of Reclamation; arrange for settlement of the projects on a sound agricultural basis and insofar as practicable, the location thereon of persons needed; extend guidance and advice to settlers thereon in matters of farm practice, soil conservation and efficient land use; acquire agricultural lands within the boundaries of such projects with titles and at satisfactory prices; arrange for the improvement of lands within the project boundaries, including clearing, leveling and preparing them for the distribution of irrigation water; enter into the repayment contracts provided by the Act and take over the administrative duties connected with the project after the Secretary of the Interior announces that the project is ready for operation.

Buford-Trenton Project

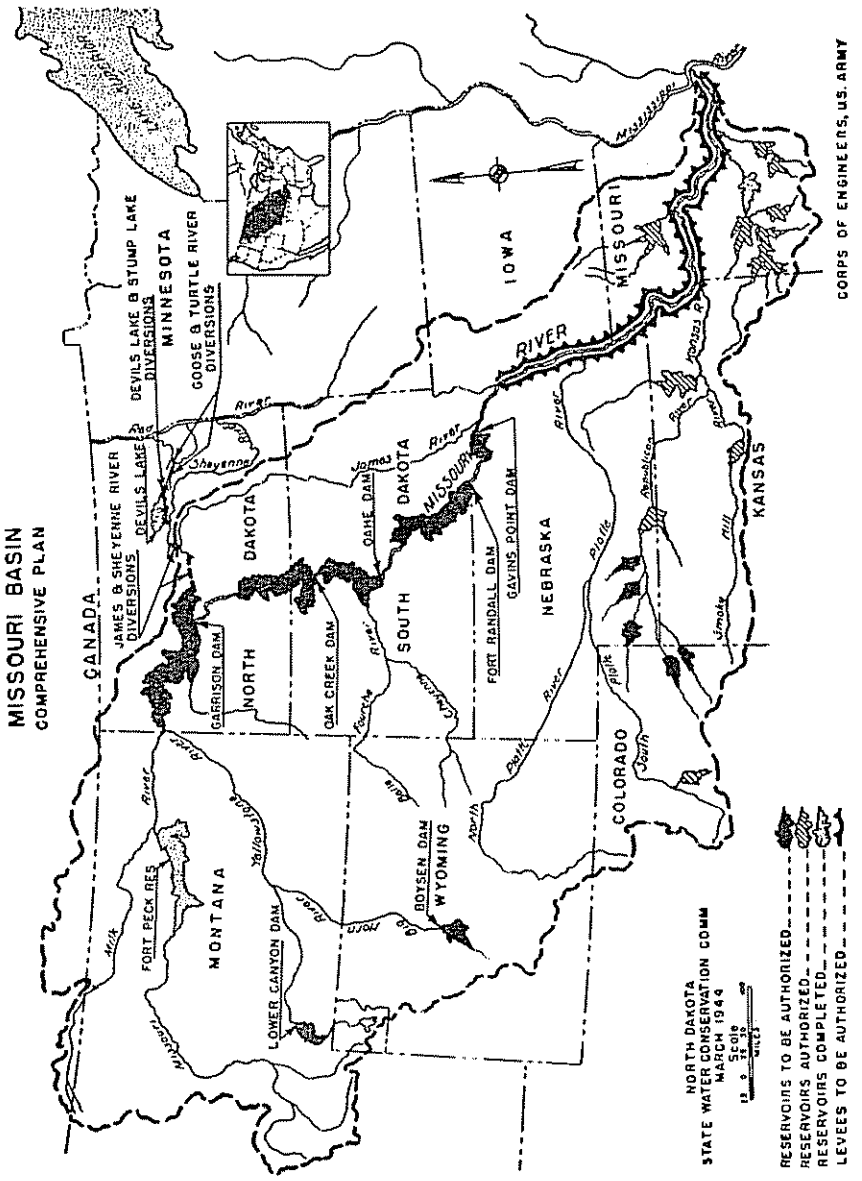
The Farm Security Administration and the Bureau of Reclamation are working on a program to bring 14,800 acres under irrigation as a development under the water conservation and utilization program. This project is located near Williston, in Williams County, North Dakota. The experience gained on the Lewis & Clark Irrigation District has contributed much to the ideas being used on the Buford-Trenton project. Approximately 1,800 acres were developed in 1942 ready for irrigation but because a Missouri river flood covered the area in the spring of 1943, no irrigation was necessary. It was planted mostly to war crops and yielded a gross income of $65,367. 3,200 more acres were prepared for irrigation in 1944, but no report has been received on the yields. It is estimated that the completed project will provide homes for 140 families.

Joseph C. Paulson has acted as Project Supervisor for the Farm Security Administration on both the Lewis & Clark and the Buford-Trenton irrigated districts.

STATE RECLAMATION ASSOCIATION

This organization, with Directors in every county in the state and a membership of about 3,500, has been active in the promotion of irrigation and Missouri River diversion. It has had active representation in all of the meetings of importance dealing with the water problems of North Dakota, and before Congressional committees where Missouri River diversion and irrigation plans are under consideration. Its state-wide influence has greatly aided in educating the citizens as to the value of irrigation as a stabilizing factor in agriculture and stock raising.

It has sent a large representation of interested citizens to the meetings of the National Reclamation Association, of which one director is a citizen of North Dakota. These forces, working to-



gether, are gradually making the nation conscious of the value and need of a well-considered program of irrigation, reclamation and water conservation for the arid and semi-arid states of the West.

THE ARMY ENGINEERS PLAN

An immense dam and reservoir near Garrison, North Dakota, which would impound 17,000,000 acre feet of water and of which the estimated cost is $130,000,000, with four other dams and reservoirs on the Missouri river in South Dakota and one in Montana and one in Wyoming, are included in the plan submitted to Congress by the U. S. Army Engineers, with the principal purpose of flood control, river navigation below Sioux City, and generating of electricity. The following extract from the report covers other uses contemplated for the waters from the Garrison reservoir:

"In connection with the proposed Garrison Reservoir, a practical solution to a situation which has long existed in the States of North and South Dakota and which periodically causes much trouble is possible. During excessively dry years the regions in the vicinity of Devils Lake and the James River Basin become so short of water that animals are subjected to great suffering and the people to severe hardship. —The best over-all use of the multiple-purpose reservoirs would permit a feasible diversion of water from the Missouri River into the Dakotas for domestic use and other purposes. First there must be conserved and stored in the Missouri Basin enough water to provide this diversion. The plan proposed herein provides for such storage in the reservoirs listed. —By the time that water is available, there should also be completed pumping facilities and conduits needed to provide the Devils Lake and James River regions at least as much water as they now have during seasons of normal rainfall. Later this flow of water can be increased to provide much additional irrigation. The plan herein contemplates that there shall be started improvements to provide a diversion of water from the Missouri River into the Dakotas and that this diversion should be progressively increased and improved as time and conditions warrant such improvements."—

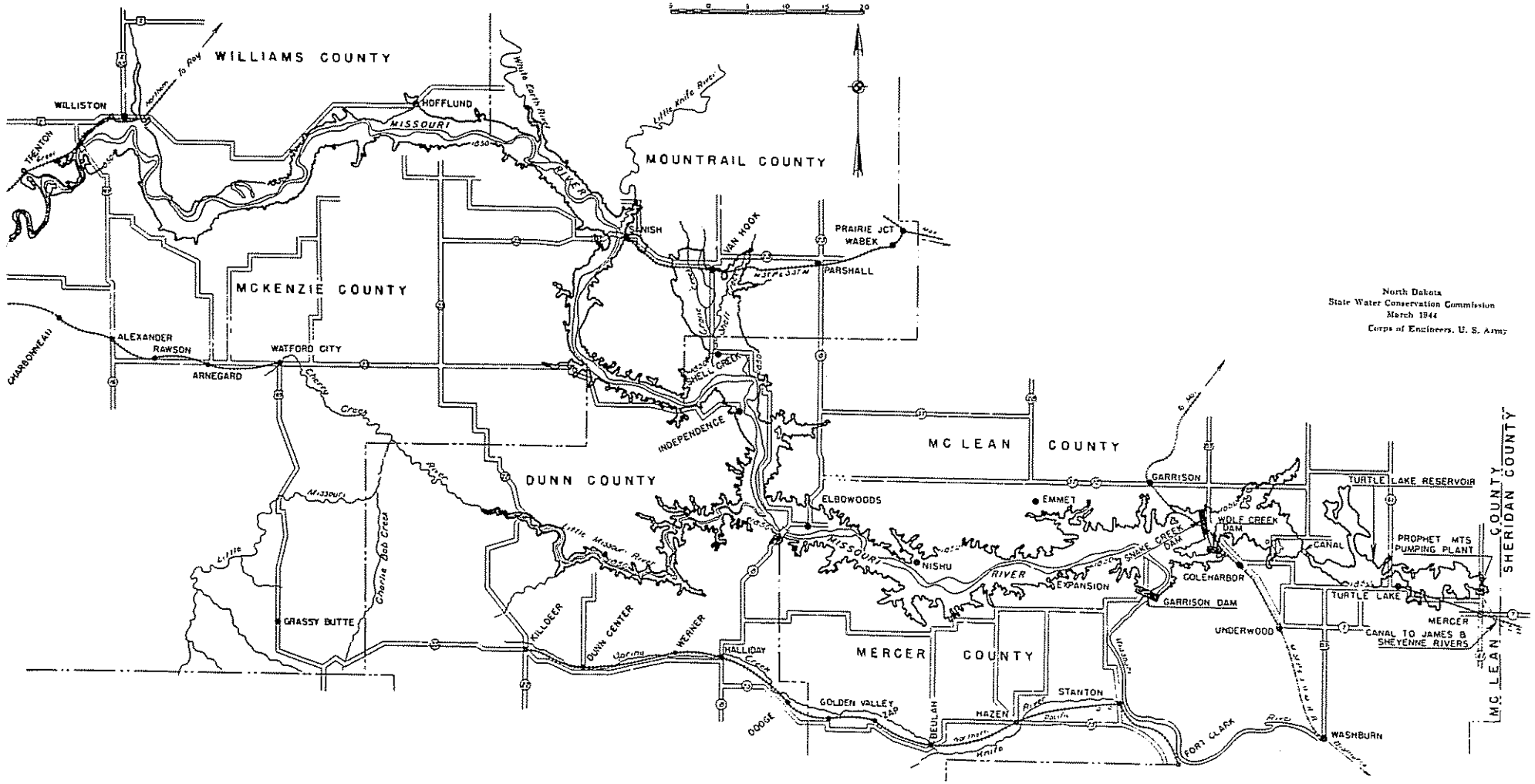
ARMY ENGINEERS STUDY RED RIVER DRAINAGE

Col. Lynn C. Barnes of the St. Paul office of the U. S. Army Engineers reports that they are making a study of a plan for regulated stream flow of the Red River and flood problems arising from the excessive rainfall of past seasons.

Richland county farmers complain that when the army engineers deepened and straightened the Bois de Sioux river it speeded the flow of waters toward Wahpeton and Breckenridge, and that further drainage ditches constructed have augmented the flow of

GARRISON & TURTLE LAKE RESERVOIRS

SCALE IN MILES



North Dakota
State Water Conservation Commission
March 1944
Corps of Engineers, U. S. Army

waters to that area, materially increasing the loss of crops from floodwaters.

Col. Barnes is reported to have stated that the flood control bill now before Congress contained a clause which would allow army engineers to make major drainage improvements; that control of Clearwater and Red Lake rivers on the north of the basin, holding back flood waters, would help Wahpeton and Breckenridge areas; also, that the completion of the Pembina, Tongue, Park River and Baldhill reservoirs on the North Dakota side would help in holding back floodwaters, just as the building of Lake Travers dams has helped in controlling floods.

SOIL CONSERVATION SERVICE

Limited space in this report compelled the digest of information furnished by A. D. McKinnon, State Soil Conservationist, telling of the organization in 1935 when directing the labor of CCC camps and WPA enabled it to construct water conservation dams and experiment with soil erosion control.

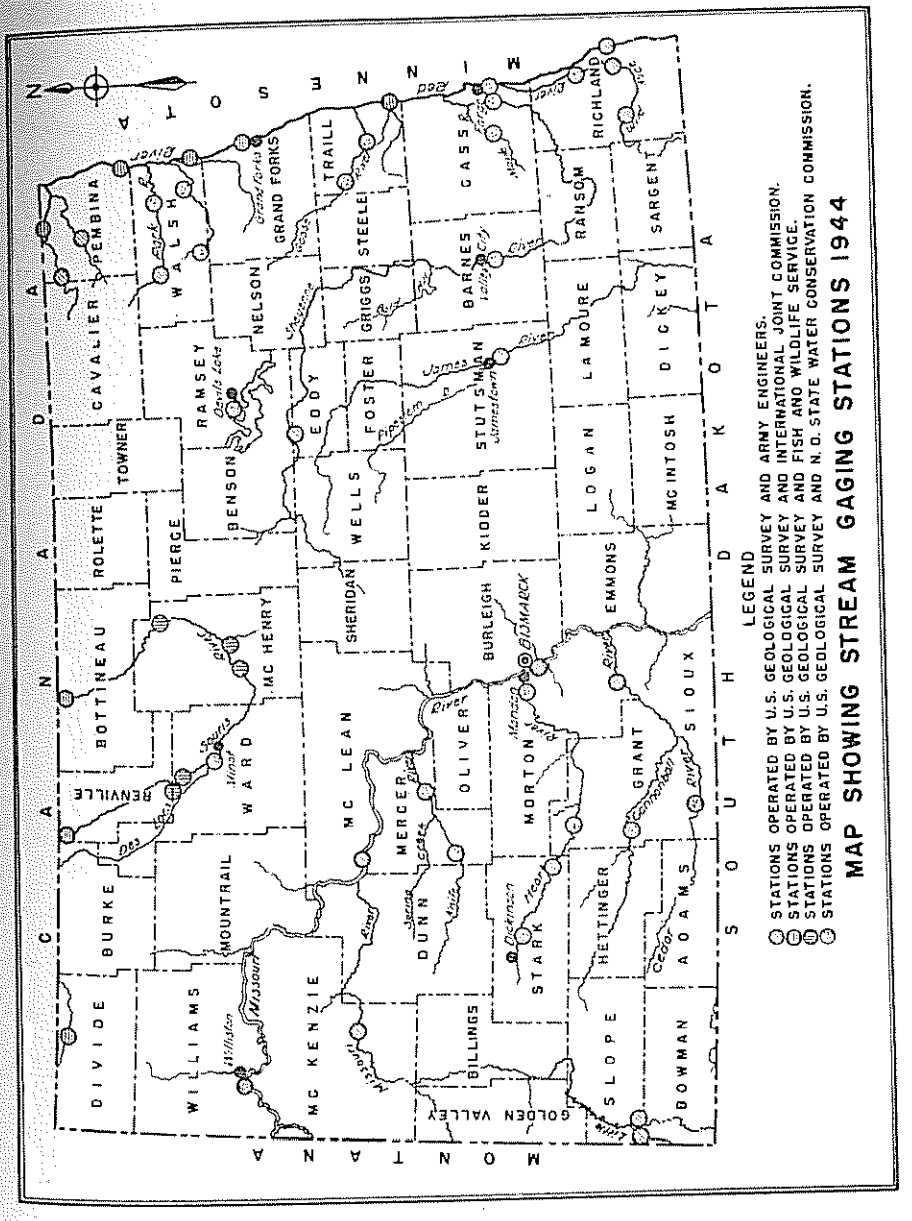
The North Dakota Soil Conservation District Law was passed in 1937 with the thought of preserving natural resources, control floods, prevent impairment of dams and reservoirs, preserve wildlife, protect the tax base and promote the health and general welfare of the people of the state.

Soil Conservation Districts have been organized covering more than half the counties in North Dakota, where the Service is assisting the Supervisors in establishing a more stable agriculture on the farms. Some of the activities include wind and contour strip cropping, water spreading and irrigation for supplemental feed supplies, developing livestock water, planting of trees and shrubs, establishing cropping rotations to improve soil fertility with a system of pasture and range improvement and improved tillage operations.

The Soil Conservation Service administers the Prairie States Forestry Project and has charge of the management and development of large tracts of government land in the state leased to grazing associations.

Approximately 1200 dams and dugouts for livestock water have been constructed under Service supervision, including similar development on government-owned lands. Wherever possible the overflow is used for irrigation or water-spreading systems. Springs have been developed for domestic and livestock water supply. Numerous small pump irrigation systems have been constructed.

The Soil Conservation Service engineers are now in charge and using a large amount of heavy equipment in the maintenance and construction of drainage ditches so badly needed in the Red River valley counties, in cooperation with the State Water Conservation Commission and the counties and drainage districts.



MAP SHOWING STREAM GAGING STATIONS 1944

THE WATER RESOURCES BRANCH

Department of the Interior
United States Geological Survey

The work of the engineers of this organization is in cooperation with the State Water Conservation Commission and on a 50-50 basis with government and state funds. Because of its importance on the proposed Missouri River diversion and irrigation works, district headquarters for the states of North and South Dakota were opened in Bismarck October 1st of this year.

The Water Resources Branch includes installation and operation of stream gages, both automatic recording and non-recording types, making discharge measurements of the streams of the state with current meters, collection of daily gage heights and discharge records, and compilation and publication of the data. Other federal agencies cooperating are the U. S. Army Engineers, U. S. Department of State, and U. S. Fish and Wildlife Service.

This state-wide program is necessary so that authentic records of the surface run-off from streams of North Dakota can be made available for use in preparing plans for irrigation projects, flood-control works, public water supplies, control of stream pollution, design of highways and bridges, propagation of wildlife and for recreation.

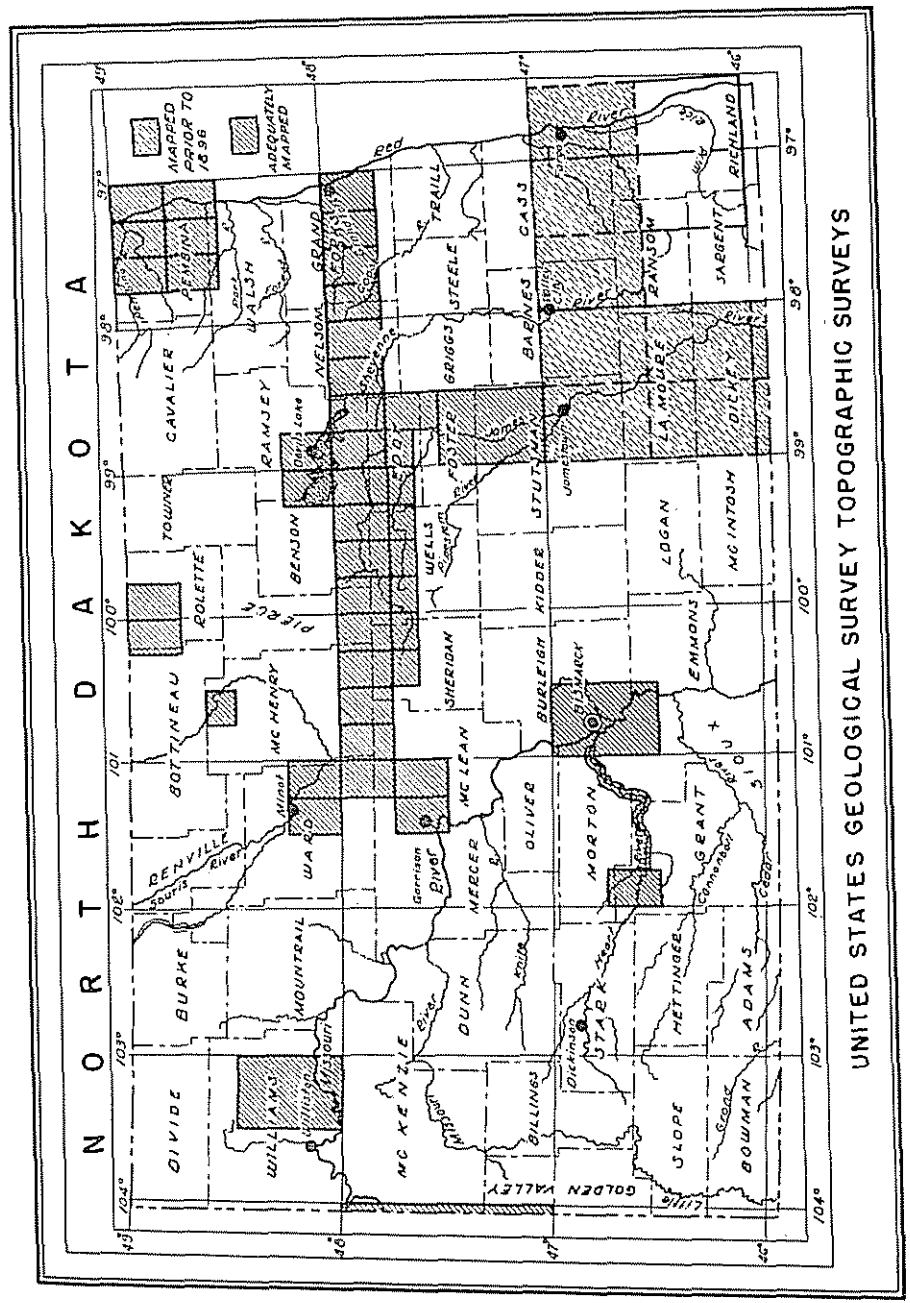
These records will be used extensively in the study, design and construction of the many projects proposed in the development of the Missouri River Basin now before Congress. The records are published in the U. S. Geological Survey Water-Supply Papers and are also available in blueprint form to those concerned with irrigation, flood control and water supply problems.

A separate supplement "B" of this State Water Conservation Biennial Report contains the stream-flow records of North Dakota up to November 1, 1944, and will be of great value in completing plans and specifications for the gigantic irrigation and water conservation works proposed for this state.

U. S. Geological Survey Mapping Division

Topographic mapping to show the elevation, depressions, levels and other details of the land surface is one of the first essentials in planning for reservoirs, canals and ditches for irrigation works. It takes time for engineers to survey and map out these details, hence it is of great importance to have these surveys completed before actual development work begins. By using the topographic maps, the time and expense of laying out reservoirs, canals and ditches for irrigation is much more rapid and simple and less expensive, and the operation greatly speeded.

The topographic maps show water, lakes, rivers, canals, swamps, mountains, hills, valleys and other features of the land



surface. Contour lines show the different elevations above sea level from which it can be determined where water will flow by gravity and the rate of fall of water in streams. Symbols on the maps show cities, roads, railroads, landmarks and many other features. (See further explanation under "Appropriations Explained.")

Progress of topographic mapping in North Dakota is shown on the attached map. Quadrangles mapped prior to the year of 1896 were more of a preliminary nature, quadrangles mapped since that date contain more important information and are classed as adequately mapped.

The U. S. Geological Engineers have been working in Eddy, Benson, Wells and Sheridan counties during the last two years. This work is incomplete and will require additional time to complete it.

UNITED STATES WEATHER BUREAU

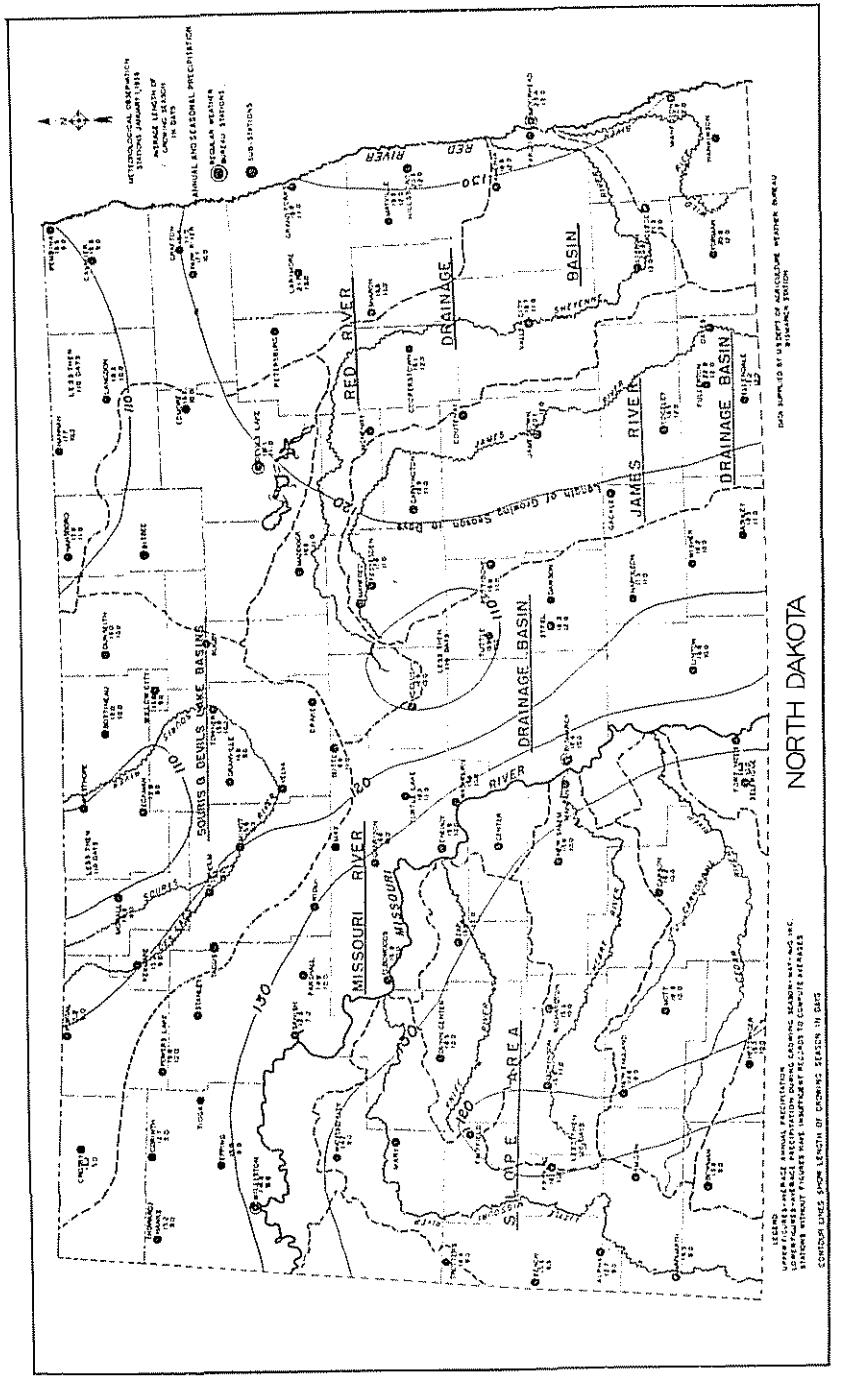
The Weather Bureau of North Dakota; The climate of any area is a natural resource that can be fully exploited for the benefit of mankind with a clear conscience. It cannot be exhausted by exploitation, as is the case with most other natural resources such as soils, forests and mines. As civilization becomes more complex, our dependence upon an intimate and accurate knowledge of climate and weather has increased, and this knowledge becomes indispensable to every civilized country. In the United States the service functions twenty four hours a day.

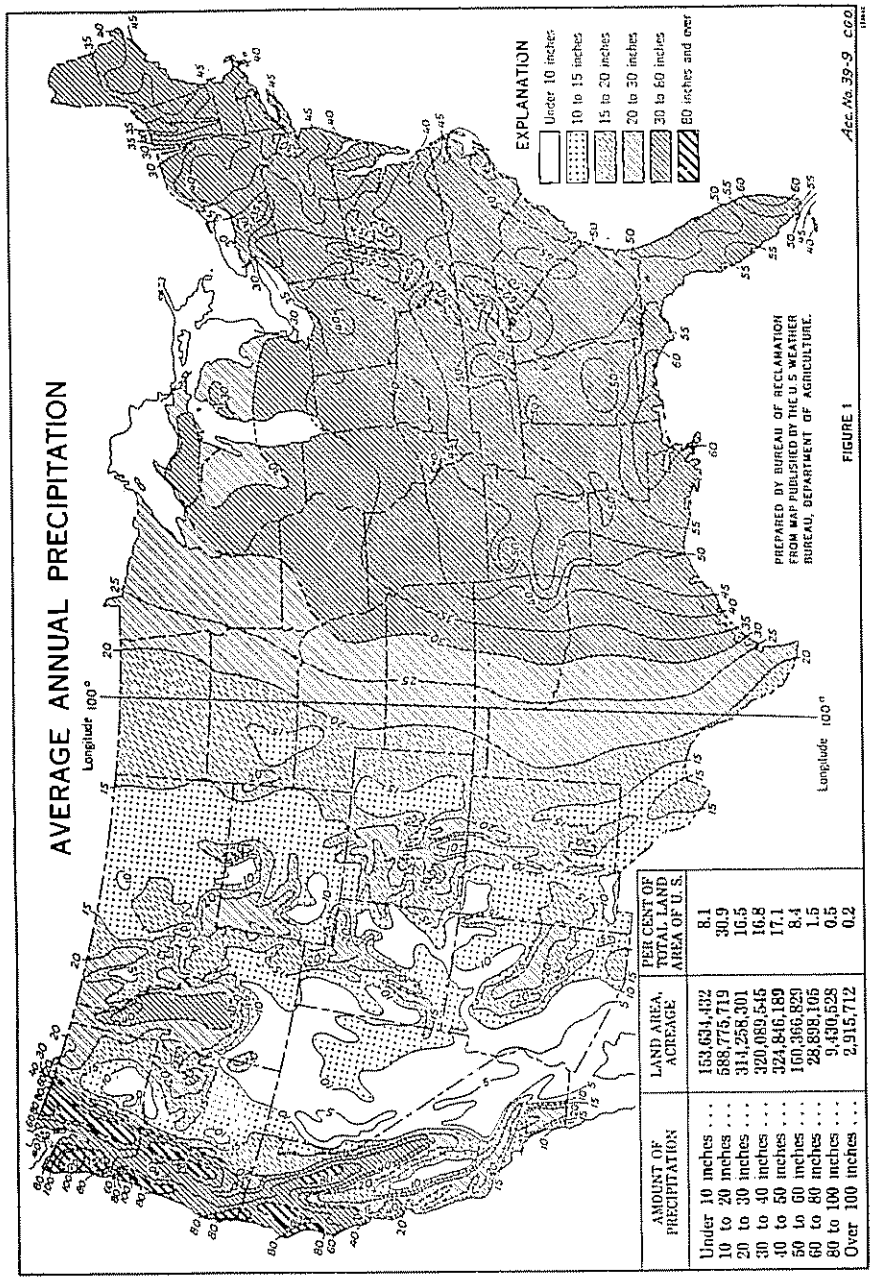
Weather extremes in North Dakota and the fact that one or two inches of rain at a critical time in the growth of crops produces a bumper crop or a crop failure, makes the people very weather-conscious. Precipitation is the most important of the elements that make climate, and for that reason the Weather Bureau gives it most attention.

All that North Dakota needs to make it one of the most important states of the Union is water. This is definitely proven by the crops raised during the past four years of ample rainfall.

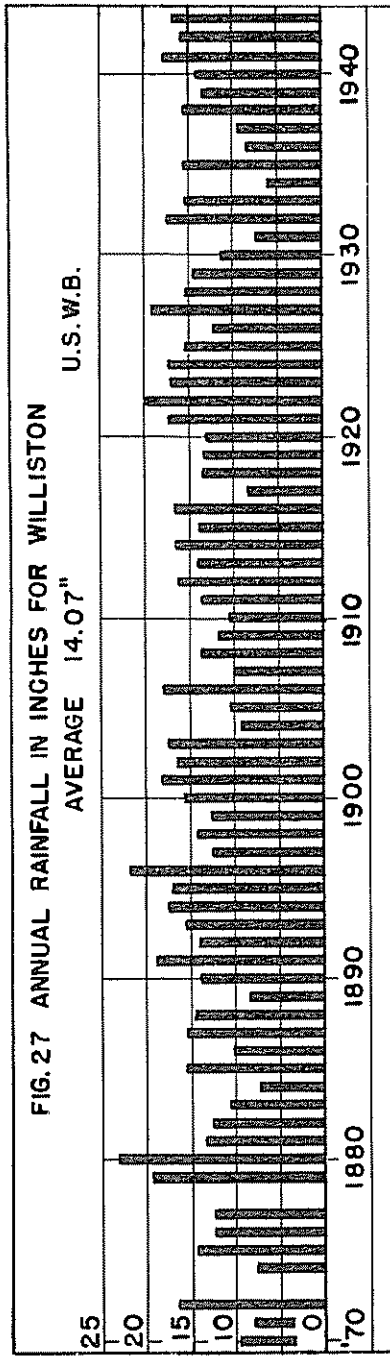
The Weather Bureau has about 120 rain gages throughout North Dakota, from which daily readings are made. Twenty five are recording gages which indicate the rate of fall besides the amount. The rate of fall is important for determining run-off from the fall per hour. One-half inch of rain falling slowly over a period of six hours is worth more to the state than an inch that falls in an hour. Fortunately, rainfalls of one inch per hour occur only twice in the average year in North Dakota.

The first weather records in North Dakota were made by Lewis & Clark in 1804-5. The army began regular observations in 1860 but a good distribution of stations was not secured until 1892 when





AMOUNT OF PRECIPITATION	LAND AREA, ACREAGE	PER CENT OF TOTAL LAND AREA OF U. S.
Under 10 inches . . .	153,634,432	8.1
10 to 20 inches . . .	588,775,719	30.9
20 to 30 inches . . .	314,258,301	16.5
30 to 40 inches . . .	320,089,545	16.8
40 to 50 inches . . .	324,846,189	17.1
50 to 60 inches . . .	160,366,829	8.4
60 to 80 inches . . .	28,898,105	1.5
80 to 100 inches . . .	9,430,528	0.5
Over 100 inches . . .	2,915,712	0.2



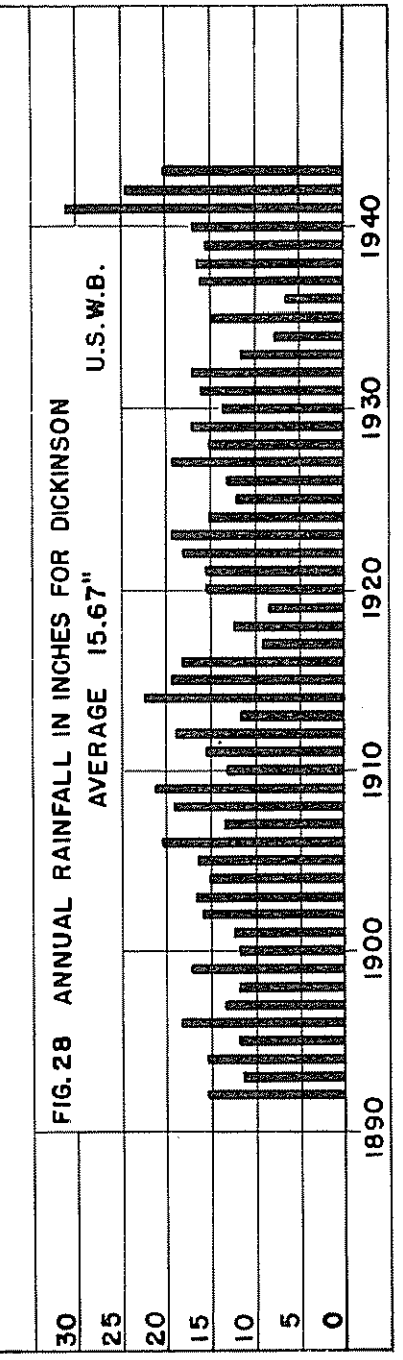


FIG. 29 ANNUAL RAINFALL IN INCHES FOR MOTT
U.S. WEATHER BUREAU
AVERAGE 16.21"

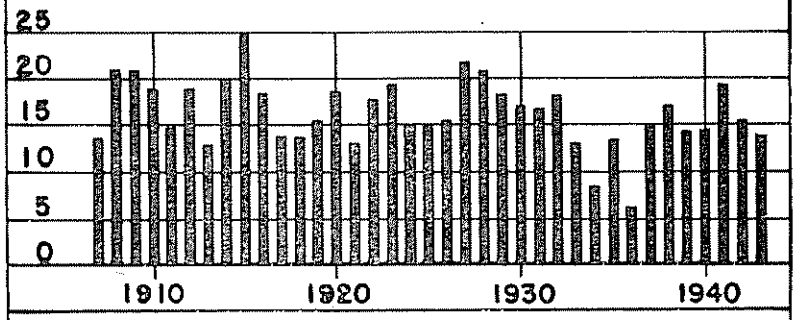


FIG. 30 ANNUAL RAINFALL IN INCHES FOR BOWMAN
U.S. WEATHER BUREAU
AVERAGE 15.24"

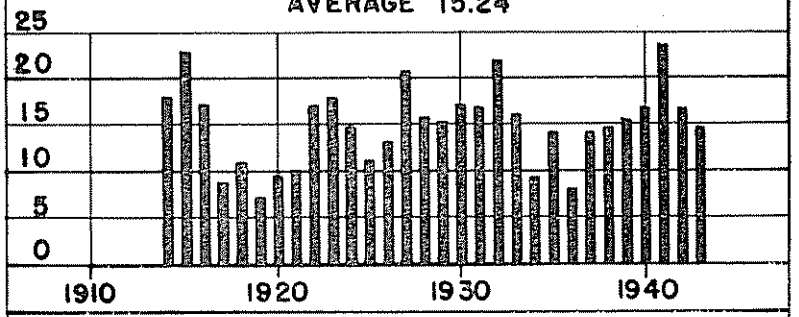


FIG. 31 ANNUAL RAINFALL IN INCHES FOR BEACH
U.S. WEATHER BUREAU
AVERAGE 15.21"

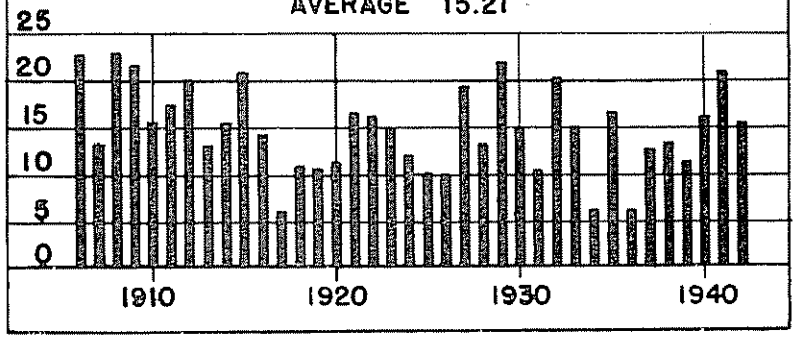


FIG. 32 ANNUAL RAINFALL IN INCHES FOR MINOT
AVERAGE 15.48"
U.S.W.B.

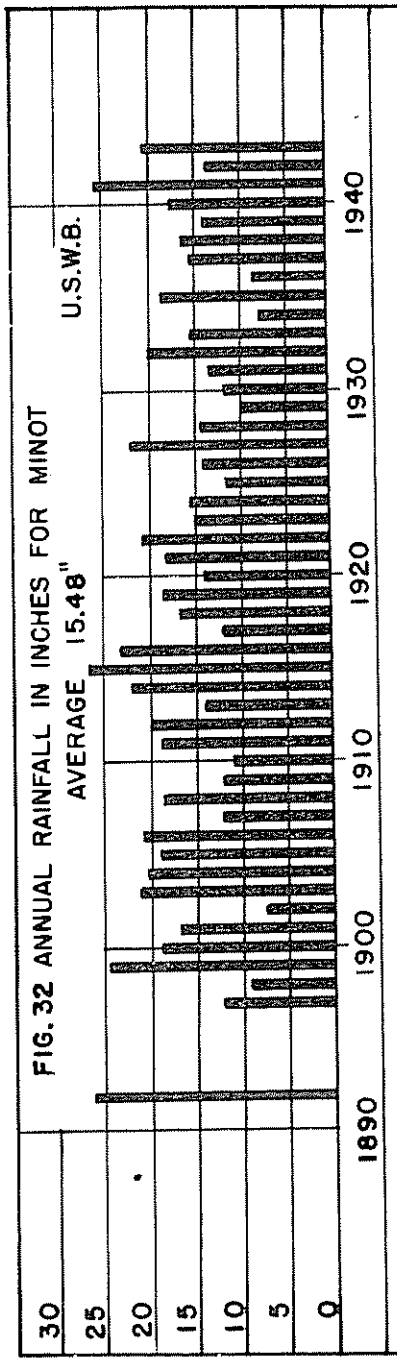
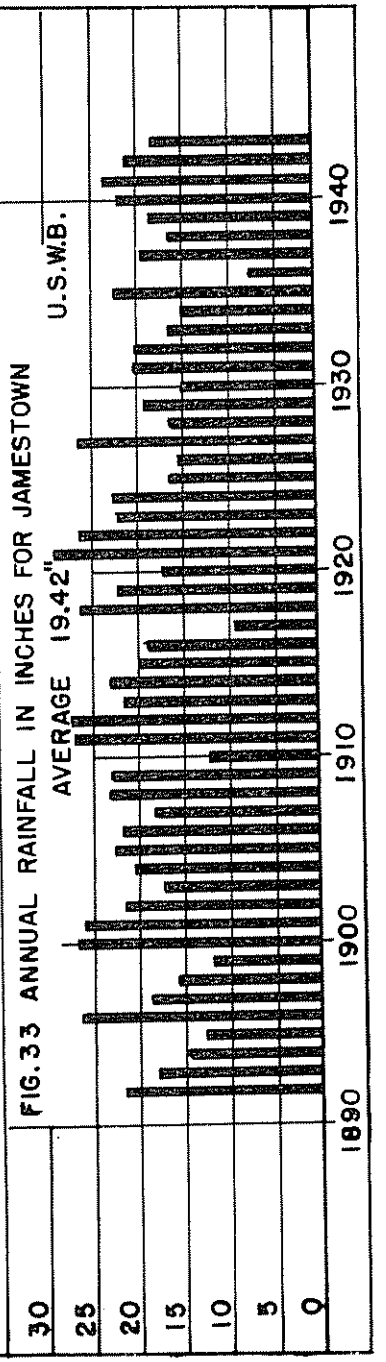


FIG. 33 ANNUAL RAINFALL IN INCHES FOR JAMESTOWN
AVERAGE 19.42"
U.S.W.B.



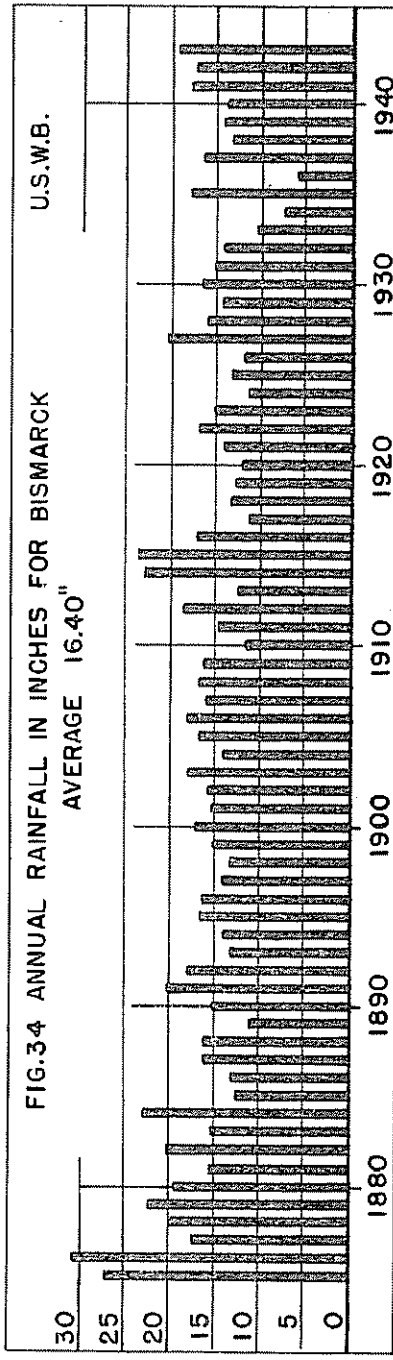


FIG.34 ANNUAL RAINFALL IN INCHES FOR BISMARCK
AVERAGE 16.40"

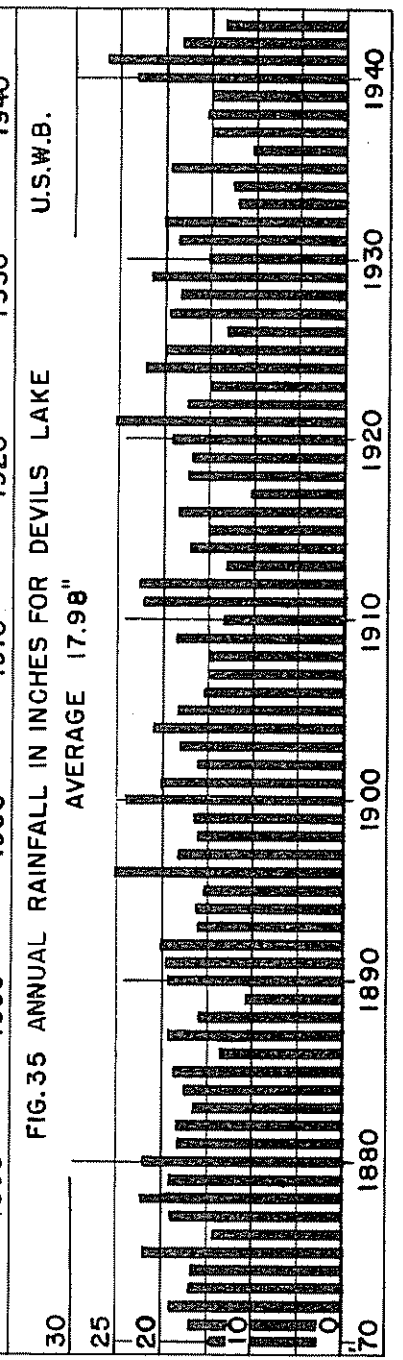


FIG.35 ANNUAL RAINFALL IN INCHES FOR DEVILS LAKE
AVERAGE 17.98"

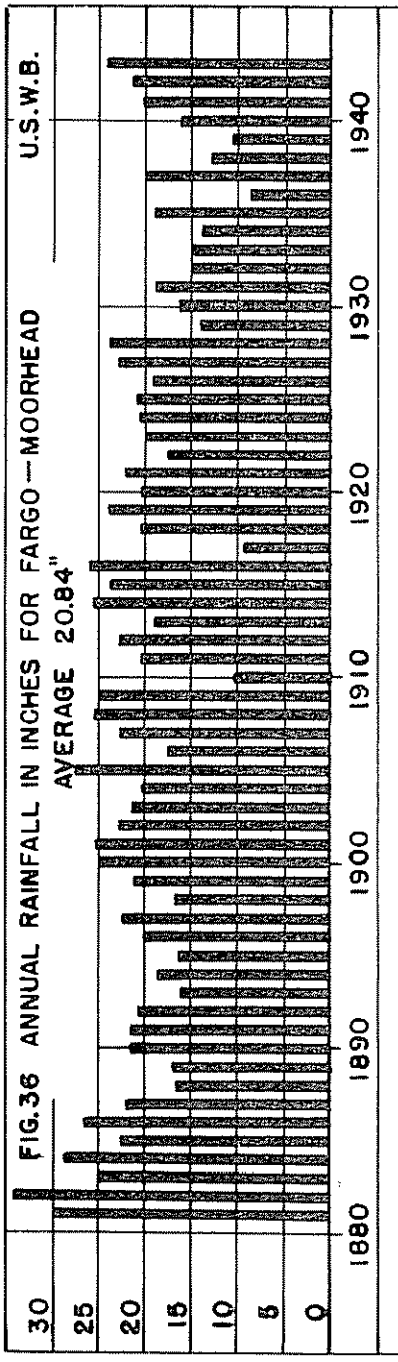


FIG.36 ANNUAL RAINFALL IN INCHES FOR FARGO—MOORHEAD
AVERAGE 20.84"

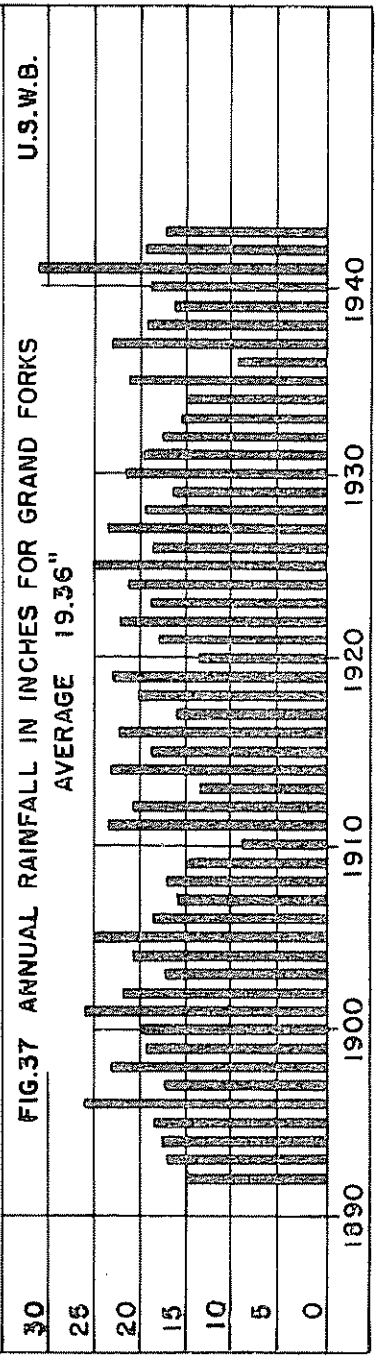


FIG.37 ANNUAL RAINFALL IN INCHES FOR GRAND FORKS
AVERAGE 19.36"

forty were in operation. Complete records for more than fifty years are available and include precipitation, temperature, sunshine, wind, humidity, state of the sky, etc. Records of the upper air made by means of balloons are also available.

Also, since river stages are governed mainly by precipitation and temperature, river gage readings are recorded.

Besides the 120 stations of the Weather Bureau reports are received regularly from more than 100 employees of the Army, Soil Conservation Service, State Historical Society and individuals. All are kept for public use, from 1860 down to the present time. Many years of records are needed to get a complete picture of climate. Records show a slight decrease in average precipitation from 1892 to 1940, but the past four years indicate a wetter trend. The past four years have been the wettest experienced in North Dakota since records were kept and drier years should follow. Temperature averages and extremes have changed little in the years recorded. About 77% of the annual precipitation in North Dakota occurs during the crop growing season, which is the greatest percentage of crop season rainfall of any state.

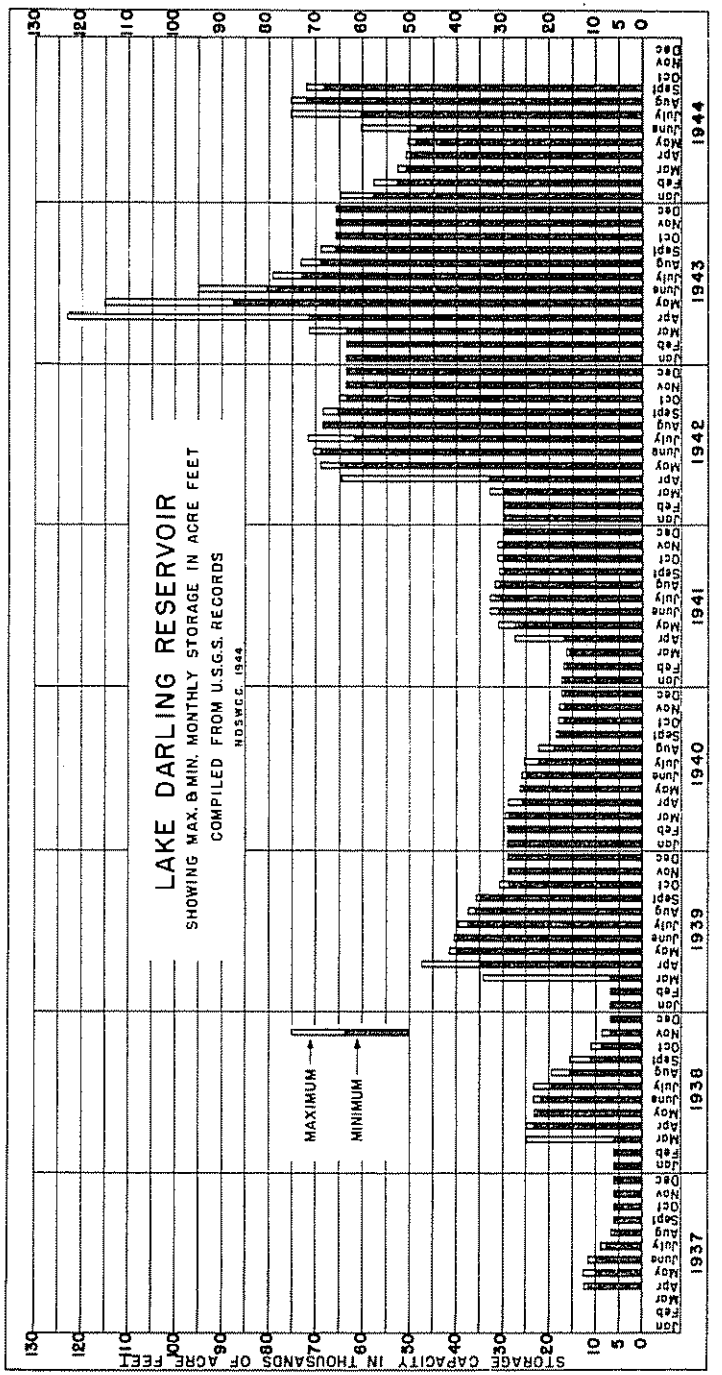
STATE GAME AND FISH DEPARTMENT

Cottagers and community groups from the length and breadth of the state are attracted to North Dakota's natural lakes with wooded shores, such as Spiritwood, Wood, Metigoshe and Upsilon. Other bodies of water, both natural and impounded, are being improved for recreation centers. Cedar Lake in Slope County, Lake Odland near Beach in Golden Valley County, Spring Lake at Rhame in Bowman County, and the Epping-Springbrook Dam in Williams County are outstanding examples.

Other impounded lakes and ponds could be further improved for fish production if the shore lines were adequately protected from over-grazing and trampling by livestock, with resulting fouled water. If cattle are allowed access to a pond, it would best be to a portion near the dam, but not including the dam itself, which would be injured by their continual tramping. The upper part of the pond will then be kept in better shape for swimming, fishing and wildlife cover. A good growth of vegetation on the dam itself will prevent excessive wave action and washing.

A well-managed lake or pond is a popular place for community meetings, combining business with pleasure. Such bodies of water should be even more carefully guarded. Sanitation and orderliness are essential. Part of the shoreline ought to be left in its natural condition with supplemental plantings of wildlife cover. Birds and animals will endure a certain amount of disturbance if left in peace the rest of the time.

The possibilities of waterfowl, fish and muskrat production can be greatly enhanced by proper management of impounded



waters after the projects have been completed, and an opportunity for studying the needs of each individual area has been given the sponsors.

Thanks are due the State Water Conservation Commission and its engineering staff for the cooperation given in the construction and repair of structures to which it has lent financial aid.

Lake Darling, on the Mouse River near Foxholm, in Ward County, was created by a dam constructed by the U. S. Fish and Wildlife Service for a game refuge. The lake covers an area of approximately 11,000 acres at spillway level and has a capacity of 112,000 acre feet, and is used for the regulation and control of the river.

U. S. FISH AND WILDLIFE SERVICE

The principal storage and regulating reservoir is known as Lake Darling and has a capacity of 112,000 acre feet, covering an area of 11,000 acres and extending along the Souris (Mouse) River from about the international boundary line between the United States and Canada to river mile No. 83 just below the Renville-Ward County line and approximately 50 river miles above Minot, North Dakota.

Operation of Lake Darling is under the direction of U. S. Fish and Wildlife Service. They cooperate with the International Joint Commission and the State Water Conservation Commission in regulating the amount of water to be released for flood control, storage, irrigation, maintenance of water fowl grounds and also control releases to Canada.

Other large wildlife refuges under the control of the U. S. Fish and Wildlife Service include the following:

Name of Refuge	Drainage System	Marsh Area (Acres)	Storage Capacity (acre feet)
Below Lake Darling	Souris (Mouse) River	2.300	From Lake Darling
Lower Souris Refuge	Souris (Mouse) River	17.900	From Lake Darling
Des Lacs	Des Lacs River	6.855	65.000
Arrowood	James River	3.289	15.890
Lake Ardock	Forest River	1.150	2.875
Dakota Lake	James River	1.600	3.200
Chase Lake	Stutsman County	2.536	
Lac Aux Mortes (Lake Alice)	Ramsey County	3.067	
Lake Tewaukan	Sargent County	1.512	
Lake Zahl	Williams County	1.300	
Long Lake	Emmons County	13.700	
Rock Lake	Towner County	948	
Willow Lake	Rolette County	1.200	
Lake Ilo	Dunn County	1.240	

There are 60 additional areas containing nearly 100,000 acres of land developed for wildlife refuges that provide water and marsh areas for the waterfowl breeding grounds and resting areas for the birds while in migration.

SOURIS (MOUSE) RIVER INVESTIGATIONS

Investigations and surveys are being continued and records kept on the flow of the Souris (Mouse) River which crosses the International boundary into North Dakota and out again into Canada, for the purpose of determining and agreeing on a fair distribution and use of the waters of the river.

An International Joint Commission was created by the two countries to recommend and control a proper distribution of the river flow. It held a meeting October 7-9, 1944, at Minot, and arranged for a continuation of the studies and records of the stream flow. It had previously adopted interim measures pending permanent settlement of the questions referred to it for consideration and recommendation, and is studying the results of these temporary regulations.

STATE GEOLOGIST

The North Dakota Geological Survey is the only state agency in North Dakota working specifically on underground water problems. The North Dakota Survey has been interested in the subject of water since its inception in 1895, and many of the early stream and well measurements in the state were made by this organization. Inasmuch as nearly 85% of the citizens of North Dakota are directly dependent on underground water for all their needs, domestic and otherwise, the subject should receive more attention that it has in the past.

Our ground water studies work can be divided into two divisions: regional studies and specific local studies. In our regional studies an area needing work is chosen and all information both geologic and hydrologic is gathered.

This information is released to the people of the state through the medium of printed reports. Our regional work also includes our observation-well program. In this program we maintain about 150 observation wells scattered all over the state. Some of these wells are measured weekly while others are measurd twice a year, in the spring and in the fall. These wells are arranged by drainage basins so we can correlate our ground-water studies with the surface-water studies being made by the Water Commission. This observation-well program should be expanded to make our studies more effective. Data on these wells is published every year by the United States Geological survey, with whom we cooperate in this work. At the present time a regional study of the Devils Lake area is in progress.

Our specific local studies are projects conducted in the immediate vicinity of some town or other are where detailed local information is desired. Such studies have been carried out in the vicinity of Fargo, Dickinson, Fessenden, Minot and Camp Grafton. The Fargo and Minot studies were financed by the cities which

matched their funds on a 50-50 basis with the United States Geological Survey through the office of the State Geologist. The Dickinson project was financed by the State Department of Health and the city of Dickinson cooperatively with the U. S. Survey, and the Fessenden study was financed by the State Department of Health and the U. S. Survey. The Camp Grafton project was financed by the North Dakota Geological Survey cooperating with the United States Geological Survey.

Our municipal work must be expanded to provide help for cities now requesting it. The State Geologist feels this should be done for the municipalities only if the cities are willing to put up part of the necessary funds. In other words, if a city puts up $500 for a study, the State would match it with an equal sum, making $1000. This $1000 would then be matched on an equal basis by the Federal Government, making a total of $2000 in all.

Our regional studies and observation well-program must be continued and expanded. This need is particularly acute in areas to be affected by the proposed Missouri River Development Plan.

STATE HEALTH DEPARTMENT

Doctor F. H. Hill, then Director of the State Health Department, and Mr. K. C. Lauster, Director Division of Sanitary Engineering, in a radio address early this year emphasized the need of additional waters and a continuous year-round flow for the rivers of North Dakota, to provide ample water for human consumption and to carry off waters contaminated by sewage which otherwise are a danger to the health of the people of this state.

They explained that this increased flow and continuous year-round flow needed is possible only by the diversion of the waters from the Missouri River to the streams which drain the central and eastern portions of the state. They explained that the investigation of the State Health Department of the pollution of the Red River of the North saved the Missouri River diversion from being discarded by the Corps of Engineers of the U. S. Army.

This investigation involved weekly sampling and testing of waters at twelve main stations and ten tributary stations of the Red River over a period of a year and a half, from November, 1939 to March, 1941. The investigation extended from Fargo to the Canadian border, and the expense was paid from federal funds.

The investigation demonstrated that insufficient water is available within the Red River watershed, particularly when the river is covered by ice. From this survey it is stated that the waters of practically every stream in the state except the Missouri are in an unsatisfactory condition during the periods of winter ice coverage, and that many streams are badly polluted during the summer months of low flow. Continuous stream flow with adequate sewage

treatment can remedy this very unhealthy condition. Industrial wastes disposal from packing plants, flour mills, potato dehydration plants and creameries adds to the problems and dangers of stream pollution, for the health of the people of the state.

BANK OF NORTH DAKOTA

The best of cooperation in every way has been given by the Bank of North Dakota to the State Water Conservation Cooperation.

The latest evidence of good will has been in the purchase of refunding bonds aggregating $97,298.00 at a two per cent interest rate. This money has been used to finance the different irrigation districts, and this decided reduction in interest will be passed on to the farmer-owners.

This state-owned bank acts as Trustee for all the issues of bonds to raise funds for irrigation construction, and is thus a great aid to the land owners who wish to secure larger yields and regardless of shortage of rainfall.

GREATER NORTH DAKOTA ASSOCIATION

This organization of progressive men, seeking to build up all farming and stock-raising and business interests in this state, have been of great assistance in bringing facts to the people of North Dakota as to what a stabilizing influence it would be to have a larger acreage under irrigation throughout the state when years of low rainfall are experienced again. They have particularly emphasized the importance of this development to the stockraisers, who must have feed year in and year out to enable them to at least hold their foundation stock during years of shortage of feed crops. They recognize that income from stock is the foundation on which a stabilized agriculture must be built and that the greatest blow experienced by the people of the state was when the shortage of feed compelled them to ship out their foundation stock and they had to begin all over again.

THE FARMERS UNION

President Glenn J. Talbott and his efficient co-workers scattered over the state have been enthusiastic supporters of the plans for diversion of the Missouri river and the irrigation of large tracts of land in North Dakota. They have aided in distributing information through their county leaders to the people so that they will understand the great value to farmers and stockraisers of having ample feed within easy trucking distance of every farmer, and that this can be assured only by having as much land as possible under irrigation and raising great crops of alfalfa and other feed crops.

TRI-STATE WATERS COMMISSION

The Tri-State Waters Commission, which was created by a compact between North Dakota, South Dakota and Minnesota, centers its activities in the drainage basin of the Red River of the North. The development of the water resources is its problem, relief from floods, improvement of facilities for storage of water, stabilization and control of lake levels, dependable low-water stream flow, improvement of low water channels, regulation of construction of small dams, correction of flood flow, readjustment of land drainage, reduction of stream pollution, installation of water works and improvement of existing water treatment plants and distribution systems.

Eleven projects have been recommended for consideration: Lake-Traverse-Bois de Sioux; Sheyenne river Bald Hill Dam; Red Lake River and Tributaries; Pembina-Tongue River and Tributaries; Park River; Red River; Little Minnesota Diversion; Forest River; Goose River; Rosau River and Missouri River diversion.

The Lake Traverse-Bois de Sioux project was completed in 1941 and has demonstrated what planned flood control can do.

The Sheyenne river Baldhill Dam will be a large regulating reservoir upstream from Valley City. This would help to provide a regulated flow of water. It has been recommended by the Corps of Engineers to Congress.

Stabilizing the level of Red Lake river and Clearwater river will improve recreational conditions and reclaim extensive areas from floods, and provide a regulated stream flow.

Maximum benefits from flood control and water utilization on the Red River are being studied by the Corps of Engineers. The Little Minnesota River diversion in North Dakota and the Roseau river in Minnesota will be studied for additional data.

The Forest River project in North Dakota and the Goose River Project in Minnesota received unfavorable reports but request has been made for a re-study of possibilities.

Meetings and activities of the Tri-State Waters Commission have been curtailed during the war.

Dean H. L. Walster, President of the Tri-State Waters Commission, and others from North Dakota, appeared before the Board of Rivers and Harbors of the U. S. Engineers to present supporting data on the proposed Sheyenne River project, and clarified some of the questions which otherwise were unfavorable. The project was recommended for construction, by the Corps of Engineers.

The Tri-State also filed data with the Chief of Engineers regarding the Red Lake River project and showing that if the channel clearance could be effected it would release a large acreage for food crops which is flooded at present with spring rains.

The Sheyenne River Baldhill project, the Pembina-Tongue River project and the Park River projects can start construction as soon as the emergency is over, but the question of the sponsor's contribution as specified is yet to be solved, as small communities without funds accumulated find it difficult to comply. It is hoped that legislative appropriations will solve this problem.

Pollution of the Red River has been the subject of conferences sponsored by the Health Departments and it is hoped that a steady flow of water from reservoirs built where practical will solve this danger to the health of the people.

KFYR RADIO STATION

One of the outstanding cooperators with the State Water Conservation Commission on its program of education of the people of North Dakota as to the possibilities of development and stabilization by irrigation of the agriculture and business income of the state, has been the weekly broadcast of KFYR Radio Station over which there has been given public service programs for seventy-eight weeks, offering free and open discussion on which many men of experience and training have given the people facts and figures gathered from actual irrigation operation scattered over western United States, and in North Dakota. These programs have been a public service feature of the Meyer Broadcasting Company, for which they are entitled to commendation.

WDAY Radio Station at Fargo, and KGCU at Mandan together with its Mutual System of other stations in North Dakota have also cooperated liberally on broadcasting some of these discussions.

STATE PLANNING BOARD

It is recognized by this state agency that the proposed Missouri River diversion and irrigation works offer probably the best opportunity for the employment of thousands of returned Armed Forces veterans and employees of Defense Industries after the war, and that broad irrigation tracts over the state would enable many of these men to establish permanent future homes in North Dakota, either as irrigation farmers or in new industries which will be needed to process and market the increased production which irrigation would bring.

It is also recognized that irrigation works will provide income to cover the annual upkeep required on any public works program, and also pay back the initial investment by the state and government over a period of years, and help amazingly in stabilizing the annual income for both farmers and businessmen in North Dakota.

The fullest cooperation is given mutually in working together for the best future interest of the state and its citizens, as well as providing needed employment for returned soldiers and defense workers.

LITTLE MISSOURI RIVER COMPACT

Consent was given by Congress for the States of Montana, North Dakota and South Dakota to enter into a compact or agreement for a division of the waters of the Little Missouri River.

It is estimated that there are 24,000 acres of irrigable lands along the Little Missouri river in North Dakota. The equitable apportionment of the waters of the stream is therefore important to this state. As the surveys and estimates for the complete stream have not been completed, on which to base an apportionment, any definite action has been postponed pending the report. The time in which to complete the compact has been extended.

YELLOWSTONE RIVER COMPACT

Congress also has given consent for the states of Wyoming, Montana and North Dakota to enter into a compact or agreement for the equitable distribution of the waters of the Yellowstone River and streams tributary thereto. After assembling a vast amount of data on land and water use in the Yellowstone River Basin, the Commissioners from the states mentioned approved a compact which will be submitted to the respective state legislatures for approval and afterwards to the Congress of the United States.

MISSOURI RIVER EIGHT-STATES COMMITTEE

Proposals were for a Missouri River Basin compact to include the states of Wyoming, Montana, North Dakota, South Dakota, Nebraska, Colorado, Iowa, Kansas and Missouri, covering the distribution and use of the waters of the Missouri River. The organization conferences resulted in the forming of the Missouri River Eight-States Committee which has held several meetings and made recommendations regarding the development of the waters of the Missouri River and its tributaries on plans submitted by the U. S. Army Engineers and the Bureau of Reclamation.

It passed a resolution to Congress supporting the amendment proposed to it, giving irrigation priority over Navigation in the use of surplus waters of the Missouri River.

Governor John Moses has attended a number of meetings of this Committee and was designated by the Governors of the northern states of the Missouri Basin to present their case to Congressional committees, which he did in a very creditable manner.

AGRICULTURAL COLLEGE

Dean H. L. Walster of the North Dakota Agricultural College was given a leave of absence of three months to permit him to act as agricultural advisor of the Bureau of Reclamation engineers in the final preparation of their report to Congress on the diversion of the Missouri River surplus waters and irrigation in North Dakota and other states. His years of experience in this area make his services invaluable in determining the probable increased yields and added income resulting from the use of water for irrigation.

Thomas Long has charge of an irrigated tract of about forty acres on the Lewis & Clark Irrigation District near Williston, and thus has opportunity to observe and study actual results from irrigation in North Dakota.

BISMARCK IRRIGATION PROJECT

The proposed Bismarck Irrigation Project, as originally planned, contained an estimated 5,000 acres of land lying immediately south of Bismarck on the east bank of the Missouri River. It was felt, however, that considerably more land could be incorporated into the project by including higher land, commonly referred to as the "second bench" lying in the vicinity of Fort Lincoln.

In November, 1943, the State Water Conservation Commission engineers commenced making detailed topographic surveys of the project, completing the survey of 15,876 acres. The project, as planned, is located south of Bismarck and includes the river bottom lands and extends east covering the second bench to Apple Creek and in the vicinity of Fort Lincoln and the North Dakota Prison Farms. From these surveys, designs, estimates and plans will be prepared for post-war construction. The Bureau of Reclamation engineers are cooperating in the land classification and making detailed soil analysis and surveys, to determine the lands and soil suitable for irrigation.

Construction of this project has been under consideration since 1904, when the Bureau of Reclamation made surveys and studies covering the original project. However, due to lack of local interest by the land owners in complying with the recommendations of the Bureau, the project was abandoned until the drought period, when interest in irrigation was revived again.

HEART RIVER IRRIGATION

Included in the State Water Conservation Commission plan is the development of lands for irrigation in the Heart River Valley below the proposed Heart Butte dam and reservoir, extending downstream to the Missouri River. Plans and approval of the dam have been recommended by the Corps of Army Engineers for flood control and storage, making water available for approximately 15,000 acres of irrigable land.

The State Water Conservation Commission engineers are at present making the necessary detailed topographic surveys before designing and laying out of the proposed irrigation system.

HEART RIVER-DICKINSON UNIT

Detailed topographic surveys were made by the State Water Conservation Commission engineers of the Heart River Valley from a point two miles west of Dickinson to a point five miles southeast of Gladstone, or one mile below the mouth of Antelope Creek. The area surveyed included 5,036 acres of the valley bottom lands along the river.

These surveys were necessary as a basis for determining the irrigable land along the Heart River. Storage facilities for maintaining an adequate supply of water for Dickinson municipal uses and the irrigation of lands will be provided by the proposed storage dam and reservoir located on the Heart River, a few miles above Dickinson. This reservoir would contribute in controlling flash floods during periods of excessive run-off.

The U. S. Bureau of Reclamation is at present engaged in making studies from surveys and maps prepared by the State Water Conservation Commission for designing the Dickinson Dam, in order to have plans ready for post-war work.

STATE TRAINING-SCHOOL DIKE

In April, 1943, the spring run-off flood waters of the Heart River overflowed the banks and inundated most of the lands farmed by the State Training School, as well as doing considerable damage to its buildings and cellars. The business section of the city of Mandan as well as portions of the residence section and the whole south side of the city were inundated and immense damage done.

The Army Corps of Engineers, cooperating with the State Water Conservation Commission and the City of Mandan, have strengthened the dikes to endeavor to prevent a repetition of the flood damage.

The old dike was reconstructed on the west side of the Heart River from the railroad embankment which forms a natural dike on the north, to the hill elevation on the south, of sufficient height to protect the Training School lands and buildings from reflooding.

This was paid for from government funds by the Corps of Engineers but with a refund of $3,000 of the cost from the Drainage Fund appropriation to the State Water Conservation Commission after approval by the attorney general.

APPROPRIATIONS EXPLAINED

Commissioner Per Diem

This appropriation is for payment of compensation of the members of the State Water Conservation Commission for actual days of service at the rate of $7.00 per day. This is less than the actual earning of any member of the Commission and has been used partly to pay actual expenses of the members which are not covered by state regulations but which are a necessary expense when away from home. This additional expense while traveling has been considerably increased during the war period. The result is that each member of the Commission shows his spirit of public service in serving as a member at considerable financial loss to himself on each year of service.

Administration

This is a continuing appropriation to cover the part of Commission expenses which the word implies, and which are not covered by other specific appropriations. It covers largely the clerical work and supervision, with necessary stationery, postage, supplies, etc. required in the conduct of the office and supervision of the work. Amounts collected on refunds and collections help to serve as a revolving fund by being deposited with the State Treasurer to this fund.

Tri-State Waters—Red River Basin

As the basin of the Red River of the North includes the drainage of portions of Minnesota and South Dakota as well as North Dakota, the regulation of the waters of this stream with its tributaries are a tri-state cooperative enterprise conducted by a Commission under authority of the legislatures of the three states. Necessary expenditures are on a cooperative basis between these states. The appropriation made by the North Dakota legislature is to cover its part of necessary expenses of supervision of the control of waters in the Red River basin.

International and Interstate Stream Compacts—Commissioner and Conference Expenses

The preliminary arrangements for a gigantic over-all Missouri River Basin flood control, irrigation, navigation and electric generation plan of development has required many conferences arranging compacts or agreements as between states included in the watershed of the Missouri River and its tributaries. This has entailed a considerable expense for transportation and daily living of members of the Commission and its representatives while attending these conferences and appearing before Congressional committees for hearings on the different proposals.

This is necessary in order to protect the interest of the state and to avoid future expensive litigation as between states having

an interest in the waters of these streams. The returns for the future from these efforts promise to refund this expenditure many, many fold. These conferences must be continued until the fullest possible benefits for the state have been secured.

Topographic and Conservation Branches in Cooperation with U. S. on 50-50 basis.

The surveying and preparation of topographic maps have been completed over a large portion of the United States by the U. S. Geological Survey engineers. The State Water Conservation Commission entered into an agreement with the Geological Survey to complete topographic mapping in the areas where irrigation works are contemplated along the headwaters of the Sheyenne and James Rivers, with water diverted from the Missouri River either from the proposed Garrison Dam reservoir or by the proposed Missouri-Souris River canal route. Under this agreement, the expense of these topographic surveys is shared on a fifty-fifty basis by the government and the State of North Dakota. The importance of having these surveys completed in advance of starting actual irrigation construction cannot be over-emphasized, because of the saving in expense on planning and the increased speed of construction which will result.

Hydrographic Surveys

The necessity of having dependable data on the flow of streams on which to base plans for water power, irrigation and flood control works emphasizes the importance of stream-gaging information over as long a period of time as possible.

The records of minimum and maximum flow of water in a stream indicate to the engineer the size of proposed reservoirs and how many acres of land might be irrigated from the water available. Long-time records are important to show the fluctuations of the stream-flow of different seasons and different years. Much of the controversy on the Missouri River diversion is due to a lack of sufficient records over a period of years to definitely show the volume of water for different seasons and different years. With the prospect of utilizing surplus waters of the streams of North Dakota for irrigation, the importance of stream-flow records is increasingly evident, and the opportunity for securing these records with half the cost being paid by the U. S. Geological Survey is fortunate for the State.

The State Engineer

This official is the Executive Secretary of the State Water Conservation Commission and the directing head and supervisor of the use of the waters of the state. He arranges for cooperative Topographic and Hydrographic surveys with the U. S. Geological Survey; for cooperative plans and surveys by the U. S. Bureau of Reclamation and the U. S. Army Engineers; approves designs, plans and specifications for the construction of dams and irrigation works; he is Chief Engineer of the State Water Conservation Commission in irrigation development, cooperating with state, county and federal agencies; and is a member of the Mouse River Valley Authority that controls and regulates the distribution of the Mouse River waters within the state; he cooperates with the Board of University and School Lands, Dean of the School of Mines and State Geologist in determining coal bearing lands, and has many other duties.

Secure Amendment to the Law Regarding the Use of the Waters from Ft. Peck Dam

Without a change in the regulations concerning the use of the waters from the Ft. Peck Dam Reservoir, it will not be possible for North Dakota to realize to the fullest extent its possibilities for a large irrigated acreage, because the largest block of land which lends itself to irrigation in the state is located in the northern area. The only plan so far devised to bring sufficient water for irrigation of this area requires the release of water from Ft. Peck Dam for irrigation. Earnest effort is being made to have Congress amend the present law to permit this.

Maintenance and Construction Drains

A government agricultural statistician made a survey of the crop losses from flooded lands in the Red River valley in North Dakota in 1943 and estimated the total loss to be $10,852,000.00 in six counties. A very heavy flood damage had been experienced in 1944, now estimated at $13,565,000. and in years previous to 1943. This brought home to the people of the State the necessity for the repair and cleanout of existing drainage channels and the construction of additional drainage ditches where needed.

The 1943 session of the North Dakota legislature appropriated $50,000. for aid and promotion of this work. The North Dakota State Water Conservation Commission allocated this money to the six counties in proportion to their losses as determined by the government statistician, and entered into an agreement with the U. S. Soil Conservation Service to use their big machinery and supervise the drainage construction work. Progress has been greatly hampered by the wet season and the shortage of trained workers. Much more rapid progress is now being made on the construction and repair of these drainage ditches. It is probable that the completion of adequate drainage for the Red River valley lands will require several years for construction work.

Cooperation with the Bureau of Reclamation and U. S. Army Engineers

Pursuant to the appropriation of the last session of the North Dakota legislature providing $200,000.00 for cooperation with the

Bureau of Reclamation and U S Army Engineers on a 50-50 basis, an agreement was made with the Bureau of Reclamation for the cooperative expenditure of not to exceed $190,000.00 in conformity with the appropriation. Approximately $117,000.00 of this amount has been expended under this agreement as this is written, for surveys, plans and specifications which would place under irrigation approximately one and a quarter million acres of North Dakota lands

Other Post-war Projects

There was also appropriated "For investigations, surveys and preparatory work on projects other than those approved by the Bureau of Reclamation, which may be matched either in whole or in part by State or Federal Agencies, $100,000.00." Under this appropriation the engineers of the North Dakota State Water Conservation Commission have centered their efforts on surveys, plans and specifications for proposed irrigation works not included in the plans of the Bureau of Reclamation, or cooperating with the Bureau, with the idea of having as many work-projects ready for employment of returned soldiers and defense workers as possible before the close of the war and expected Congressional employment appropriations.

Construction Bond Guarantee Fund

This is a revolving fund provided by the legislature to enable the State Water Conservation Commission to give additional security to bond issues to raise funds for irrigation construction work, and thus make the bond issues more readily marketable and at a lower rate of interest because of the added security No new bond issues have been made during this biennium. Because of the shortage of labor and materials due to the war, the time was not propitious for the construction of irrigation works It is expected, however, that there will be big irrigation works constructed as soon as the labor and materials are available, and that there will be further bond issues needed to finance some of the work.

MAINTENANCE OF EXISTING DAMS

During the past biennium, the North Dakota State Water Conservation Commission has been cooperating with the State Game and Fish Department and county and civilian organizations in the maintenance of existing dams, constructed during the drouth years by federal or other agencies.

These comparatively small dams are of community value and provide fishing, bathing, boating and wildlife conservation as well as providing water storage for cities, towns, livestock, and some irrigation. The original investment in these dams is large. Without regular maintenance many of these dams would be lost. The major part of maintenance costs includes materials and labor for reconstruction and repair of rubble masonry spillways that have been undermined and washed out.

At the request of local organizations or interested parties, the engineers of the North Dakota State Water Conservation Commission inspects projects to determine its feasibility, the type and amount of repair work needed, and makes preliminary estimates of the cost of repairs. If required funds can be raised by interested parties or organizations as sponsors, detail plans and specifications are prepared.

The providing of sufficient funds for labor and materials required to keep the existing dams in repair is becoming very difficult. Because of the limited appropriation by the legislature for this work and the large number of dams requiring repairs, the State Water Conservation Commission has had to limit its expenditures for each repair project, and is unable to provide sufficient funds to purchase material for large repair jobs. The State Game and Fish Department has cooperated by contributing funds to projects that are beneficial to fish and wildlife. Additional funds must be raised by interested parties or organizations. Many worthwhile dams are being lost because of lack of sufficient funds for repair work needed. On some of the repair projects the sponsors are advertising for bids for construction work required. The Commission does the engineering work, preparing of plans and specifications and furnishes supervision during construction of repairs.

The following is a list of dam repair projects on which work has been done in the past two years, showing expenditures since constructed. In addition, there has been a number of surveys, investigations and reports on other projects throughout the state:

Maintenance Existing Dams 1942-44

Project No.	Dam	County	Amount
325	Agnes Township	Grand Forks	$ 83.77
246	Antelope Creek	Mercer	1,085.25
362	Balta	Pierce	23.89
267	Bathgate	Pembina	231.25
393	Beaver Lake	Logan	19.35
369	Bentley	Hettinger	6.25
320	Bohlman	Hettinger	84.93
313	Boyeson	Bowman	67.03
292	Burnt Creek	Burleigh	1.00
353	Cedar River	Slope	108.03
341	Center	Oliver	405.13
339	Charbonneau	Rolette	50.00
388	Coyote Creek	Bowman	6.15
376	Crystal Lake	Wells	15.11

241	Dodge	Stutsman	302.04
358	Dvorak	Nelson	18.75
356	Ekron	Stutsman	8.20
382	Elgin	Grant	849.87
346	Epping	Williams	1,589.08
396	Filipi	Hettinger	16.07
269	Fordville	Walsh	19.80
281	Fort Berthold	Mercer-Dunn	1.00
287	Fort Clark	Oliver	1.00
71	Grantier	McKenzie	29.60
257	Green River	Stark	17.94
373	Halliday	Dunn	105.99
317	Hebron	Morton	508.55
368	Hesper	Benson	206.29
375	Hurdsfield	Wells	3.73
363	Iverson	Benson	402.19
253	Jackson	McKenzie	1.44
354	Jamestown	Stutsman	407.81
231	Johnson	McKenzie	5.75
352	Jung	Hettinger	216.25
259	Kulm	LaMoure	11.00
384	Lake Sheyenne	Sheridan	20.41
377	Lehr	McIntosh	49.86
316	Lisbon	Ransom	111.50
355	Loftus	Nelson	21.62
265	Logan Center Twp.	Grand Forks	151.87
336	Long Creek	Burke-Mountrail	13.64
13	Lynn	Steele	6.73
344	Maple River	Dickey	35.27
271	Meissner	Morton	59.05
399	Memorial Park	LaMoure	19.35
386	Monango	Dickey	89.46
249	Mott	Hettinger	86.13
202	Murray Moxley	Mercer	14.06
274	Neche	Pembina	300.00
270	Noonan	Barnes	100.00
367	Northern Pacific	McKenzie	9.61
394	Odland	Golden Valley	28.15
372	Oliver	Oliver	6.36
350	Regent-Larson	Hettinger	892.74
272	Richland County	Richland	967.57
309	Riggins	Ramsey	12.99
357	Roshill Twp.	Foster	44.59
332	Sand Creek	McKenzie	24.48
381	Sehlenker	McIntosh	36.65
378	School Section	Slope	7.73
279	Shell Creek	McLean	1.00
384	Sheyenne Lake	Sheridan	209.53
391	Silver Lake	Sargent	45.03

387	Solum Twp. Road	Sioux	13.55
344	State Line	Dickey	180.38
256	Strand	Billings	196.26
338	Timber Creek	McKenzie	145.94
266	Tolna	Nelson	331.05
258	Verona	LaMoure	9.80
319	Wakopa	Rolette	369.21
254	Walhalla	Pembina	82.17
240	Warwick-Sheyenne River	Eddy	186.07
395	Weisser	Emmons-McIntosh	38.66
348	Westfield	Emmons	9.62
380	Williams Creek	Golden Valley	201.33
359	Wolf Butte	Adams	43.98
364	Yanktony	McLean	25.62
392	Talkington	Stark	15.35
	Total expended to Oct. 31, 1944		12,113.86

FINANCIAL STATEMENT

As of Oct. 31, 1944

Appropriation Approved March 18, 1943, Chapter 76 of 1943 Session Laws—State Conservation Commission—Projects.

For Cooperating with Bureau of Reclamation or Army Engineers, to be expended only when matched in equal amounts by Federal Funds, and under the direction of the Bureau of Reclamation or Army Engineers	$200,000.00
Expended in cooperation with Bureau of Reclamation	55,155.04
Balance in fund, Nov. 1, 1944	$144,844.96
For Investigations, surveys and preparatory work on projects other than those approved by the Bureau of Reclamation, which may be matched either in whole or in part by state or federal agencies	$100,000.00
Expended on other post-war projects	36,738.02
Balance in fund, Nov. 1, 1944	63,261.98

Appropriation Approved March 20, 1943, Chapter 77 of 1943 Session Laws—State Conservation Commission—Administration

As of Oct. 31, 1944

	Appropriated	Expended	Nov. 1, 1944 Balance
Commissioners per diem	4,000.00	1,417.00	2,583.00
Administration,	27,775.00		
Refunds and collections added	6,482.78	13,442.30	20,815.48
Maintenance existing dams in cooperation with other agencies	10,000.00	4,301.94	5,698.06

Tri-State Waters, Red River Basin, North Dakota program, portion of administrative and conference expenses	7,500 00	3,611 21	3,888 79
International and Interstate Stream Compacts-comm. & conference expenses	12,500 00	5,693.32	6,806.68
Topographic and Conservation Branches (Coop with U S. on 50-50 basis)	20,000.00	12,961 92	7,038.08
Hydrographic Surveys	8,000 00	5,489 26	2,510.74
State Engineer	4,400 00	2,933 31	1,466.69
Secure amendment federal laws relating to Fort Peck Dam to obtain adequate water supply for Missouri and Souris river diversion projects	2,500.00	1,500.00	1,000.00
To promote the maintenance of existing drainage channels in good agricultural lands & construct needed channels	50,000.00	13,106 48	36,893.52
	153,157.78	64,456.74	88,701.04

BONDS OUTSTANDING

As of Oct. 31, 1944

Refunding bonds Series J Issued 1944 mature serially on or before May 1, 1962

$67,000. Interest rate 2% Sold to Bank of North Dakota
Bonds and securities of irrigation projects held as collateral, with $19,459. Guaranty Fund

CONSTRUCTION BOND GUARANTY FUND

On deposit with Bank of North Dakota as collateral to Series J bonds	$19,459.00
Balance in hands of State Treasurer	70,541.00
Total of appropriations	$90,000.00

The Series J Refunding bonds sale was negotiated by Judge A. M. Christianson, who is entitled to credit for a big saving in interest for the Commission and the Irrigation Districts obligated to it for construction work done

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